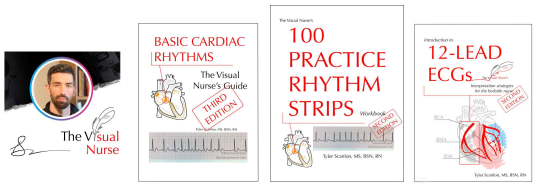


Tyler Scanlon MS, BSN, RN | www.thevisualnurse.com | Instagram: @thevisualnurse

THE BASIC CARDIAC RHYTHMS COMPANION COURSE

1

NOTICE

The criteria presented here are based upon a consensus of previously published information in addition to the author's own experiences and viewpoints. Readers should seek additional references regarding ECG interpretation to continually improve their skills. While topics presented may include causes and treatments where appropriate, the primary focus of this text will include the proper identification of selected cardiac rhythms. Readers should review package inserts and user manuals for any medications, therapeutic agents, or devices as directed by the USFDA. The author, editor, and publisher disclaim responsibility for adverse effects resulting from omissions and undetected errors or adverse results obtained from the use of the information in this book. Application of the information in any situation remains the professional responsibility of the licensed individual performing such interventions. Information presented in this text is not medical advice and it is the responsibility of the reader to verify accuracy of all materials presented.

2

Overview

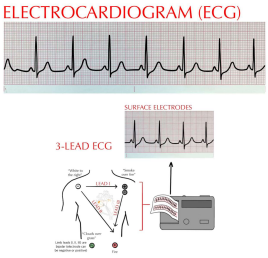
- Introduction
- Cardiovascular principles as they pertain to cardiac rhythms
- Essentials of ECG monitoring
- The Cardiac Cycle
- Rhythm analysis progression & rhythm standardization
- Rhythms presented by site of origin with recap quizzes following each section

- Rhythms categorized by site of origin for targeted study:
  - Sinus origin
  - Atrial origin
  - Junctional origin
  - Ventricular origin
  - Atrioventricular (AV) blocks
  - Pacemakers
  - 60 second quick review videos for select popular topics

3

Introduction

- What is an electrocardiogram (ECG)?
- Methods for visualizing and/or characterizing cardiac activity
- ECG uses
- What are dysrhythmias and why do we care?



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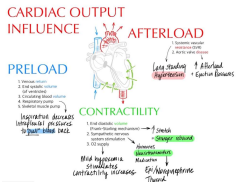
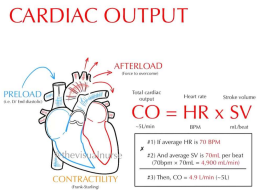
Cardiovascular physiology





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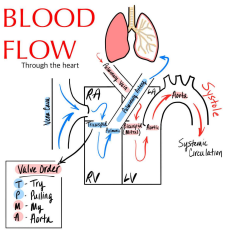
Blood flow

- How does blow flow through the heart?
- The relationship between electrical and myocardial cells
- Which came first: the chicken, or the egg?



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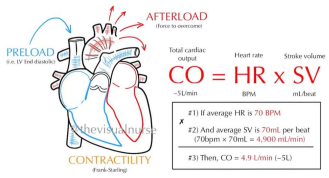
CARDIAC OUTPUT

How do we measure the output of the heart?

- What is cardiac output?
- Stroke volume
- Heart rate



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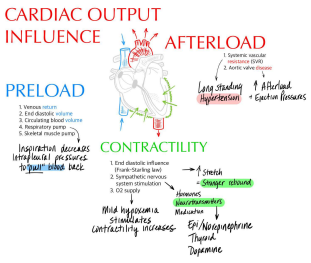
Variables influencing cardiac output

- Preload
- Afterload
- Contractility
- How beta blocking medications work



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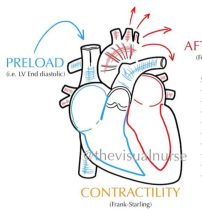
Impairments in cardiac output

CARDIAC OUTPUT
(HR X SV)



Signs of impaired cardiac output
- Hypotension
- Chest pain
- Weak peripheral pulses
- Hypoxia
- Cardiac dysrhythmias
- Palpitations
- Dyspnea, Fatigue, Dizziness
- Decreased urine output
- Cool, clammy skin

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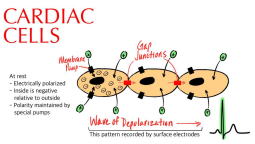
Cardiac cells: pacemaker and muscle

- Automaticity
- Excitability
- Conductivity
- Comparing pacemaker cells to myocardial cells
- Depolarization and positive deflections



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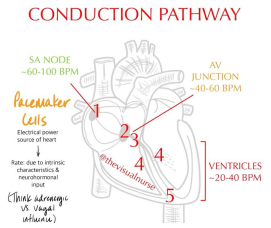
Impulse conduction: top to bottom

- Electrical versus plumbing
- Myocardial cells
- Pacemaker cells
- Inherent heart rate by location
- What does the natural conduction pathway look like?



