



**SEVEN RIVERS**  
REGIONAL MEDICAL CENTER



**BASIC ECG PRINCIPLES**  
Wayne W Ruppert, CVT, CCCC, NR-P  
Interventional Cardiovascular Technologist  
Cardiac Accreditations / Emergency Manager  
Bayfront Health Dade City



[www.ECGtraining.org](http://www.ECGtraining.org)  
[www.practicalclinicalskills.com](http://www.practicalclinicalskills.com)

WWW.ECGTRAINING.ORG  
HELPFUL PDF DOWNLOADS

*All materials featured on this page are copyright protected. This content is offered for INDIVIDUAL USE by Medical Professionals neither and/or printed for sale or distribution without prior written consent of the author. EXCEPTION: Physicians and allied health hospitals and all EMS agencies who routinely serve CHS hospitals may download, reproduce and distribute the documents and of*

- Download Sudden Cardiac Death Prevention - ACC / SCPC 19th Congress
- Download Initial Stabilization of the Atrial Fib Patient - SCPC 19th Congress
- Download QTc Monitoring Policy for Patients on QT Prolonging Meds
- Download A-Fib / Flutter ER Physician's Order Set - BHDC
- Download A-Fib / Flutter Flowchart Emerg Care BHDC
- Download Team Driven Performance Improvement - SCPC 19th Congress
- Download TDPI in Ambulance Industry Journal
- Download TJC Sentinel Event Alert - Disruptive Physicians
- Download ACLS 2015 Algorithm Cheat Sheets
- Download 2015 ACLS Algorithms with ECG examples
- Download Neighbors Saving Neighbors Program
- Download Basic ECG Course with 2015 ACLS Algorithms
- Download STEMI Assistant
- Download ECG ID of SADS CONDITIONS
- Download ECG Review of Hypertrophy
- Download 14 Point AHA Screening Form for Genetic and Congenital Heart Conditions

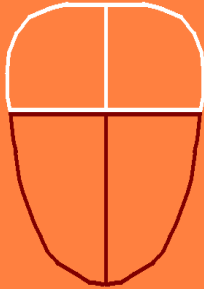
Navigation menu on the left includes: HOME, 12 LEAD ECG IN ACS, STEMI ASSISTANT, ACCREDITATION, WORKSHOPS, ECG ID OF SADS, WORKSHOP OBJECTIVES, TEXTBOOKS, PHYSICIAN REVIEWS, BIO OF WAYNE RUPPERT, TESTIMONIALS, **DOWNLOADS - PDF**, HELPFUL INFORMATION, CONTACT US.

Yellow arrows point to the 'Downloads - PDF' menu item and the 'Download Basic ECG Course with 2015 ACLS Algorithms' link.

The Heart:

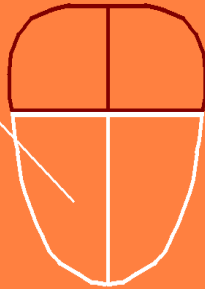
- Muscle cells
- Electrical system cells
- Connective tissue

**FOUR CHAMBERED PUMP . . .**

**2 ATRIUM** → 

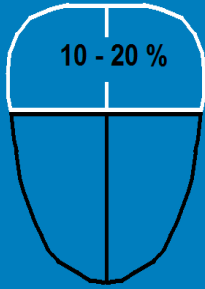
**PRIMARY JOB:**  
**"PACK VENTRICLES  
 FULL OF BLOOD"**

**FOUR CHAMBERED PUMP . . .**

**2 VENTRICLES** → 

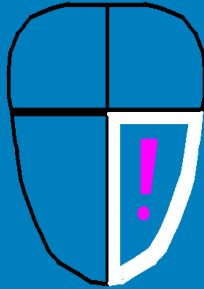
**PRIMARY JOB:**  
**"PUMP BLOOD TO THE  
 LUNGS AND THE  
 REST OF THE BODY"**

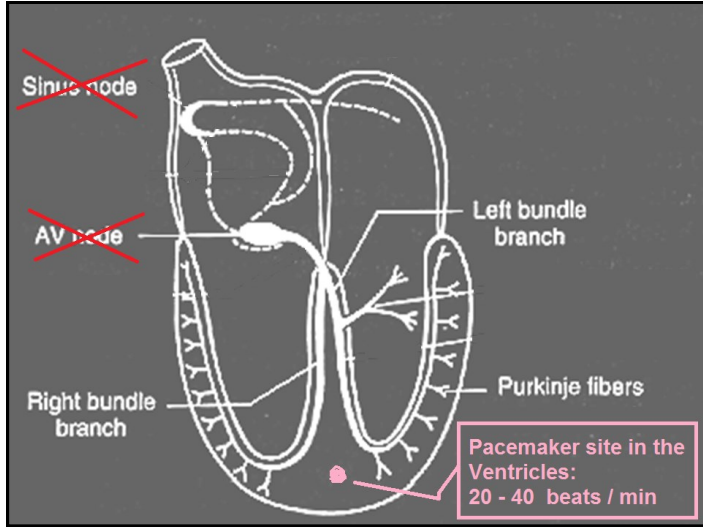
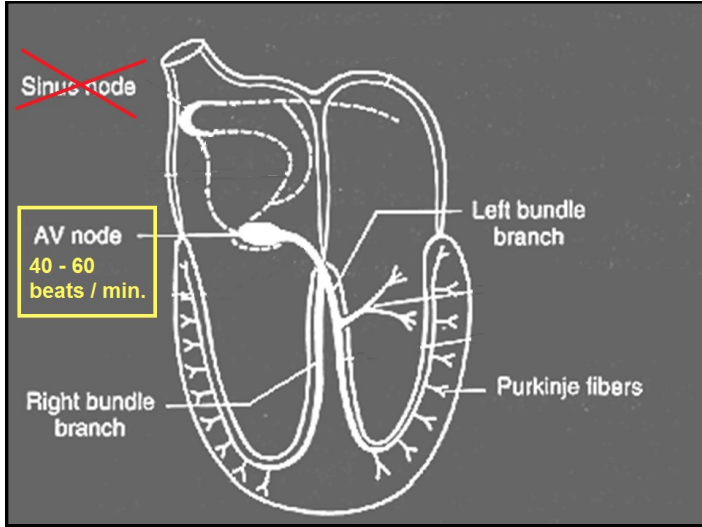
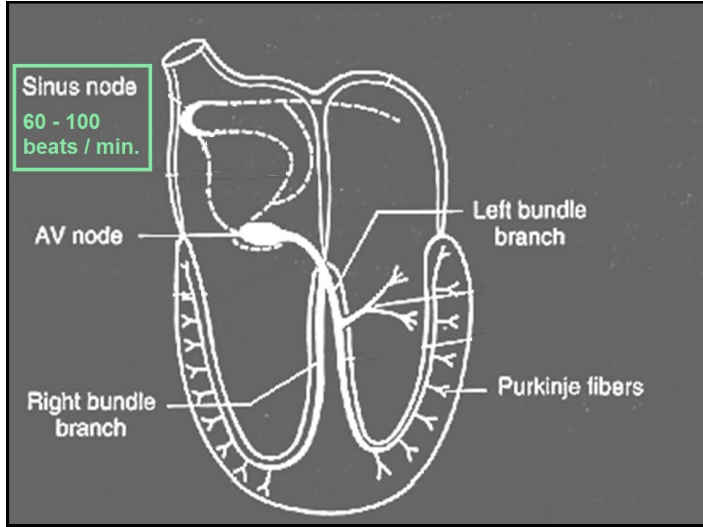
**WHEN FUNCTIONING PROPERLY,  
 THE ATRIUM SUPPLY  
 APPROXIMATELY  
 WHAT  
 PERCENTAGE  
 OF THE  
 CARDIAC OUTPUT ?**

**10 - 20 %** 

**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**





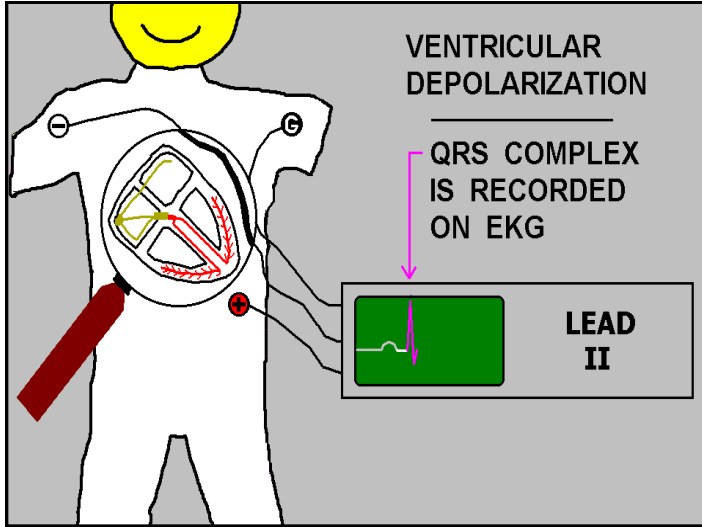
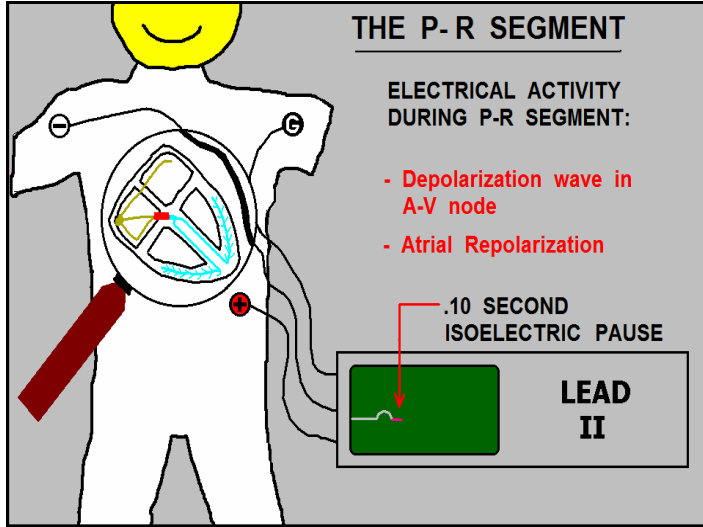
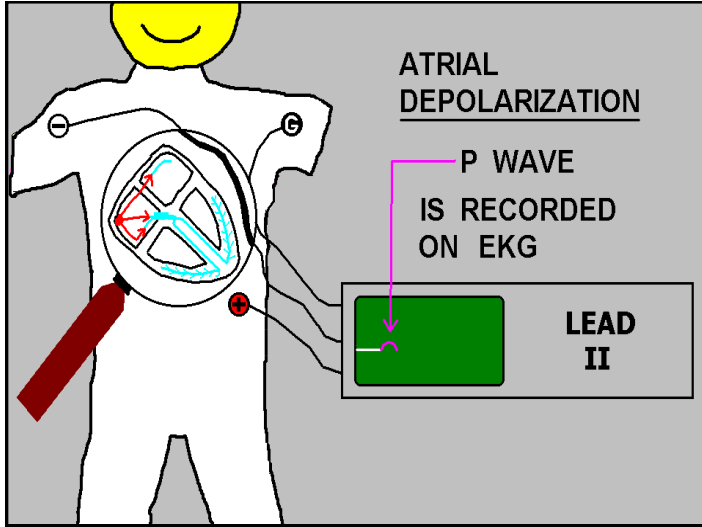
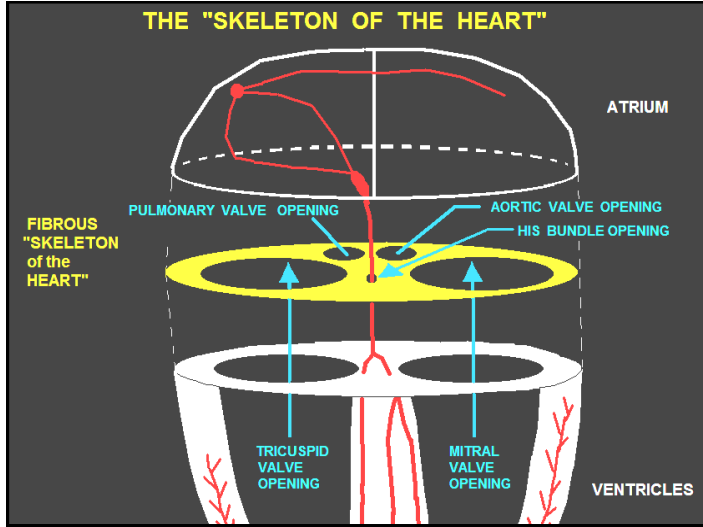
**NORMAL "INHERENT" RATES:**

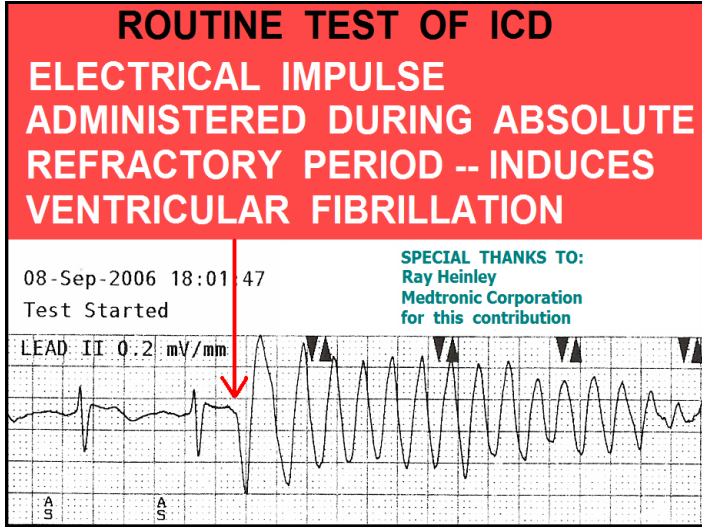
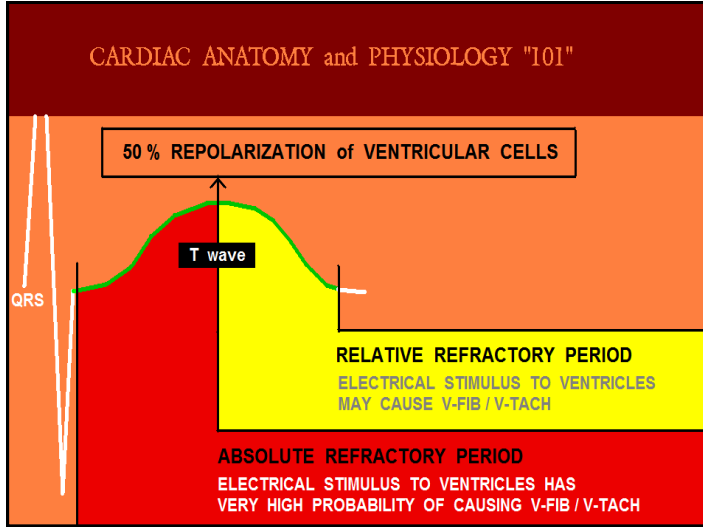
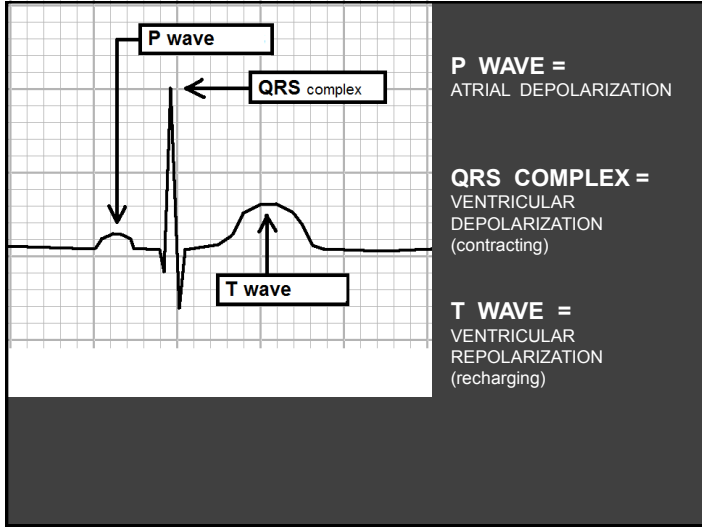
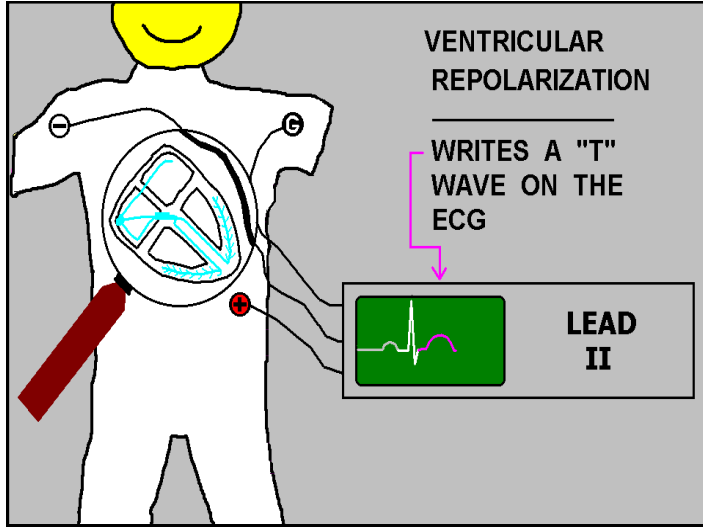
SA NODE: 60 - 100

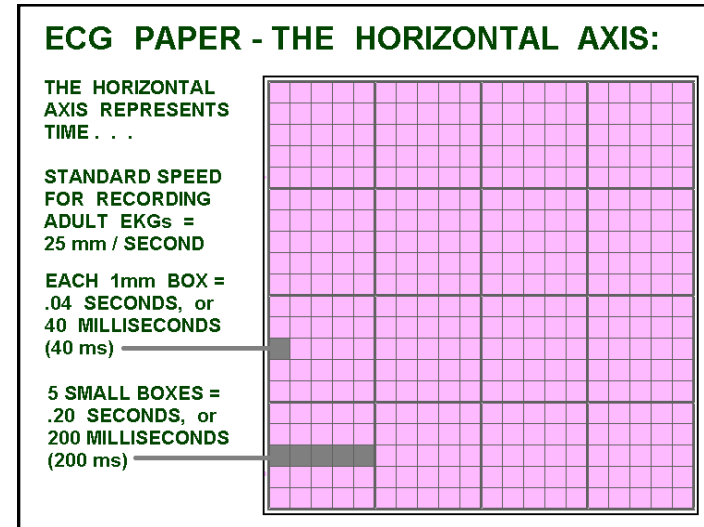
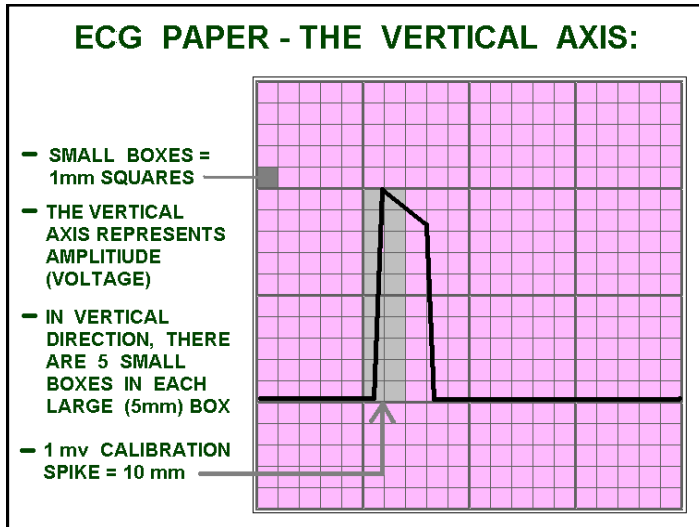
AV NODE: 40 - 60

\* VENTRICLES: 1 - 40

\* Most reference sources indicate ventricular focal rates as being between "20-40" beats per minute. Since I have personally witnessed patients who have had regular, pulse-producing "idioventricular" rhythms as low as 4-5 beats per minute, I can not endorse "20" as a minimum ventricular rate.







## THE EKG MACHINE

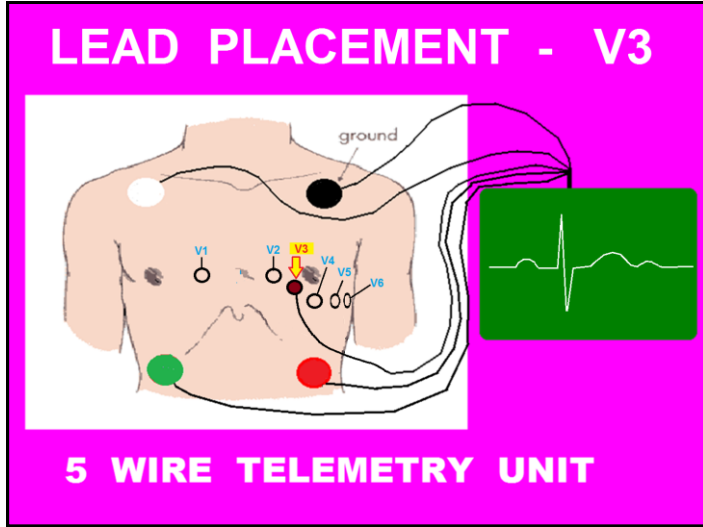
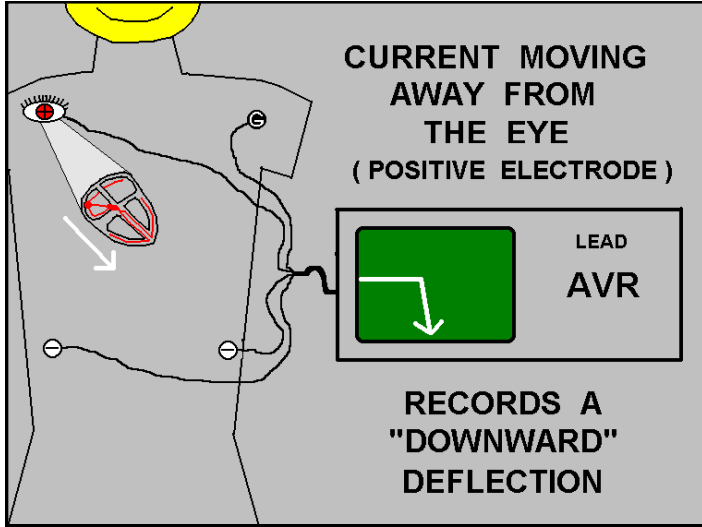
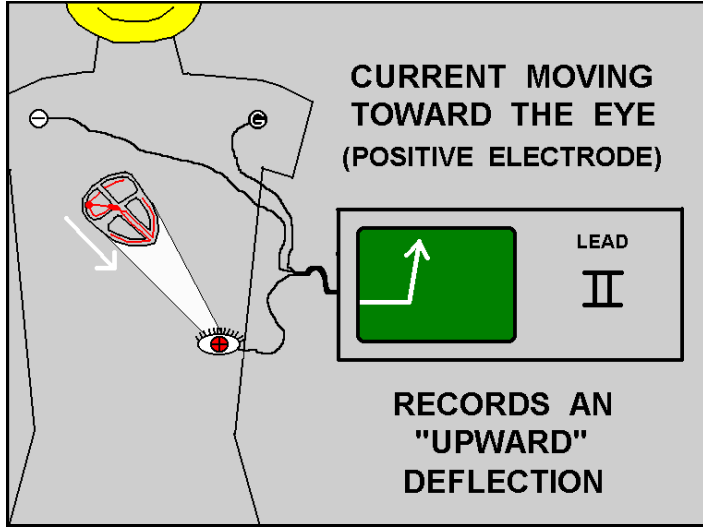
STANDARD 12 LEADS - USES 10 WIRES ( 6 CHEST and 4 LIMB )