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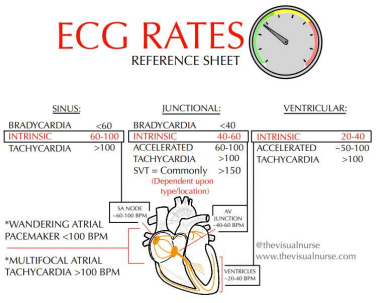

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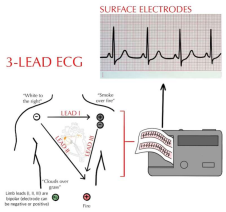

RECORDING ELECTRICAL ACTIVITY

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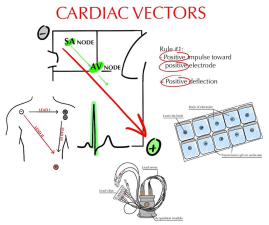
Cardiac vectors

- What is the cardiac vector?
- Rule #1 of cardiac rhythm interpretation
- Natural path of electrical progression in the heart
- Positive vs. negative deflections
- The purpose of ECG graph paper



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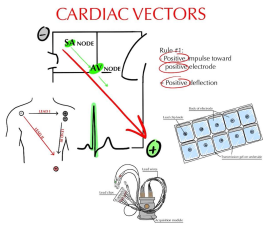

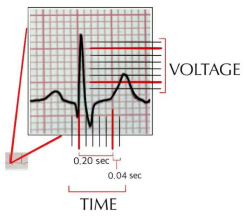

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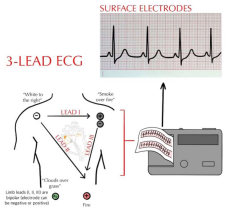
Leads: What are they reading?

- White to the right, smoke over fire
- Leads = camera angles
- Positive deflections in leads I & III
- Lead II: often preferred as the *rhythm lead/ rhythm strip*



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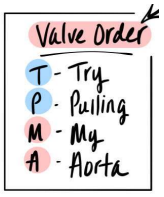
Lessons 1 & 2: Review

- Blood flows through the heart's AV and semilunar valves in what order?
  - Tricuspid
  - Pulmonary
  - Mitral (bicuspid)
  - Aortic



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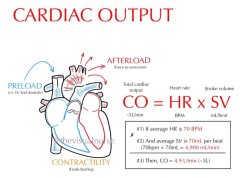
Lessons 1 & 2: Review

- Cardiac output is the product of what 2 variables?
  - Heart rate X Stroke volume
- Why is cardiac output equal to roughly ~5L on *average*?



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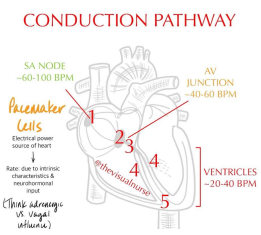
Lessons 1 & 2: Review

- Which of the following is correct regarding pacemaker sites and inherent rate of depolarization?
  - SA node: 60 – 100 BPM
  - Junctional: 20 – 40 BPM
  - Ventricular: 40 – 60 BPM



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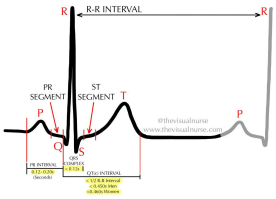
THE CARDIAC CYCLE



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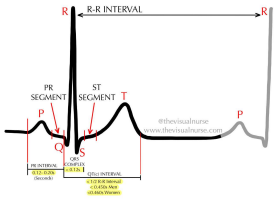
The cardiac cycle

- What is the cardiac cycle and what does it represent?
- Each cardiac cycle *should* produce a palpable pulse
- Danger associated with ventricular tachycardia



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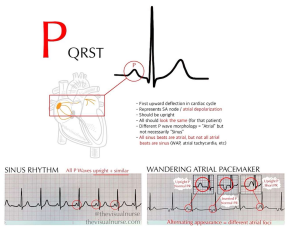
The P wave

- What does the P wave represent?
- What about differing P wave morphology?
- Sinus versus *atrial*
- The *wandering atrial pacemaker*



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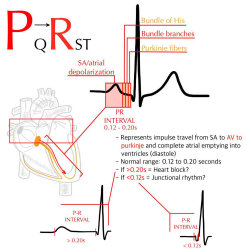
The PR interval and PR segment



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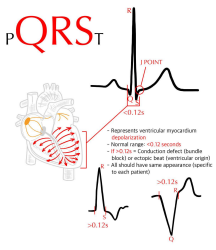
The QRS complex

- Represents what?
- Normal range?
- Wider than normal complexes



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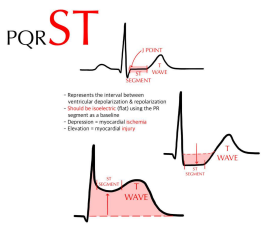
The J point and ST segment

- Significance of the J point
- Significance of the ST segment
- How to evaluate the ST segment and what the ST indicates
- How do we describe elevation or depression?



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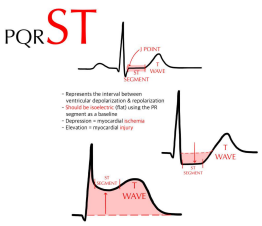
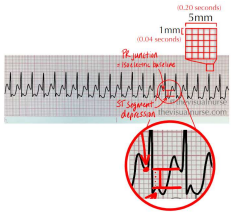
The J point and ST segment





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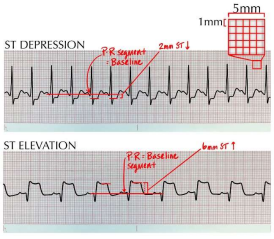

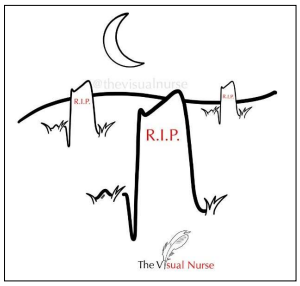

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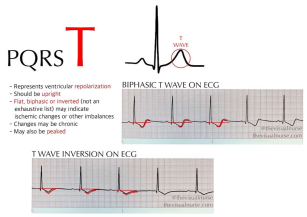
The T wave

- Repolarization
- Refractory state of the ventricles
- Abnormal T waves



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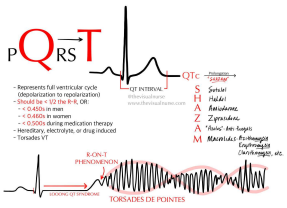
The QT interval

- Represents?
- Dangers of prolonged QTi
- Remember the T wave and the concept of refractory states



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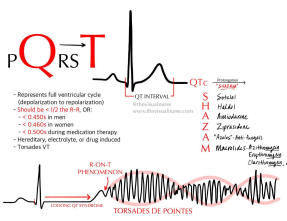
The QT interval



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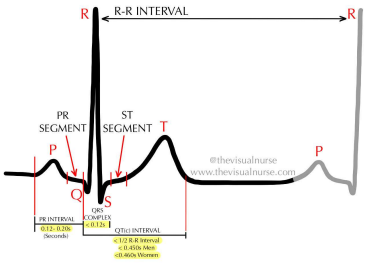
0.12 to 0.20 (PRI), less than 0.12 (QRS), add all 3 to get = less than 0.44 (QTI)



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Review

- What is the normal range for the PR interval?
  - < 0.12 seconds
  - 0.12 to 0.20 seconds
  - < 0.44 seconds
  - < 0.46 seconds
- True or false:
  - If the PR interval is greater than 0.20 seconds, this may indicate an atrioventricular (AV) block, or AV delay.

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Review

- The QRS complex should be:
  - ≤ 0.12 seconds
  - 0.12 to 0.20 seconds
  - < 0.44 seconds
  - < 0.46 seconds
- True or false:
  - A narrow QRS (≤ 0.12 seconds) indicates the impulse is coming from above the ventricles.

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Review

- Generally speaking, ST segment depression may represent this until proven otherwise:
  - Myocardial ischemia
  - Myocardial injury
  - Nothing, this is an expected finding
- Generally, the QT interval should be:
  - < 0.12 seconds
  - < 0.44 seconds*
  - > 0.80 seconds
  - > 1 second

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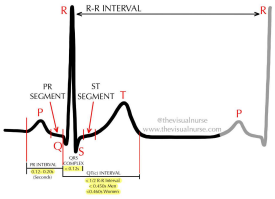
Review

- How do we easily remember normal values for cardiac cycle intervals?