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

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

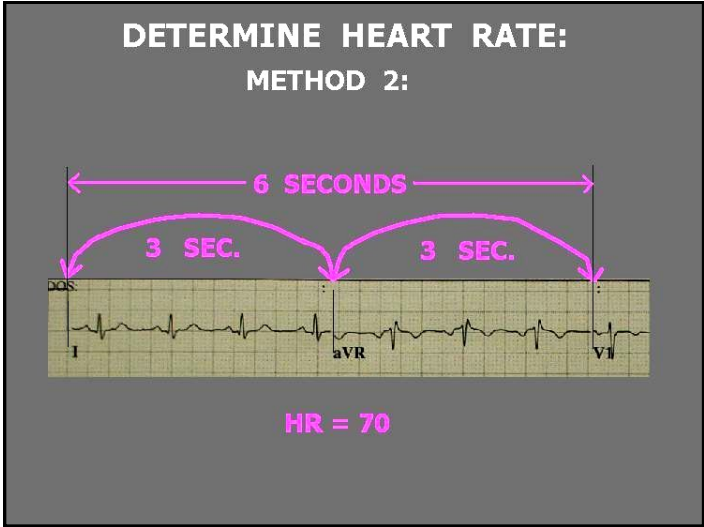
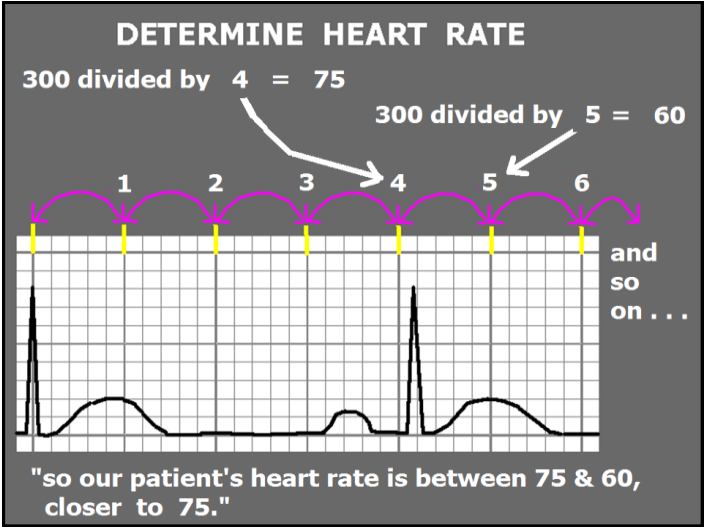
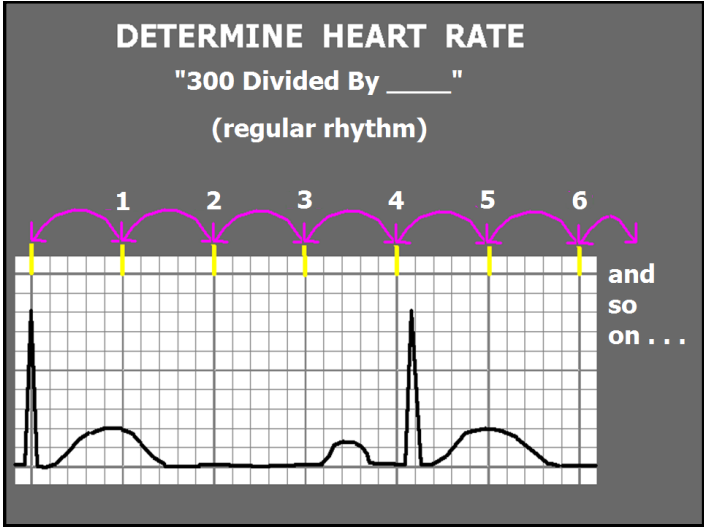
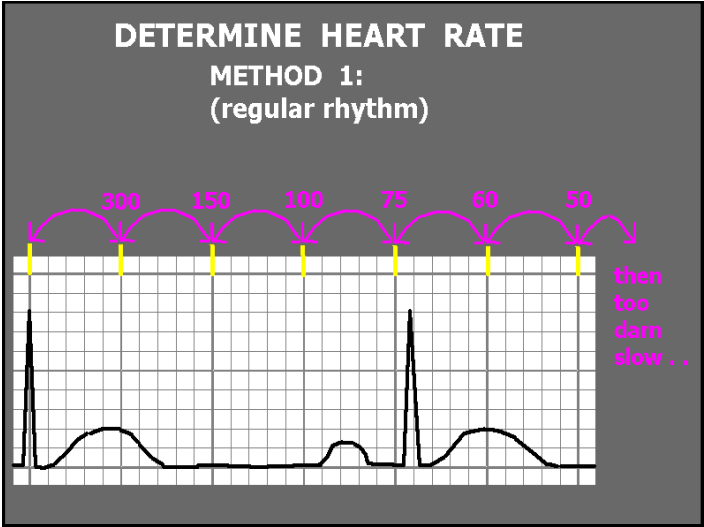
## THE POSITIVE ELECTRODE

IS THE "EYE" . . .



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

- RATE
- RHYTHM
- INTERVALS
- P:QRS RATIO





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

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

" HEART RATE IS SIXTY- FIVE ! "

— THE CONCERNS OF ACLS —

IS THE  
**VENTRICULAR RATE :**

← T O O S L O W

← ~~TOO FAST~~

← **JUST RIGHT.**

" 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

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

***- CRITICAL ECG ALERT -***

- Immediately check patient
- Notify next "higher up" in chain of command

1. Heart rate LESS THAN 50 or GREATER THAN 150

### HEART RATE CLASSIFICATIONS

<u>Heart rates that are:</u>	<u>CLASSIFIED AS:</u>
Below 60	BRADYCARDIA
60 - 100	NORMAL
Above 100	TACHYCARDIA

### ACLS TACHYCARDIA GUIDELINES


150	<b>SVT</b>	
100	<b>SINUS TACH</b>	
	<b>NSR</b>	


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


- RATE
- RHYTHM
- INTERVALS
- P:QRS RATIO

## DETERMINE RHYTHM

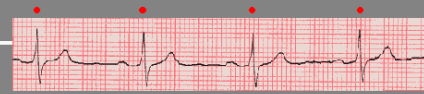
**"WHEN YOUR R - R INTERVALS . . ."**

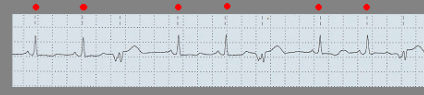
**REGULAR** —  **"ARE ALWAYS CONSISTENT"**

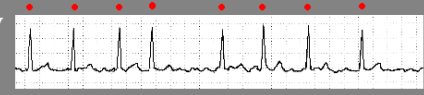
**REGULARLY IRREGULAR** —  **"FOLLOW A PATTERN"**

**IRREGULARLY - IRREGULAR** —  **"ARE TOTALLY CHAOTIC"**

## DETERMINE RHYTHM

**REGULAR** — 

**REGULARLY IRREGULAR** — 


**IRREGULARLY IRREGULAR** — 

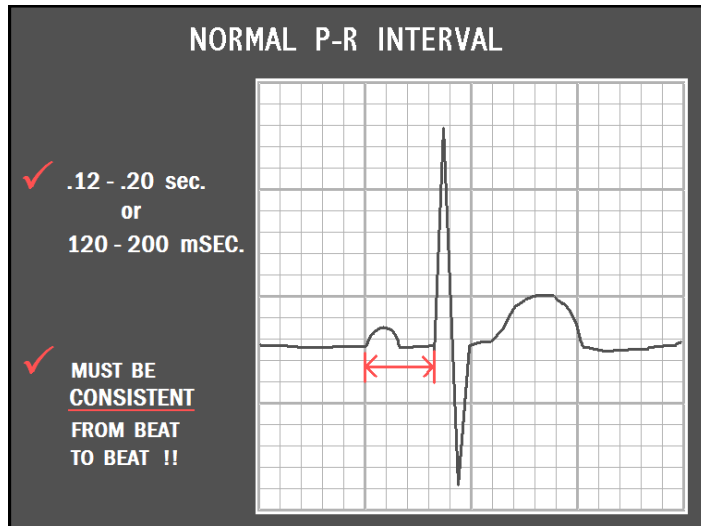
## DETERMINE RHYTHM

EXAMPLES :

<b>REGULAR</b>	<ul style="list-style-type: none"> <li>• SINUS RHYTHM</li> <li>• JUNCTIONAL RHYTHM</li> <li>• VENTRICULAR RHYTHMS</li> </ul>
<b>REGULARLY IRREGULAR</b>	<ul style="list-style-type: none"> <li>• WENCKEBACH (2nd Degree Type I HB)</li> <li>• BIGEMINY, TRIGEMINY, etc</li> </ul>
<b>IRREGULARLY IRREGULAR</b>	<ul style="list-style-type: none"> <li>• ATRIAL FIBRILLATION</li> <li>• MULTIFOCAL ATRIAL RHYTHMS</li> </ul>

## ESTABLISH YOUR ROUTINE ECG EVALUATION . . . .

- RATE
- RHYTHM
-   INTERVALS
- P:QRS RATIO



**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 LONG**  
GREATER THAN 200 mSEC

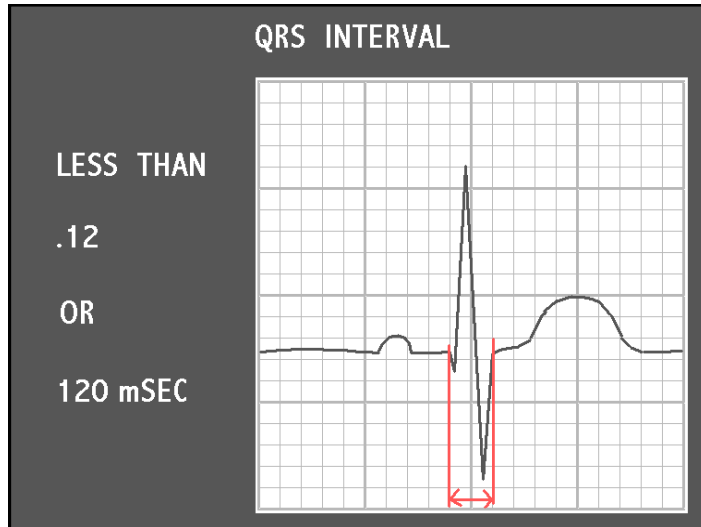
**THINK:**

- HEART BLOCK

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

**THINK:**

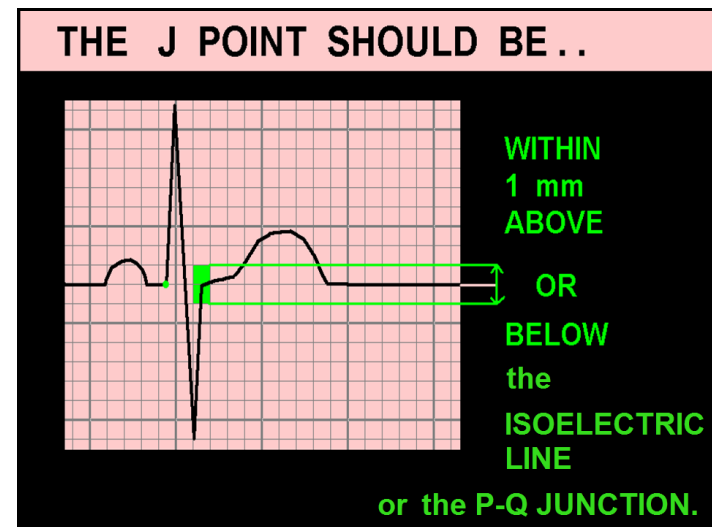
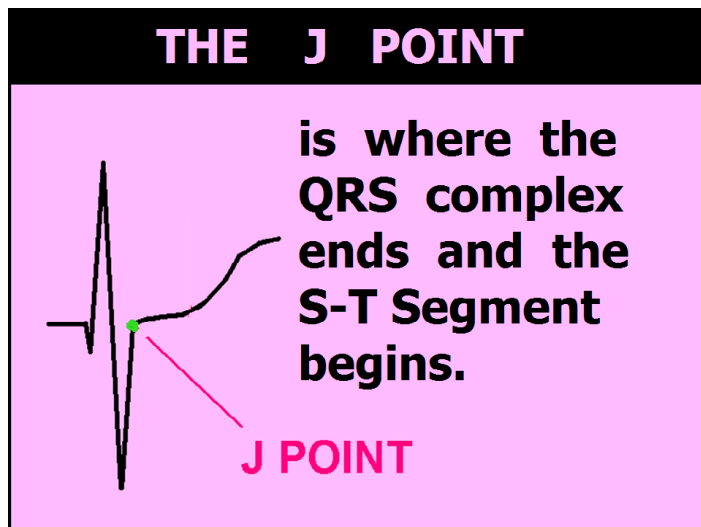
- 2° TYPE 1 HEART BLOCK  
(WENKEBACH)
- 3° HEART BLOCK  
(COMPLETE HEART BLOCK)



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

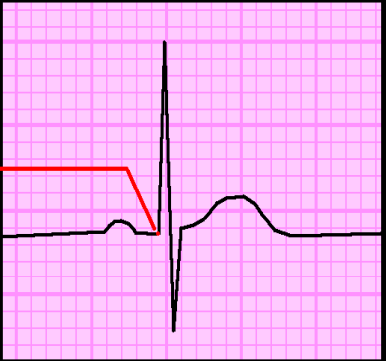
**THINK:**

- BUNDLE BRANCH BLOCK
- **VENTRICULAR COMPLEX (ES)**
- PACED RHYTHM
- L VENTRICULAR HYPERTROPHY
- **ELECTROLYTE IMBAL.** (↑K<sup>+</sup> ↓Ca<sup>++</sup>)
- DELTA WAVE (PRE-EXCITATION)



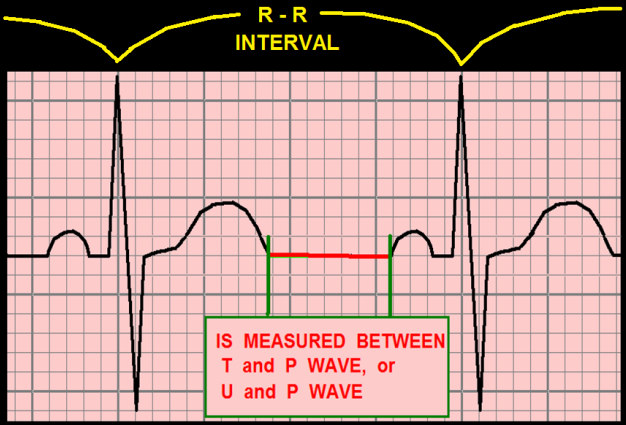
### THE P-Q JUNCTION

... 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

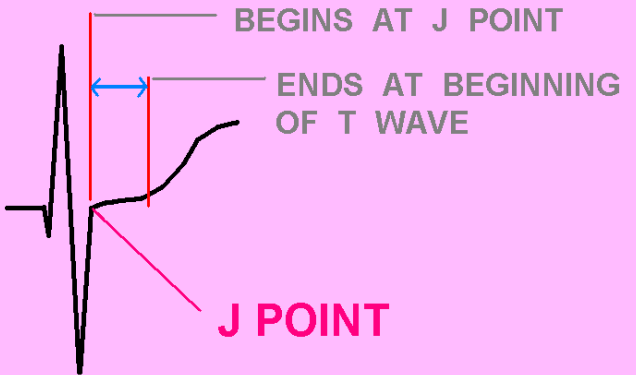
### THE ISOELECTRIC LINE



R - R INTERVAL

IS MEASURED BETWEEN T and P WAVE, or U and P WAVE

### THE S-T SEGMENT




BEGINS AT J POINT

ENDS AT BEGINNING OF T WAVE

J POINT

### Q - T INTERVAL

- VARIES BASED ON HEART RATE AND SEX



**DETERMINING Q-T INTERVAL LIMITS**  
**BAZETT'S FORMULA**

$$QTc = \frac{QT}{\sqrt{R-R}}$$

- REQUIRES CALCULATOR WITH SQUARE ROOT FUNCTION

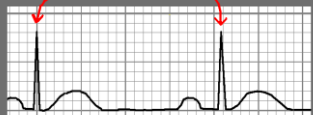
**THE \*QTc INTERVAL**

\* QTc = Q-T interval, corrected for heart rate

HEART RATE	MALE	FEMALE
150	0.28	0.28
125	0.26	0.29
100	0.31	0.34
93	0.32	0.35
83	0.34	0.37
71	0.37	0.40
60	0.40	0.44
50	0.44	0.48
43	0.47	0.51

Annals of Internal Medicine, 1988 109:905.