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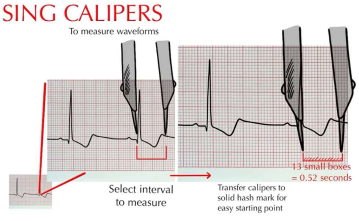
USING CALIPERS

To measure waveforms



HOW DO WE STANDARDIZE RHYTHMS?

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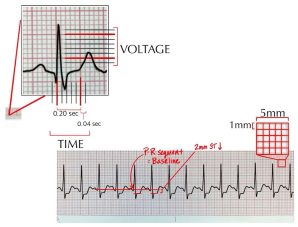
Special paper for waveform recording

- Purpose of ECG paper
- Smallest boxes in the paper
- "Big boxes"
- Using time as a constant



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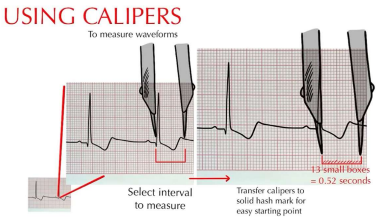
Measuring waveforms and intervals



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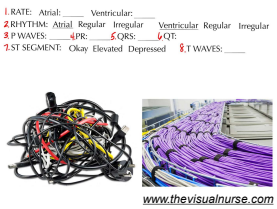
Standardizing rhythm evaluation

- Use the same progression *every single time*
- Use the analysis template to the right
- Practice daily



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Rhythm analysis progression

- Rate
- Rhythm
- P waves
- PR interval
- QRS complex
- QT interval
- ST segment
- T waves

R x2 → [1] Rate & [2] Rhythm

P x2 → [3] P waves & [4] PR interval

& Q x2 → [5] QRS & [6] QT interval

STaT → [7] ST segment & [8] T waves

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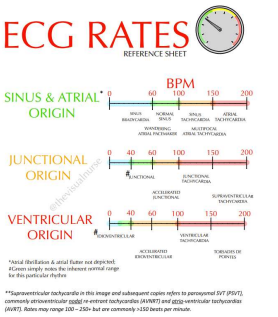
Step 1: Calculating heart rate

- What is heart rate?
- Relation to cardiac output
- Significance of rapid heart rate determination



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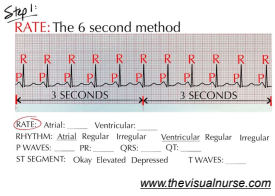
Rate: The 6 second method

- Preferred method for beginners
- What are we referring to here?
- Remember your big boxes
- Testing and exam purposes



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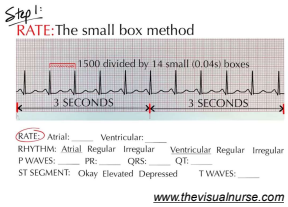
Rate: The small box method

- What makes this method work?
- Each small box = 0.04 seconds
  - How many small boxes in 1 minute?
- Advantages
- Disadvantages



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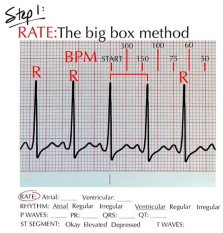
Rate: The big box method

- Some memorization involved
- 300, 150, 100, 75, 60, 50
- Advantages and disadvantages
- Why does this method work?



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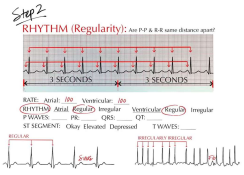
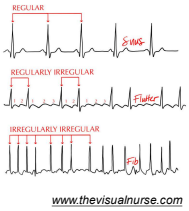
Step 2: Rhythm regularity

- What does regularity describe?
- Why do we care?





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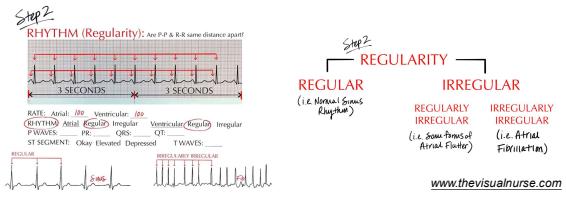
Step 2: Rhythm regularity



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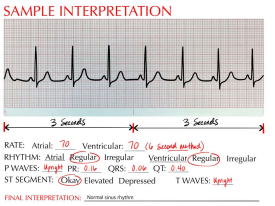
Putting it all together

- Use this formatted template for rate, rhythm regularity, segments and intervals
- Let's look at some actual rhythms!



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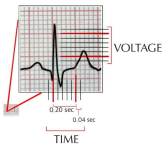
Review

- The smallest box on the ECG graph paper measures:
  - 0.04 seconds
  - 0.20 seconds
  - 1 second
  - 6 seconds
- The "big box" on the ECG paper measures:
  - 0.04 seconds
  - 0.20 seconds
  - 1 second
  - 6 seconds



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Review

- This method of HR calculation involves counting the total number of complexes present and multiplying by 10:
  - Small box method
  - 6 second method
  - Big box method
- This method of HR calculation involves dividing 1500/# 0.04s boxes between complexes:
  - Small box method
  - 6 second method
  - Big box method

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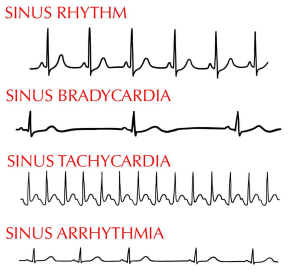
RHYTHMS OF SINUS ORIGIN



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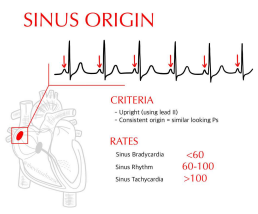
50

Rhythms of sinus origin

- What does sinus origin represent?
- Shared criteria of this group
- PR interval considerations
- P wave morphologies and appearance



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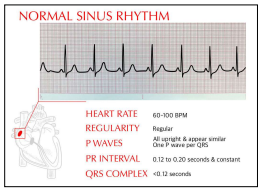
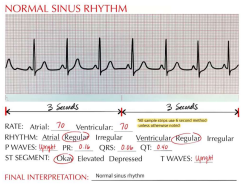
"Normal" sinus rhythm

- What does normal indicate?





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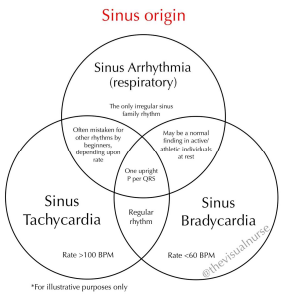
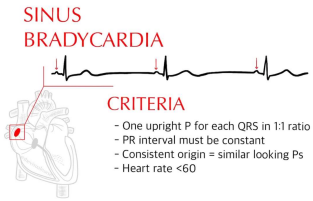


53

Sinus bradycardia

- Rate less than 60 BPM
- May be symptomatic or asymptomatic
- "Athlete's heart"
- Additional causes



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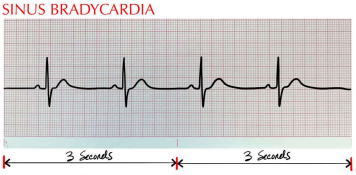
SINUS BRADYCARDIA



RATE: Atrial: 40 Ventricular: 40
RHYTHM: Atrial (Regular) Irregular Ventricular (Regular) Irregular
P WAVES: Upright PR: 0.20 QRS: 0.12 QT: 0.56
ST SEGMENT: (Okay) Elevated Depressed T WAVES: Upright

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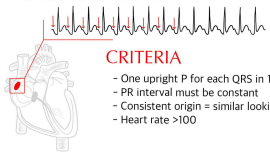
Sinus tachycardia

- Rate considerations
- Sinus versus atrial tachycardia
- The clue is in the T wave
- Treatment = identification of causative factors

SINUS TACHYCARDIA



CRITERIA

- One upright P for each QRS in 1:1 ratio
- PR interval must be constant
- Consistent origin = similar looking Ps
- Heart rate >100

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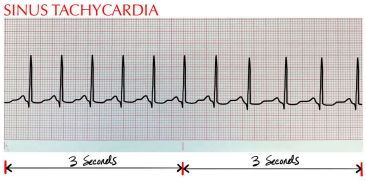
SINUS TACHYCARDIA



RATE: Atrial: 110 Ventricular: 110
RHYTHM: Atrial (Regular) Irregular Ventricular (Regular) Irregular
P WAVES: Upright PR: 0.16 QRS: 0.08 QT: 0.32
ST SEGMENT: (Okay) Elevated Depressed T WAVES: Flat

FINAL INTERPRETATION: Sinus tachycardia

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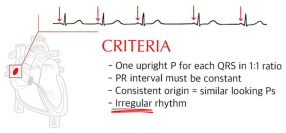
Sinus arrhythmia

- Two common *irregularly* irregular rhythms…
- Pressure changes in the thoracic cavity with breathing
- Diaphragm influence
- Do not confuse with atrial fibrillation