**DETERMINING Q-T INTERVAL LIMITS**  
**THE "QUICK PEEK" METHOD**  
( for Heart Rates 60 - 100 )



**DETERMINING Q-T INTERVAL LIMITS**  
**RAUTAHARJU FORMULA**

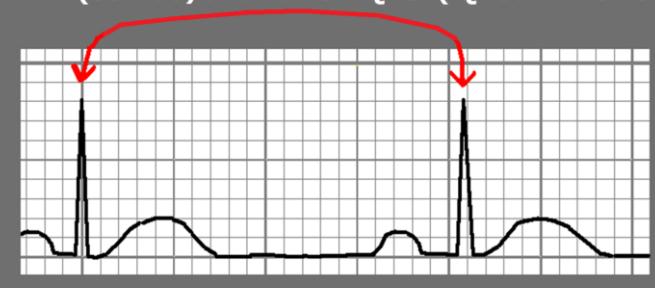
$$QTc = \frac{656}{1 + \frac{HR}{100}}$$

- ACCURATE AT ALL RATES

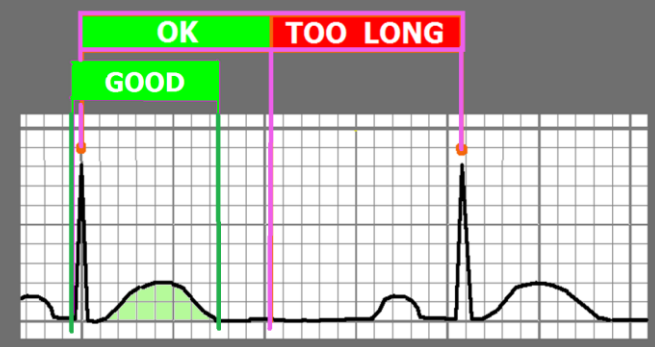
**DETERMINING Q-T INTERVAL LIMITS**  
**THE "QUICK PEEK" METHOD**

☞ Relatively accurate method to quickly identify patients with abnormal QT Intervals.


- Applies to patients with normal heart rates (60-100) and narrow QRS ( QRSd <120ms )

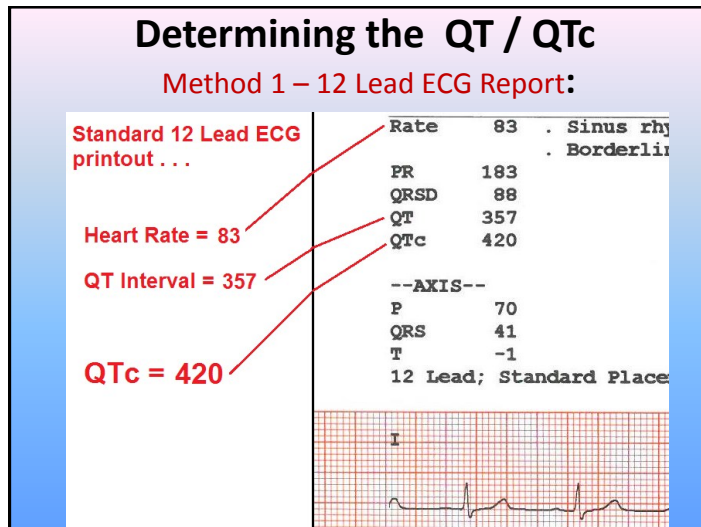


**The Q - T Interval should be LESS THAN 1/2 the R - R Interval**



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

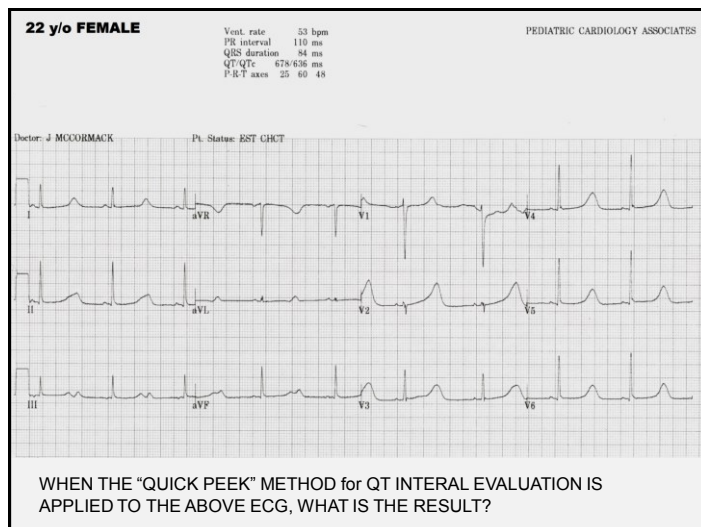




### QTc Values:

Males:	
Too Short:	<390 ms
Normal:	390 - 450 ms
Borderline High:	450 - 500 ms
Critical High:	> 500 ms
Females:	
Too Short:	<390 ms
Normal:	390 - 460 ms
Borderline High:	460 - 500 ms
Critical High:	> 500 ms

SOURCE: "ACC/AHA/HRS Recommendations for Standardization and Interpretation of the ECG, Part IV: The ST Segment, T and U Waves, and the QT Interval". Rautaharju et al 2009



**-- CRITICAL ECG ALERT --**

**-Immediately check patient**  
**-Notify next "higher up" in chain of command**

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)



**Etiology of Long QT Syndromes:****Congenital** (14 known subtypes)

Genetic mutation results in abnormalities of cellular ion channels

**Acquired**

Drug Induced

Metabolic/electrolyte induced

Very low energy diets / anorexia

CNS & Autonomic nervous system disorders

**Miscellaneous**

Coronary Artery Disease

Mitral Valve Prolapse

**PROLONGED Q - T INTERVAL****THINK:**

- CHECK K+ AND MAG LEVELS
- POSSIBILITY OF TORSADES

**PROLONGED Q - T INTERVAL****THINK:**

- CHECK K+ AND MAG LEVELS
- POSSIBILITY OF TORSADES

**- QUESTION MEDS THAT PROLONG Q-T**

**QT Prolongation -- STAT Intervention:**

- Evaluate patient's meds list for meds that prolong the QT Interval.
- Discontinue any medication(s) known to prolong the QT Interval
- Consult pharmacist and the patient's physician to determine alternate medications that do not prolong the QT interval.
- Obtain a thorough patient history, to rule out incidence of syncope, seizures (of unknown etiology), and family history of sudden death/ near sudden death.
- Rule out hypothermia
- Rule out CVA / intracranial bleed
- Evaluate the patient's electrolyte levels
- Continuously **MONITOR PATIENT'S ECG FOR RUNS OF TORSADES**
- Consider "expert consult" (electrophysiologist) to rule out LQTS

**QT Prolongation -- *STAT* Intervention:**

*👉 Avoidance of Meds that are known to prolong the QT Interval. Click here for current list from [CREDIBLEMEDS.ORG](http://CREDIBLEMEDS.ORG)*

**Commonly used QT prolonging meds include:**

- Amiodarone**
  - Ritalin**
  - Procainamide**
  - Pseudoephedrine**
  - Levaquin**
  - Haloperidol**
  - Erythromycin**
  - Thorazine**
  - Norpace**
  - Propulcid**
  - Tequin**
  - Zofran**
  - Benadryl**
  - Ilbutilide**
- and MANY more!**

From: **What Clinicians Should Know About the QT Interval**  
 JAMA. 2003;289(16):2120-2127. doi:10.1001/jama.289.16.2120

**Table. Pharmacokinetic Interactions With Selected QT-Prolonging Drugs\***

QT-Prolonging Drugs	Drugs Possibly Affecting Pharmacokinetics
<b>Antiarrhythmics</b>	
Disopyramide	Erythromycin
Dofetilide	Cimetidine, ketoconazole, megestrol, prochlorperazine, trimethoprim, verapamil, thiazide diuretics
Procainamide	Amiodarone, cimetidine, trimethoprim
Quinidine	Amiodarone, cimetidine, possibly erythromycin and verapamil
<b>Antipsychotics</b>	
Haloperidol	Fuoxetine, venlafaxine
Pimozide	Erythromycin
Thioridazine	Paroxetine
Ziprasidone	Fluconazole, itraconazole, ketoconazole
<b>Antidepressants</b>	
Amtriptlyline	Cimetidine, fluconazole, fuoxetine, ritonavir
Desipramine	Venlafaxine
<b>Anti-infectives</b>	
Erythromycin	Ritonavir
Sparfloxacin	Cisapride
<b>Other</b>	
Bispril	Ritonavir
Cisapride	Clarithromycin, erythromycin, fluconazole, indinavir, itraconazole, ketoconazole, nefazodone, ritonavir

\*Drugs from the "very probable," "probable" and "possible in high-risk patients" categories of the box are included in the table. This is not an all-inclusive list of all pharmacokinetic drug-drug interactions with these agents but, rather, some interactions that could lead to increased serum concentrations of the QT-prolonging drug. New drug-drug interactions may be identified in the future. Pharmacodynamic interactions are not included in this table; however, combinations of QT-prolonging drugs such as macrolide antibiotics and quinolones are strongly discouraged.<sup>10-12</sup>

Date of download: 10/3/2016

Copyright © 2016 American Medical Association. All rights reserved.



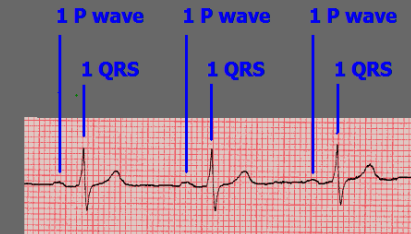
**ESTABLISH YOUR ROUTINE ECG EVALUATION . . . . .**

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

**DETERMINE P : QRS RATIO**



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



## P : QRS RATIO

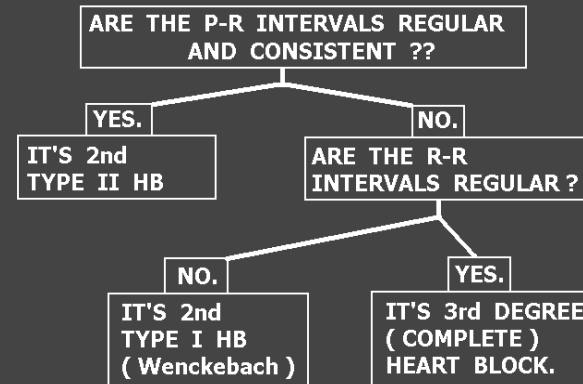
IF GREATER THAN 1 : 1

THINK:

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

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

MORE P-WAVES THAN QRS COMPLEXES PRESENT.



LET'S TEST THE PROCEDURE . . .

1



2



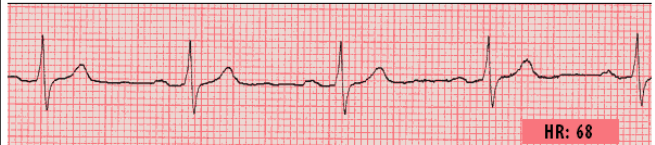
3



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

- RATE
- RHYTHM
- INTERVALS
- P:QRS RATIO

**THIS RHYTHM IS: NORMAL SINUS RHYTHM**



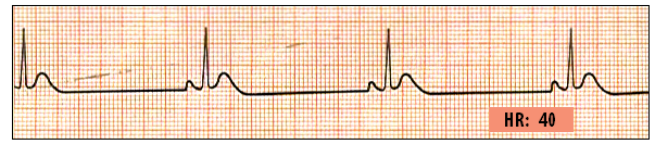
HR: 68

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

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

**POTENTIAL PROBLEMS: NONE!**

**THIS RHYTHM IS: SINUS BRADYCARDIA**



HR: 40


**MAIN IDENTIFICATION CHARACTERISTIC(S): HEART RATE LESS THAN 60**

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

**POTENTIAL PROBLEM(S):**

- HYPOTENSION / SHOCK
- MAY HAVE OTHER SERIOUS PROBLEMS (SUCH AS ACUTE MI)

**SHOCK ASSESSMENT**



SECONDS

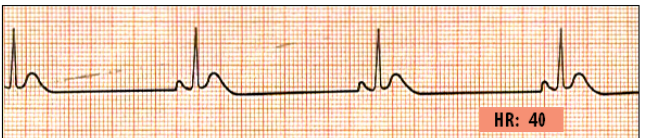
**SHOCK = INADEQUATE TISSUE PERFUSION**

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

**SHOCK ASSESSMENT**

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

**THIS RHYTHM IS: SINUS BRADYCARDIA**



HR: 40


**WE MUST CONSIDER UNDERLYING CAUSES:**

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

**AND TREAT THEM:**

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

**THIS RHYTHM IS: FIRST DEGREE HEART BLOCK**




280 mSEC

**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**




280 mSEC

**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" . . .

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

**STEP 1**  
EVALUATE P - R RELATIONSHIP

ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??

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

**STEP 2**  
EVALUATE R - R INTERVALS

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

**MAIN IDENTIFICATION CHARACTERISTIC(S):** 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<sup>o</sup> TYPE I HB ( Wenckebach )

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

**POTENTIAL PROBLEMS:**

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

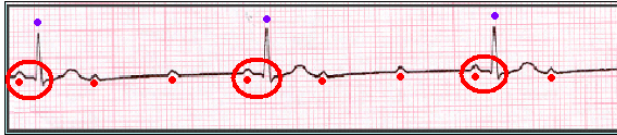
### WHEN YOU SEE "EXTRA P WAVES" . . .

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

**STEP 1**  
EVALUATE P - R RELATIONSHIP

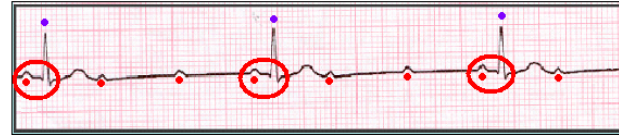
ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??

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

**THIS RHYTHM IS: 2nd<sup>o</sup> TYPE II HEART BLOCK**

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

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

**THIS RHYTHM IS: 2nd<sup>o</sup> TYPE II HEART BLOCK**

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

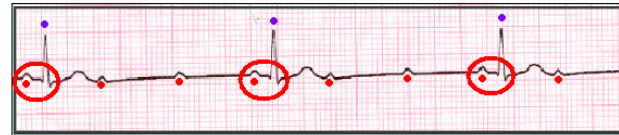
**POTENTIAL PROBLEMS:**

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

**– CRITICAL ECG ALERT –**

- Immediately check patient
- Notify next “higher up” in chain of command

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK

**THIS RHYTHM IS: 2nd<sup>o</sup> TYPE II HEART BLOCK**

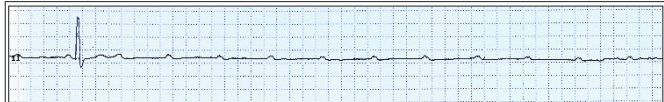
MAIN IDENTIFICATION CHARACTERISTIC(S): **MORE THAN ONE P WAVE FOR EACH QRS – BUT EVERY QRS HAS A NORMAL, CONSISTENT P-R INTERVAL**



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




**ADAMS - STOKES SYNDROME**



**CASE HISTORY:**  
 72 y/o male with history of **SYNCOPE OF UNKNOWN ORIGIN**. While undergoing Cardiac Catheterization (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 Implantation. Patient experienced full recovery, was discharged.

**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.

**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<sup>o</sup> HB  $\bar{c}$  JUNCTIONAL ESCAPE



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

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



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

**MAIN IDENTIFICATION CHARACTERISTIC(S):** P - R INTERVAL INCONSISTENT, 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

ANTERIOR VIEW

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

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

**STEP 1**  
EVALUATE P - R RELATIONSHIP

ARE THE P-R INTERVALS REGULAR AND CONSISTENT ??

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

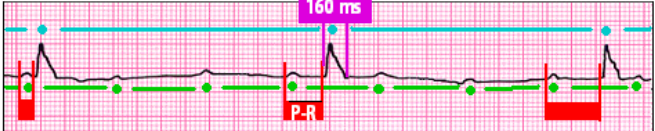
**STEP 2**  
EVALUATE R - R INTERVALS

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

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


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

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

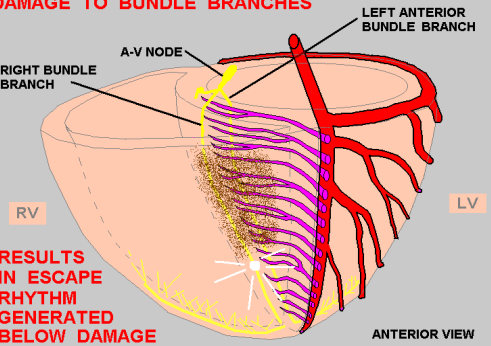


**MAIN IDENTIFICATION CHARACTERISTIC(S):** P - R INTERVALS INCONSISTENT  
P - P INTERVALS REGULAR, R - R INTERVALS REGULAR. NO  
RELATIONSHIP BETWEEN P WAVES AND QRS COMPLEXES. QRS  
COMPLEXES are WIDER THAN 120ms, AND RATE ( usually < 40 )

**POTENTIAL PROBLEMS:**  
**HYPOTENSION and SHOCK** due to ↓ HEART RATE and  
↓ CARDIAC OUTPUT




**DAMAGE TO BUNDLE BRANCHES**



Labels: A-V NODE, RIGHT BUNDLE BRANCH, LEFT ANTERIOR BUNDLE BRANCH, RV, LV, ANTERIOR VIEW

**RESULTS IN ESCAPE RHYTHM GENERATED BELOW DAMAGE**



**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

**— CRITICAL ECG ALERT —**

**-Immediately check patient**  
**-Notify next “higher up” in chain of command**

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE

**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: 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.**

**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

**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** — **VARIABLE (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
- A-FLUTTER OFTEN IS INTERMITTENT WITH A-FIB-- A-FIB PRECAUTIONS APPLY (THROMBUS RISKS)

**TREATMENT / INTERVENTIONS:**

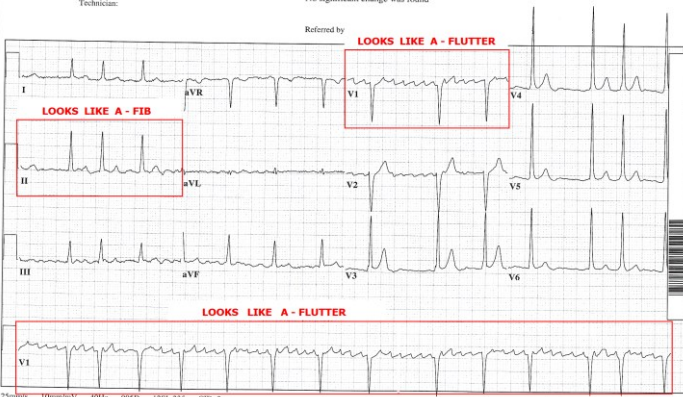
- ☞ TOO SLOW - SYMPTOMATIC BRADYCARDIA ALGORITHM
- ☞ TOO FAST - TACHYCARDIA ALGORITHM

48 yr Male Hispanic  
Room-VAM Inc:3  
Option:23

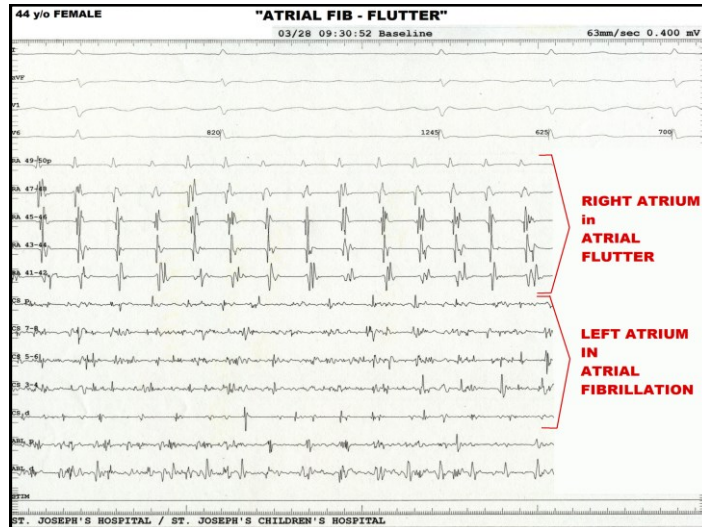
Vent rate	83	BPM
PR interval	100	ms
QRS duration	142/106	ms
QT/QTc	+ 58	46
P-R-T axes		

\*\*\*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: \_\_\_\_\_



Page 1 of 1



**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**



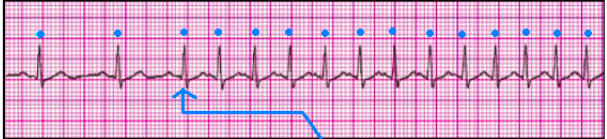
**WE MUST CONSIDER UNDERLYING CAUSES: AND TREAT THEM:**

- ANXIETY / FEAR —————→ CALM PATIENT
- HYPOVOLEMIA —————→
- DEHYDRATION —————→ FLUIDS
- BLOOD LOSS —————→ STOP BLEEDING
- MEDICATION EFFECTS ———→ CONSIDER MEDICAL Tx
- OTHER ILLNESS —————→ IDENTIFY & Tx DISORDER

### ACLS TACHYCARDIA GUIDELINES

<b>SVT</b>	
<b>150</b>	
<b>SINUS TACH</b>	
<b>100</b>	
<b>NSR</b>	

### RHYTHM CLUES . . . .

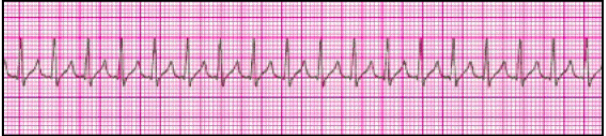


SUPRAVENTRICULAR TACHYCARDIA

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

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

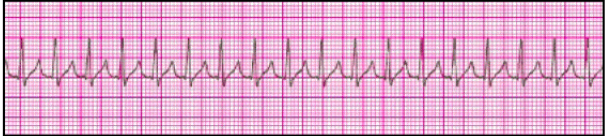
### THIS RHYTHM IS: SUPRAVENTRICULAR TACHYCARDIA (SVT)



**MAIN IDENTIFICATION CHARACTERISTIC(S):** HEART RATE TOO FAST, USUALLY > 150. P WAVES MAY BE "BURIED" IN THE PRECEDING T WAVES. P<sub>t</sub> 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

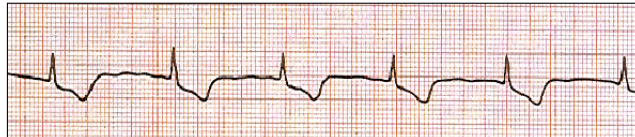
### THIS RHYTHM IS: SUPRAVENTRICULAR TACHYCARDIA (SVT)



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

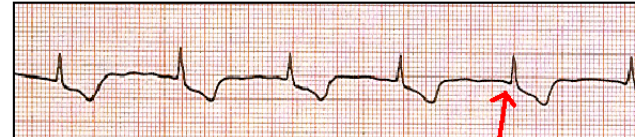
**POTENTIAL PROBLEMS:**

- 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: JUNCTIONAL RHYTHM**

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

RATE ————— 40-60  
RHYTHM ————— REGULAR  
P-R INTERVAL ——— ABSENT or SHORT  
P:QRS RATIO ——— 1:1  
QRS INTERVAL ——— NORMAL

**THIS RHYTHM IS: JUNCTIONAL RHYTHM**

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

52 HR:69

**THIS RHYTHM IS: JUNCTIONAL RHYTHM**

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

**POTENTIAL PROBLEM(S):**

- HR can be **TOO FAST** or **TOO SLOW !!** (↓CARDIAC OUTPUT)
- **COULD BE INDICATOR OF MORE SERIOUS UNDERLYING CONDITIONS:**
  - M.I.
  - **ELECTRICAL SYSTEM DISTURBANCES**


**THIS RHYTHM IS: JUNCTIONAL RHYTHM**

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

**TREATMENT/INTERVENTION:**

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

**THIS RHYTHM IS: JUNCTIONAL RHYTHM**



**HEART RATE TOO SLOW . . . .**


**WE MUST CONSIDER UNDERLYING CAUSES:**

- INCREASED VAGAL TONE →
- BLOCKED SA NODAL ARTERY (ACUTE INFERIOR MI ?) →
- ELECTROLYTE IMBAL. (K+) →

**AND TREAT THEM:**

- ATROPINE
- CARDIAC CATH - PTCA / STENT
- THROMBOLYTICS
- CORRECT ELECTROLYTES

**THIS RHYTHM IS: JUNCTIONAL RHYTHM**



**HEART RATE TOO FAST . . . .**

**WE MUST CONSIDER UNDERLYING CAUSES:**

- AV NODAL RE-ENTRANT TACHYCARDIA (AVNRT) (Pt. has DUAL AV NODES)
- WPW ORTHODROMIC TACHYCARDIA



**AND TREAT THEM:**

- "CHEMICAL" CARADIOVERSION
- SYNCHRONIZED CARADIOVERSION
- ABLATION of "SLOW PATHWAY" (AVNRT) or ACCESSORY BYPASS TRACT (WPW) in EP LAB

# ECTOPY

- ATRIAL
- JUNCTIONAL
- VENTRICULAR

## CLASSIFICATIONS OF ECTOPY

1. **PREMATURE**  
 THE ECTOPIC BEAT COMES BEFORE THE NEXT REGULARLY EXPECTED BEAT (IT'S EARLY!)  