SINUS ARRHYTHMIA



CRITERIA

- One upright P for each QRS in 1:1 ratio
- PR interval must be constant
- Consistent origin = similar looking Ps
- Irregular rhythm

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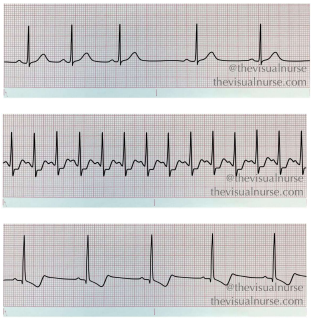
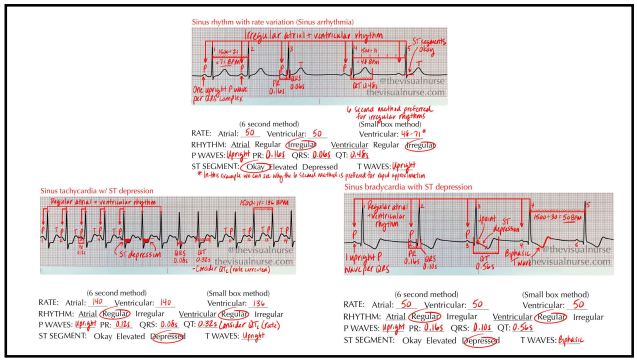
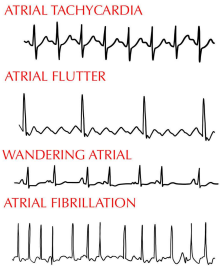


59



60

ARRHYTHMIAS OF ATRIAL ORIGIN



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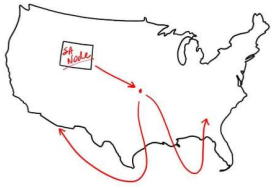
What do we mean by Atrial?

- Are sins and atrial similar?
- How are they different?



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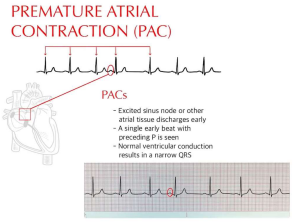
Premature atrial contractions

- Introduction to ectopy
- Origin of PACs
- P wave should still be upright
- Possible causes



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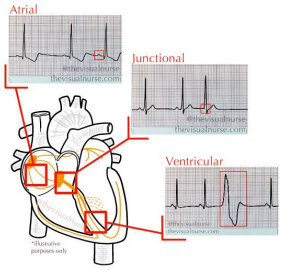
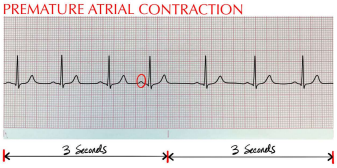
PREMATURE HEARTBEATS



64

PREMATURE ATRIAL CONTRACTION



RATE: Atrial: 70 Ventricular: 70
RHYTHM: Atrial Regular Irregular Ventricular Regular Irregular
P WAVES: Upright PR: 0.16 QRS: 0.08 QT: 0.44
ST SEGMENT: Okay Elevated Depressed T WAVES: Upright

FINAL INTERPRETATION: Sinus rhythm with premature atrial contraction

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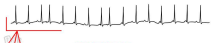
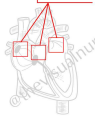
Wandering atrial pacemaker & Multifocal atrial tachycardia

WANDERING ATRIAL PACEMAKER

MULTIFOCAL ATRIAL TACHYCARDIA





CRITERIA

- One P for each QRS in 1:1 ratio
- P wave appearance differs based upon where in the atria they originate
- PR intervals will likely vary due to this
- 100 bpm is threshold of determination for WAP versus MAT

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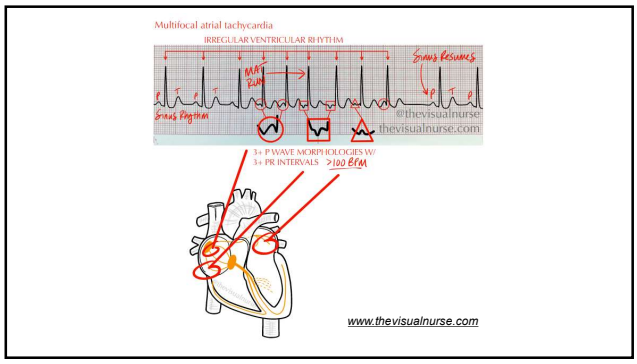
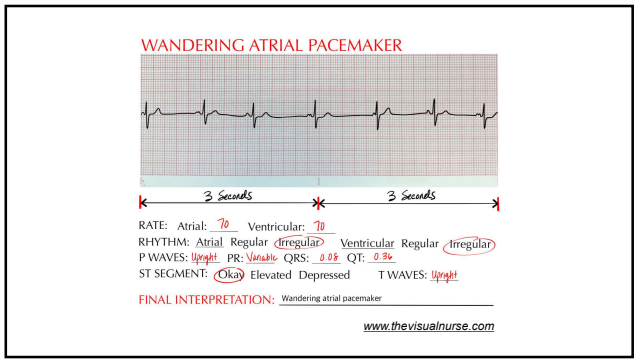
66



67



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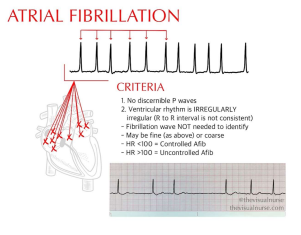
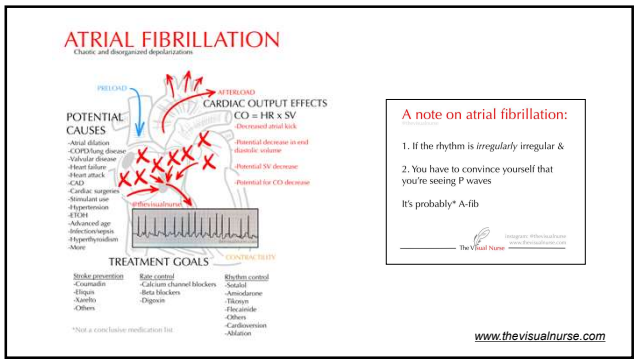
Atrial fibrillation

- Chaotic and disorganized atrial contraction
- Atrial blood pooling is a major problem
- Sporadic ventricular response
- Two most important characteristics
  - Irregularly irregular rhythm
  - No discernible P waves
- *Controlled* vs. *uncontrolled*



69


ATRIAL FIBRILLATION
Chaotic and disorganized depolarizations
PRELOAD
AFTERLOAD
CARDIAC OUTPUT EFFECTS
CO = HR x SV
-Decreased atrial kick
-Potential decrease in end diastolic volume
-Potential SV decrease
-Potential for CO decrease
POTENTIAL CAUSES
-Atrial dilation
-COPD/lung disease
-Valvular disease
-Heart failure
-Heart attack
-CAD
-Cardiac surgeries
-Stimulant use
-Hypertension
-ETOH
-Advanced age
-Infection/sepsis
-Hyperthyroidism
-More
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CONTRACTILITY
TREATMENT GOALS
Stroke prevention
-Coumadin
-Eliquis
-Xarelto
-Others
Rate control
-Calcium channel blockers
-Beta blockers
-Digoxin
Rhythm control
-Sotalol
-Amiodarone
-Tikosyn
-Flecainide
-Others
-Cardioversion
-Ablation
*Not a conclusive medication list
A note on atrial fibrillation:
1. If the rhythm is irregularly irregular &
2. You have to convince yourself that you're seeing P waves
It's probably* A-fib
The Visual Nurse
Instagram: @thevisualnurse
www.thevisualnurse.com
www.thevisualnurse.com