2. **END-DIASTOLIC, ESCAPE, or COMPENSATORY**  
 THE ECTOPIC BEAT COMES AFTER A REGULAR BEAT FAILS TO HAPPEN. END-DIASTOLIC BEATS MAY BE LIFE-SAVING  




## CAUSES OF ECTOPY

### 1. PREMATURE

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

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

- FAILURE OF SA NODE
- FAILURE OF AV NODE

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

## 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**

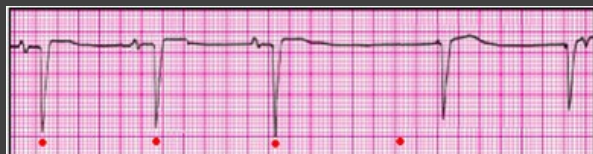


ELIMINATION OF END-DIASTOLIC BEATS COULD BE DEADLY

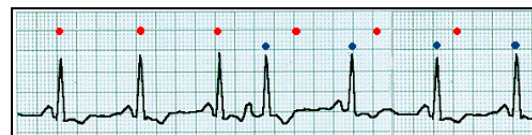
### Premature



### End Diastolic (escape)



### THIS RHYTHM IS: NSR with PAC



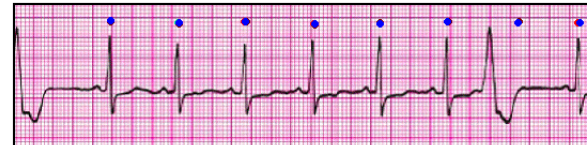
MAIN IDENTIFICATION CHARACTERISTIC(S): **PREMATURE COMPLEX, NORMAL QRS; P-WAVE DIFFERENT THAN OTHERS; P-R INTERVAL FREQUENTLY LONGER or SHORTER THAN NORMAL; NO COMPENSATORY PAUSE**

- 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 JUNCTIONAL ESCAPE BEAT**

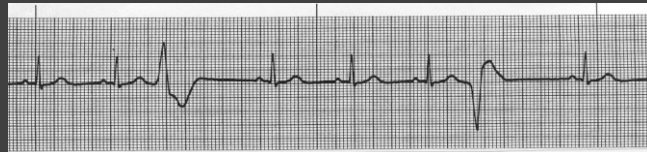
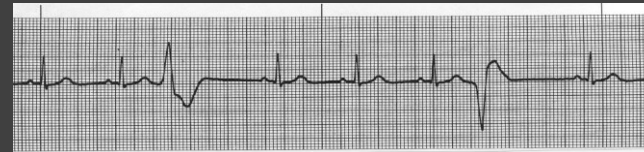
MAIN IDENTIFICATION CHARACTERISTIC(S): **BEAT OCCURS LATER THAN NEXT EXPECTED BEAT; QRS IS NORMAL; P WAVE ABSENT or JUST IN FRONT OF or JUST AFTER QRS and is USUALLY INVERTED.**

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 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**

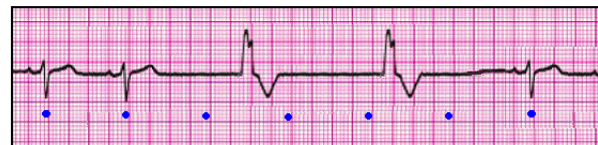
RATE ————— **NORMAL**  
 RHYTHM ————— **IRREGULAR (due to PVCs)**  
 P-R INTERVAL — **NSR BEATS - NORMAL (120 - 200 ms) PVCs - N/A**  
 P:QRS RATIO — **NSR BEATS - 1:1 PVCs - N/A**  
 QRS INTERVAL — **NSR BEATS < 120 ms PVCs > 120 ms**

**Multifocal PVCs****Multifocal Couplet PVCs**

**— CRITICAL ECG ALERT —**

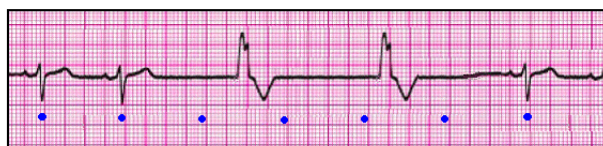
- Immediately check patient
- Notify next “higher up” in chain of command

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE
5. NEW ONSET of any DYSRHYTHMIA
6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,

**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

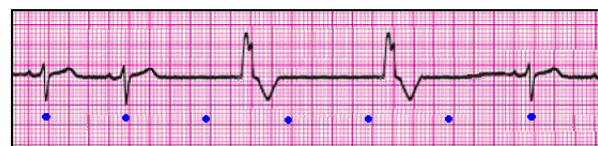
RATE ————— USUALLY < 40  
 RHYTHM ————— VENT. ESCAPE: USUALLY REGULAR  
 P-R INTERVAL ——— VENT. ESCAPE: N / A  
 P:QRS RATIO ——— VENT. ESCAPE: N / A  
 QRS INTERVAL ——— VENT. ESCAPE: > 20 ms

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

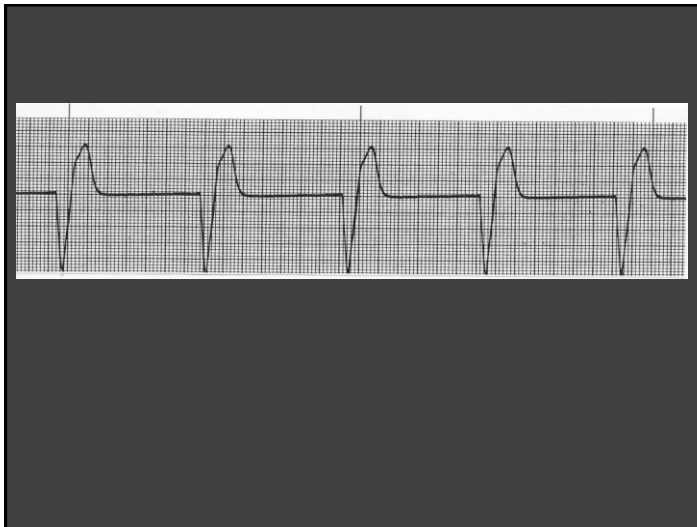
MAIN IDENTIFICATION CHARACTERISTIC(S): END DIASTOLIC (ESCAPE) BEAT(S); COMPLEXES WIDER THAN 120 ms ; MAY BE UNIFOCAL or MULTIFOCAL; MAY or MAY NOT HAVE GOOD PULSE w/ COMPLEXES

**PRESENTING PROBLEM(S):**

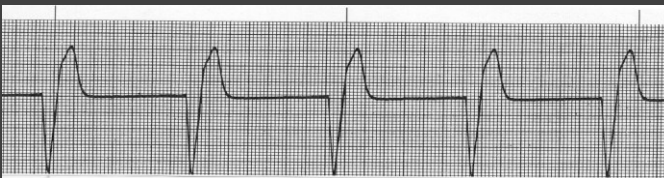
- PROBLEM IS WITH UNDERLYING REASON WHY SINUS NODE and AV NODE HAVING PERIODS OF ARREST.
- THE VENTRICULAR ESCAPE COMPLEXES MAY BE VERY SLOW, BUT MAY BE ONLY THING KEEPING PATIENT PERFUSED DURING PERIODS OF SINUS / AV ARREST.

**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 SUPPRESS VENTRICULAR ESCAPE BEATS WITHOUT HAVING BACK-UP TRANSCUTANEOUS / TRANSVENOUS PACING ATTACHED TO PATIENT !!!



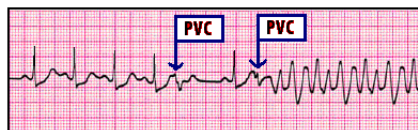
### Accelerated Idioventricular Rhythm (AIVR)



No P waves  
 Wide QRS Complexes  
 Rate usually "Ventricular" - 40 or less

**This may be the only RHYTHM keeping the Patient alive.**

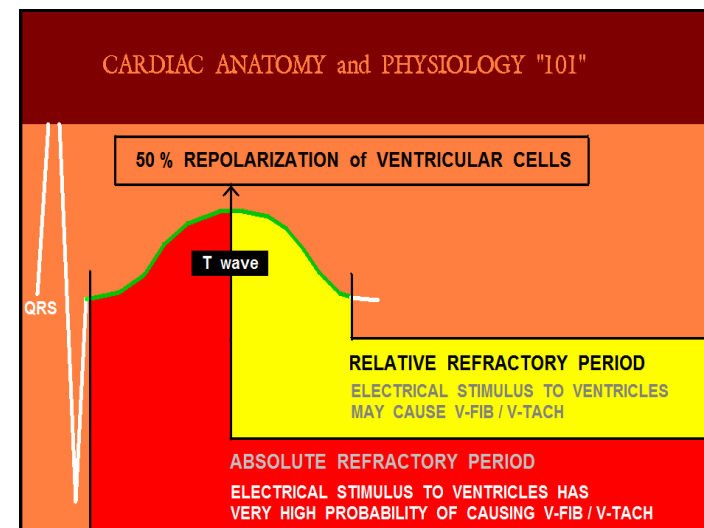
### THIS RHYTHM IS: NSR with R on T PHENOMENON



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

#### POTENTIAL PROBLEMS (S):

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



**THIS RHYTHM IS: NSR 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."**

**THIS RHYTHM IS: MONOMORPHIC V-TACH**

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


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

**— CRITICAL ECG ALERT —**

- Immediately check patient**
- Notify next "higher up" in chain of command**

- 1. Heart rate LESS THAN 50 or GREATER THAN 150**
- 2. QT INTERVAL prolonged (usually not emergent but let Dr. know)**
- 3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK**
- 4. SINUS ARREST with periods of ASYSTOLE**
- 5. NEW ONSET of any DYSRHYTHMIA**
- 6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,**
- 7. V-TACH, or WIDE QRS TACHYCARDIA of unknown origin**

**THIS RHYTHM IS: POLYMORPHIC V - TACH**



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


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

**— CRITICAL ECG ALERT —**

**-Immediately check patient**  
**-Notify next "higher up" in chain of command**

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE
5. NEW ONSET of any DYSRHYTHMIA
6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,
7. V-TACH, or WIDE QRS TACHYCARDIA of unknown origin
8. TORSADES de POINTES

**WIDE COMPLEX TACHYCARDIA**  
**TORSADES de POINTES** (QRS > 120 ms)



**ABCs**

<b>NO PULSE</b> GO TO V-FIB ALGORITHM I	<b>PULSE - UNSTABLE</b> • IMMEDIATE DEFIBRILLATION START IV CONSIDER SEDATION	<b>PULSE - STABLE</b> • O2 / IV / EKG • MAGNESIUM INFUSION 1-2 grn OVER 5-60 min
--	---	--

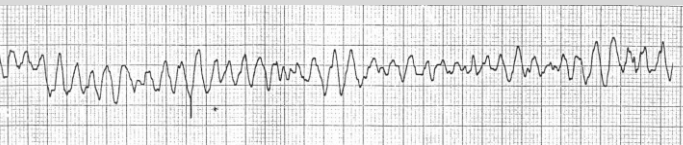
**DO NOT give PROCAINAMIDE, AMIODARONE, or SOTALOL to patients with TORSADES or POLYMORPHIC VT !!!**

**OTHER CONSIDERATIONS:**

- EVALUATE BASELINE ECG RHYTHM FOR PRONGED Q-T INTERVAL.
- EVALUATE PATIENT'S MEDS FOR Q-T PROLONGING DRUGS
- ... IF PATIENT HAS BEEN RECEIVING ANY Q-T PROLONGING DRUGS, IMMEDIATELY DISCONTINUE AND CONTACT PHYSICIAN STAT.
- EVALUATE PATIENT HISTORY FOR PREVIOUS EVENTS OF "SYNCOPE OF UNKNOWN ETIOLOGY"
- EVALUATE PATIENT FOR FAMILY HISTORY FOR SUDDEN CARDIAC DEATH

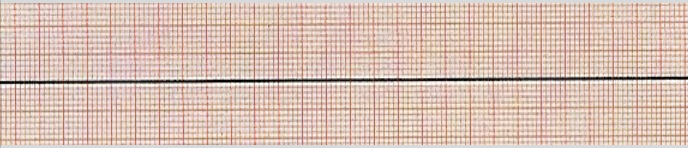
REPORT ANY ABNORMAL FINDINGS TO PHYSICIAN.

**VENTRICULAR FIBRILLATION**



**CARDIAC ARREST RHYTHM**

Ventricular Asystole

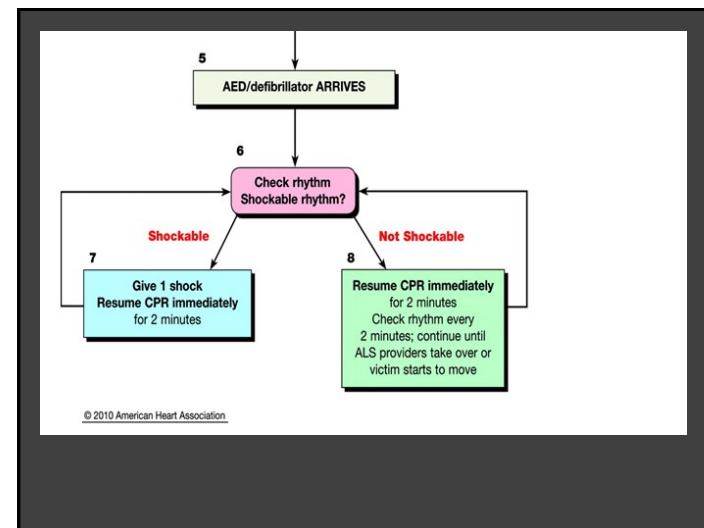
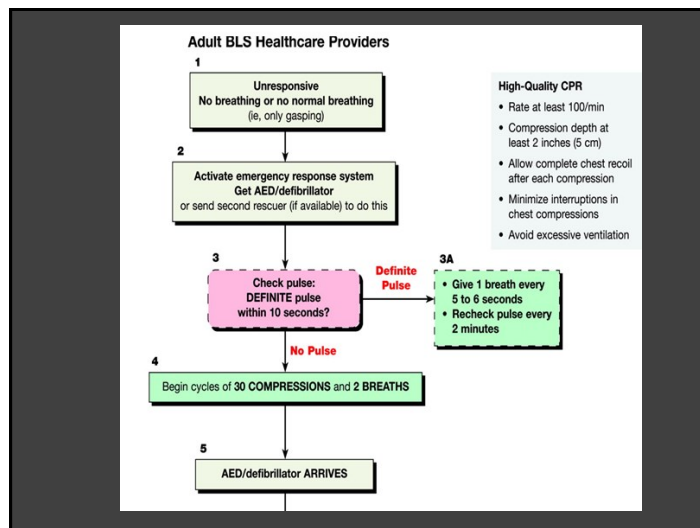


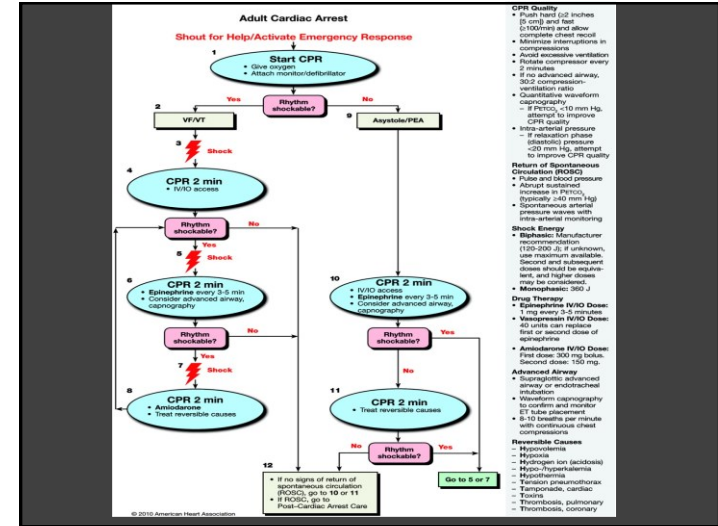
***CARDIAC ARREST RHYTHM***

***– CRITICAL ECG ALERT –***

**-Immediately check patient**  
**-Notify next “higher up” in chain of command**

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE
5. NEW ONSET of any DYSRHYTHMIA
6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,
7. V-TACH, or WIDE QRS TACHYCARDIA of unknown origin
8. TORSADES de POINTES
9. VENTRICULAR FIBRILLATION or ASYSTOLE





If QRS complexes have a PULSE then apply **PACEMAKER !!**

CPR  
 |  
 IV / AIRWAY  
 |  
 EPI 1 mg  
 |

**AHA ACLS 2010 STANDARDS**

**THE " H's " and the " T's "**

- HYPOVOLEMIA
- HYPOXIA
- HYDROGEN ION ( Ph )
- HYPOGLYCEMIA
- HYPOTHERMIA

- TOXINS
- TAMPONADE ( CARDIAC )
- TENSION PNEUMOTHORAX
- THROMBOSIS ( CORONARY or PULMONARY )
- TRAUMA





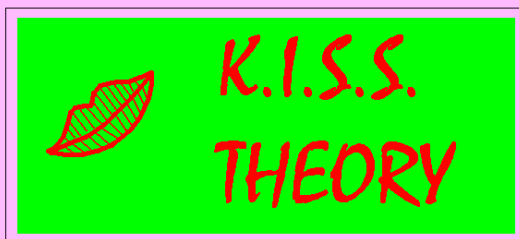
### **– CRITICAL ECG ALERT –**

**-Immediately check patient**  
**-Notify next “higher up” in chain of command**

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE
5. NEW ONSET of any DYSRHYTHMIA
6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,
7. V-TACH, or WIDE QRS TACHYCARDIA of unknown origin
8. TORSADES de POINTES
9. VENTRICULAR FIBRILLATION or ASYSTOLE
10. PACER SPIKES WITHOUT QRS – “FAILURE TO CAPTURE”

## THE QRS COMPLEX

### DIAGNOSING BUNDLE BRANCH BLOCK



## THE QRS COMPLEX

### DIAGNOSING BUNDLE BRANCH BLOCK

- There are several methods to differentiate Right Bundle Branch Block (RBBB) from Left Bundle Branch Block (LBBB).

- Our methods use Lead V1 (or MCL 1)

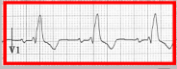
**METHOD 1:** Rotate rhythm strip 90 degrees clockwise ("York Hospital" Method)

**METHOD 2:** Terminal Deflection of QRS Complex: Negative or Positive ?



**DIAGNOSING BUNDLE BRANCH BLOCKS in LEAD V1**

**\* The "York Hospital" Method:**

- ROTATE** your rhythm strip (of LEAD V1) **CLOCKWISE**
- DIAGNOSE** -- The side of the **ISOELECTRIC LINE** that the bulk of the QRS complex rests -- is the side of the heart with the **BUNDLE BRANCH BLOCK!**



**\* I do not know whom is responsible for developing this "fine pearl" of cardiology wisdom, but the first time I ever heard of it -- after teaching 12 Lead EKG for several years -- was while teaching EKG at York Hospital in York, Pennsylvania. I promised the room full of nurses -- who were laughing, by this time -- that I would credit them for enlightening me on this rather useful and usually accurate technique!**

**LBBB!**  **RBBB!** 

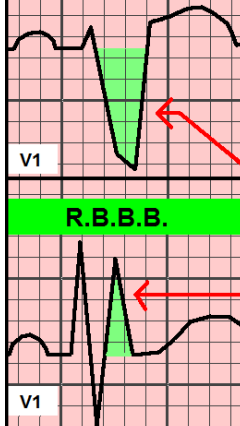
**DIAGNOSING BUNDLE BRANCH BLOCK**

**L.B.B.B.** **USING LEAD V1**

- QRS WIDER THAN 120 ms
- BEAT IS SUPRAVENTRICULAR IN ORIGIN
- TERMINAL PHASE OF QRS COMPLEX (LAST DEFLECTION)

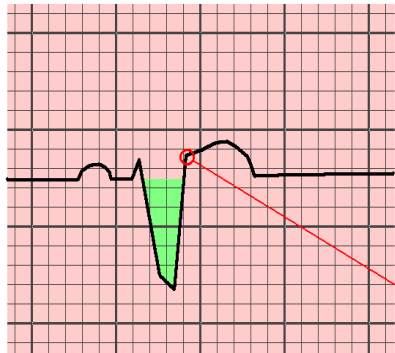
**R.B.B.B.**

- NEGATIVE = LEFT BUNDLE BRANCH BLOCK
- POSITIVE = RIGHT 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!

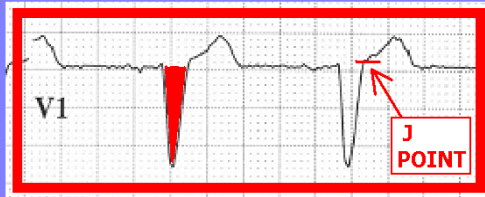


**DIAGNOSING RBBB IN LEAD V1:**

- WIDER THAN 120 ms (.12) (or 3 little boxes)
- TERMINAL PHASE (LAST PART) OF QRS COMPLEX IS POSITIVE DEFLECTION



**TERMINAL PHASE OF QRS IS  
NEGATIVE**



**= LEFT BUNDLE  
BRANCH BLOCK**

**TERMINAL PHASE OF QRS IS  
POSITIVE**



**= RIGHT BUNDLE  
BRANCH BLOCK**

***- CRITICAL ECG ALERT -***

- Immediately check patient
- Notify next "higher up" in chain of command

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE
5. NEW ONSET of any DYSRHYTHMIA
6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,
7. V-TACH, or WIDE QRS TACHYCARDIA of unknown origin
8. TORSADES de POINTES
9. VENTRICULAR FIBRILLATION or ASYSTOLE
10. PACER SPIKES WITHOUT QRS - "FAILURE TO CAPTURE"
11. CHANGES in the QRS width (new onset Bundle Branch Block)

**Use of  
TELEMETRY MONITORING  
For  
ONGOING EVALUATION of:**

- ***Acute Coronary Syndrome***
- "Low Probability Chest Pain"
- Post PCI / STENT

## **Acute Coronary Syndrome (ACS) includes:**

- **STEMI** (ST segment elev. MI)
- **NSTEMI** (Non-ST seg. Elev. MI)
- **Unstable Angina**

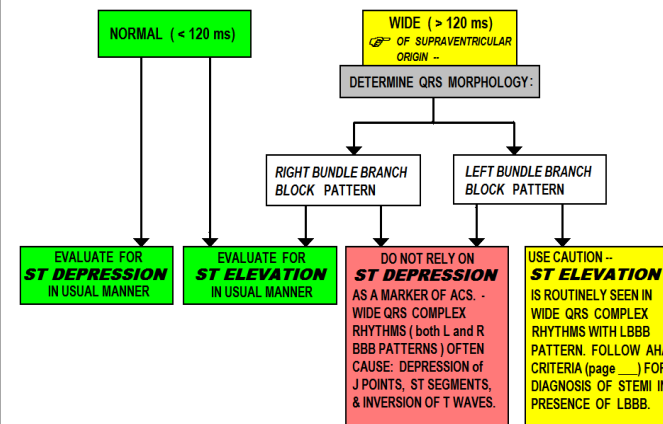
The ECG Markers of ACS involve the:

- J Point
- ST Segment
- T Wave

Of every lead on the 12 Lead ECG.

**THE ECG should NOT CHANGE.** Any changes that occur to the Patient's ECG waveforms should be considered **ABNORMAL** and should be **REPORTED**.

### STEP 1 - EVALUATE WIDTH OF QRS:



If the QRS complexes Are WIDE (> 120ms) COMPARE J POINTS, ST SEGMENTS and T WAVES of OLDER RHYTHM STRIPS to NEWER ONES !!

CONDITIONS WHICH ALTER THE ECG MARKERS of ACUTE CORONARY SYNDROME		
WIDE QRS COMPLEXES ALTER THE	RIGHT BUNDLE BRANCH BLOCK	LEFT BUNDLE BRANCH BLOCK
- J POINTS	W-P-W BYPASS TRACT, LEFT LATERAL WALL 49 y/o MALE	SAME PATIENT AS ON LEFT - IMMEDIATELY AFTER RF ABLATION OF BYPASS TRACT
- ST SEGMENTS	W-P-W BYPASS TRACT, RIGHT ANTERIOR/LATERAL WALL 14 y/o MALE	SAME PATIENT AS ON LEFT - IMMEDIATELY AFTER RF ABLATION OF BYPASS TRACT
- T WAVES	PACEMAKER - RIGHT VENTRICULAR APEX	PACEMAKER TURNED OFF HERE
Of the ECG . . .	RIGHT VENTRICULAR HYPERTROPHY ( Strain Pattern )	LEFT VENTRICULAR HYPERTROPHY ( Strain Pattern )
	VENTRICULAR TACHYCARDIA FOCUS: LEFT FASCICULAR, 17 y/o FEMALE	VENTRICULAR TACHYCARDIA-FOCUS: RIGHT VENTRICULAR APEX

**IF THE QRS COMPLEXES ON THE EKG ARE OF NORMAL WIDTH (<120 ms) :**

**STEP 2 - EVALUATE the EKG for ACS**

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

- J POINTS
- ST SEGMENTS
- T WAVES

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

When QRS complex width is **NORMAL** (< 120 ms) :

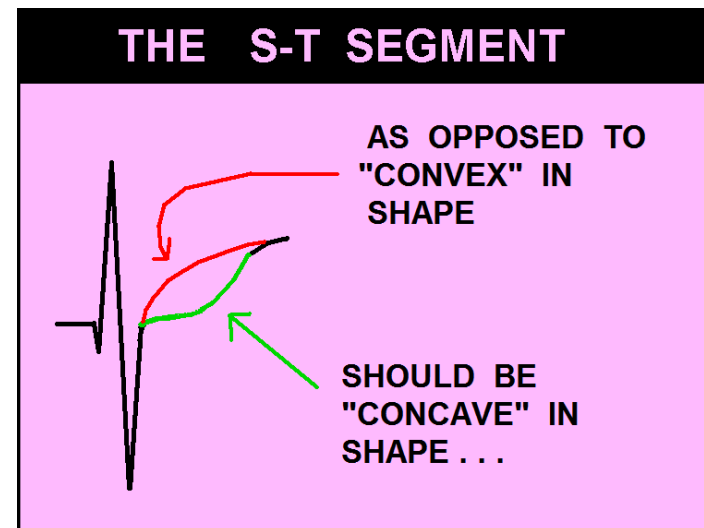
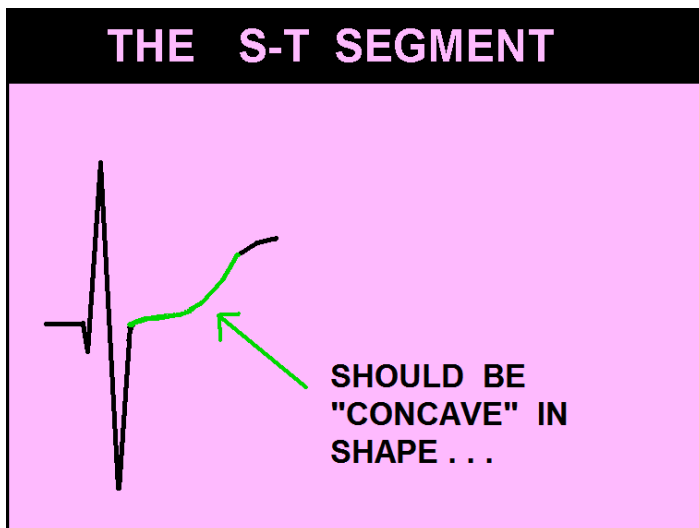
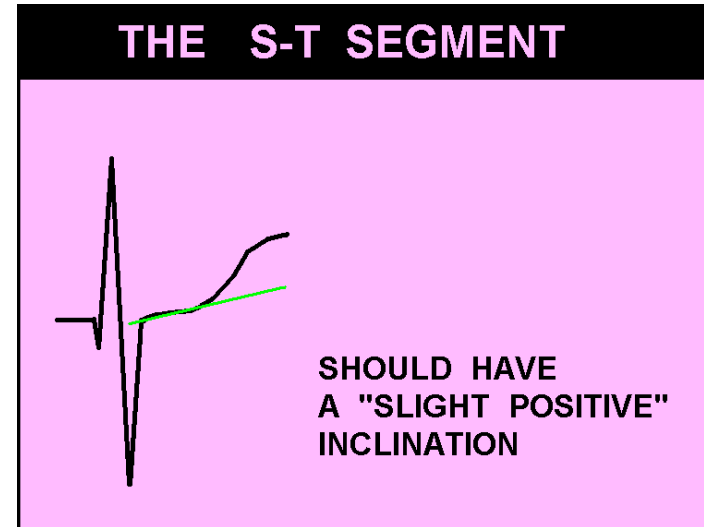
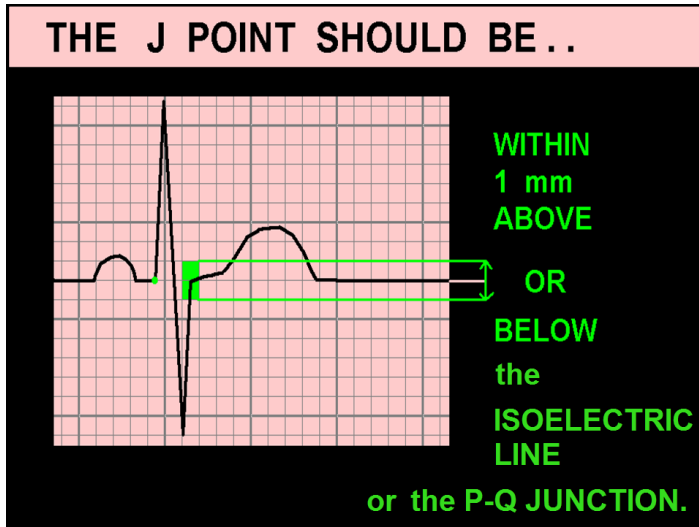
## NORMAL ST - T WAVES

- WHEN QRS WIDTH IS NORMAL (< 120 ms)

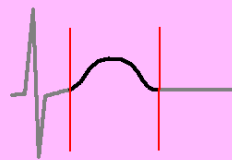
**ASSESS:**

- J POINT: ISOELECTRIC ( or < 1 mm dev. )
- ST SEG: SLIGHT, POSITIVE INCLINATION
- T WAVE: UPRIGHT, POSITIVE

**in EVERY LEAD EXCEPT aVR !!**

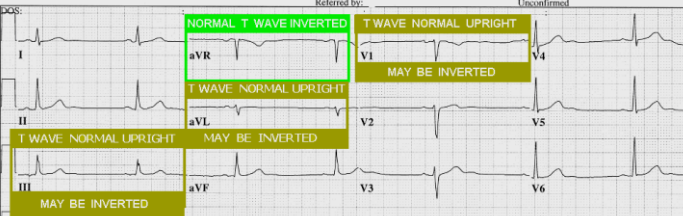


## THE T WAVE







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

### Leads where the T WAVE may be INVERTED:




Referred by: \_\_\_\_\_ Unconfirmed

I: NORMAL T WAVE UPRIGHT  
 II: T WAVE: NORMAL UPRIGHT  
 III: MAY BE INVERTED  
 aVR: T WAVE NORMAL UPRIGHT  
 aVL: T WAVE: NORMAL UPRIGHT  
 aVF: MAY BE INVERTED  
 V1: T WAVE NORMAL UPRIGHT  
 V2: MAY BE INVERTED  
 V3: T WAVE NORMAL UPRIGHT  
 V4: T WAVE NORMAL UPRIGHT  
 V5: T WAVE NORMAL UPRIGHT  
 V6: T WAVE NORMAL UPRIGHT


CHANGES ASSOCIATED WITH CELLULAR PERFUSION INVOLVING THE:  - QRS - J POINT - ST SEGMENT - T WAVE	C A R D I A C	<b>NORMAL STATE OF PERFUSION</b> ARTERIAL BLOCKAGES → NONE SIGNIFICANT CELLULAR OXYGENATION → NORMAL CELLULAR METABOLISM → AEROBIC CELLULAR FUNCTION → NORMAL CONTRACTION EKG: J POINT ISOELECTRIC, ST SEG° SLIGHT, POSITIVE INCLINATION, T WAVE POSITIVE UPRIGHT.	
	C E L L	<b>ISCHEMIA</b> ARTERIAL BLOCKAGES → PARTIAL OBSTRUCTION CELLULAR OXYGENATION → INSUFFICIENT CELLULAR METABOLISM → AEROBIC CELLULAR FUNCTION → REDUCED CONTRACTION PATIENT SYMPTOMS → POSSIBLE, WITH EXERTION EKG: J POINT DEPRESSED, ST SEGMENT VARIES, T WAVE VARIES	
	P E R F U S I O N	<b>INFARCTION</b> ARTERIAL BLOCKAGES → TOTAL OBSTRUCTION CELLULAR OXYGENATION → NONE CELLULAR METABOLISM → ANAEROBIC CELL BEGINS TO BURN GLYCOGEN RESERVES CELLULAR FUNCTION → STOPS CONTRACTING PATIENT SYMPTOMS → TYPICAL or ATYPICAL ACS Sx EKG - INDICATIVE: J POINT ELEVATES, ST SEGMENT CONVEX, T WAVE POSITIVE, MAY ENLARGE EKG - RECIPROCAL: J POINT DEPRESSES, ST SEGMENT DOWNSLOPING, T WAVE INVERTED	
	S T A T E S	<b>NECROSIS</b> ARTERIAL BLOCKAGES → TOTAL OBSTRUCTION CELLULAR OXYGENATION → NONE CELLULAR METABOLISM → CELL DIES WHEN GLYCOGEN RESERVES DEPLETED. CELLULAR FUNCTION → NONE, CELL DEAD. PATIENT SYMPTOMS → POSS. HYPOTENSION, DEATH EKG - INDICATIVE: J POINTS, ST SEGMENTS NORMALIZE; ABNORMAL Q WAVES FORM EKG - RECIPROCAL: J POINTS, ST SEGMENTS NORMALIZE; ABNORMAL TALL R WAVES FORM	

### ST SEGMENT ELEVATION:


S-T SEGMENTS ELEVATE WITHIN SECONDS OF CORONARY ARTERY OCCLUSION:




IN THIS CASE, a normal response to balloon occlusion of the RIGHT CORONARY ARTERY during PTCA in the CARDIAC CATH LAB



DOWNSLOPING  
S-T SEGMENT



FLAT  
S-T SEGMENT



UPSLOPING  
S-T SEGMENT

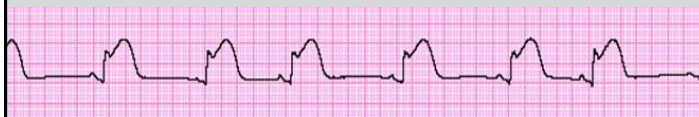
<b>EKG PATTERNS of ACS &amp; ISCHEMIA</b> J POINT, ST SEGMENT, and T WAVES ABNORMALITIES		
! S-T SEGMENT ELEVATION at J POINT		- ACUTE MI - ACUTE PERICARDITIS / MYOCARDITIS - EARLY REPOLARIZATION
! FLAT or CONVEX J-T APEX SEGMENT		- ACUTE MI - ISCHEMIA
! HYPER-ACUTE T WAVE		- HYPERKALEMIA - TRANSURURAL 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 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

### – CRITICAL ECG ALERT –

-Immediately check patient  
-Notify next “higher up” in chain of command

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE
5. NEW ONSET of any DYSRHYTHMIA
6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,
7. V-TACH, or WIDE QRS TACHYCARDIA of unknown origin
8. TORSADES de POINTES
9. VENTRICULAR FIBRILLATION or ASYSTOLE
10. PACER SPIKES WITHOUT QRS – “FAILURE TO CAPTURE”
11. CHANGES in the QRS width (new onset Bundle Branch Block)
12. CHANGES to J Point, ST Segment, and/or T Waves

WHAT IS YOUR INTERPRETATION OF THIS RHYTHM STRIP ?



WHAT IS YOUR INTERPRETATION OF THIS RHYTHM STRIP ?



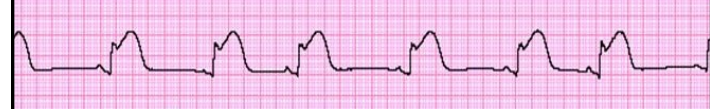
SIGNIFICANT ST SEGMENT ELEVATION, most likely patient is suffering **STEMI**



WHAT WOULD THE MOST APPROPRIATE COURSE OF ACTION BE ?



WHAT WOULD THE MOST APPROPRIATE COURSE OF ACTION BE ?



**Immediately:**

notify Charge RN  
check patient  
obtain 12 Lead ECG  
Notify physician / Cardiologist  
Activate STEMI protocol

***– CRITICAL ECG ALERT –***

**-Immediately check patient**

**-Notify next “higher up” in chain of command**

1. Heart rate LESS THAN 50 or GREATER THAN 150
2. QT INTERVAL prolonged (usually not emergent but let Dr. know)
3. 2<sup>nd</sup> degree type II or 3<sup>rd</sup> degree HEART BLOCK
4. SINUS ARREST with periods of ASYSTOLE
5. NEW ONSET of any DYSRHYTHMIA
6. PVCs that are MULTIFOCAL, 2 or MORE TOGETHER, R on T, greater than 6 per minute,
7. V-TACH, or WIDE QRS TACHYCARDIA of unknown origin
8. TORSADES de POINTES
9. VENTRICULAR FIBRILLATION or ASYSTOLE
10. PACER SPIKES WITHOUT QRS – “FAILURE TO CAPTURE”
11. CHANGES in the QRS width (new onset Bundle Branch Block)
12. CHANGES to J Point, ST Segment, and/or T Waves



*My top two reasons for giving everything in life the best I have to offer.*