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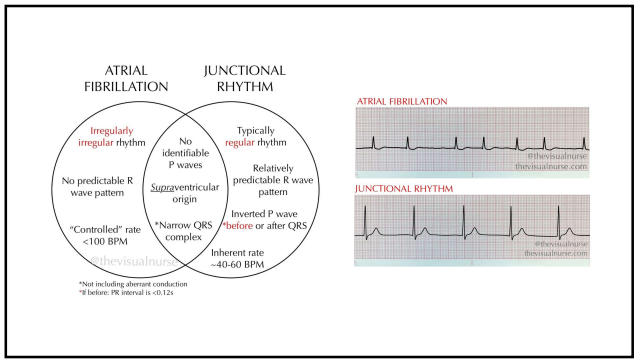
ATRIAL FIBRILLATION
JUNCTIONAL RHYTHM
Irregularly irregular rhythm
No predictable R wave pattern
"Controlled" rate <100 BPM
No identifiable P waves
Supraventricular origin
*Narrow QRS complex
Typically regular rhythm
Relatively predictable R wave pattern
Inverted P wave *before or after QRS
Inherent rate ~40-60 BPM
@thevisualnurse
*Not including aberrant conduction
*If before: PR interval is <0.12s
ATRIAL FIBRILLATION
@thevisualnurse
thevisualnurse.com
JUNCTIONAL RHYTHM
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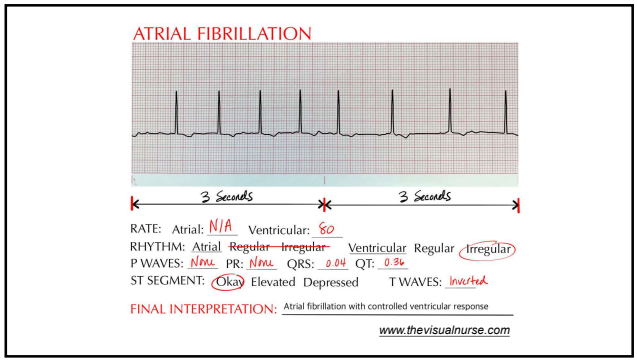
ATRIAL FIBRILLATION
3 Seconds
3 Seconds
RATE: Atrial: N/A Ventricular: 80
RHYTHM: Atrial ~~Regular Irregular~~ Ventricular Regular (Irregular)
P WAVES: None PR: None QRS: 0.04 QT: 0.36
ST SEGMENT: (Okay) Elevated Depressed T WAVES: Inverted
FINAL INTERPRETATION: Atrial fibrillation with controlled ventricular response
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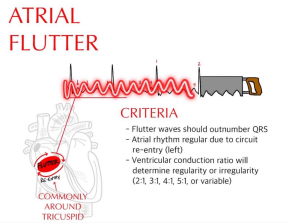
Atrial flutter

- Classic sawtooth appearance
- Flutter waves outnumber QRS complexes
- Remember cardiac output effects



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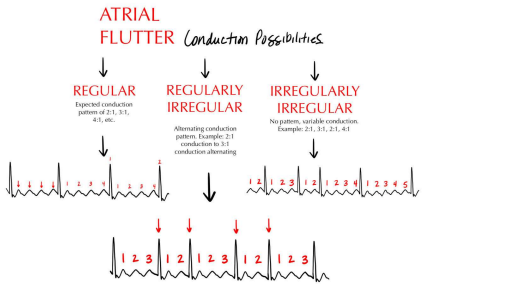
73



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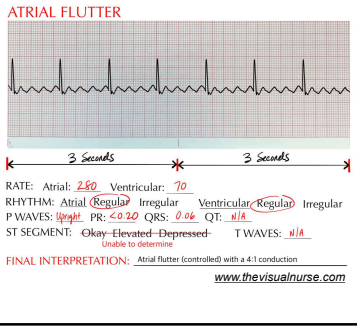

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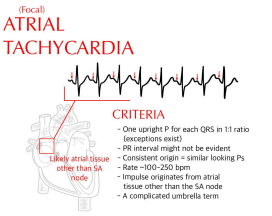
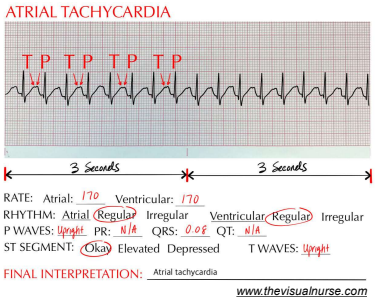
Atrial tachycardia

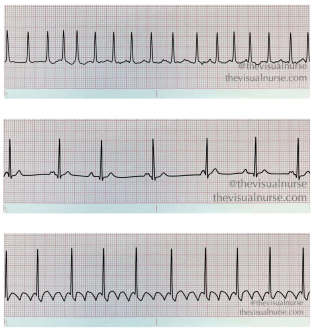
- Sinus versus atrial tachycardia
- Possible causes
- Keys to identification
- Humped T waves



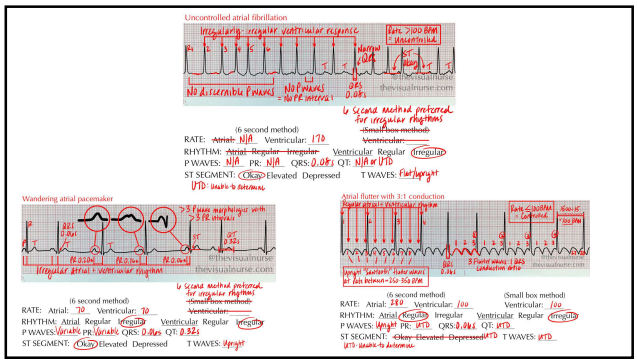
76



77



78


Uncontrolled atrial fibrillation
Irregularly irregular ventricular response
No discernible P waves
Wandering atrial pacemaker
Irregular atrial + ventricular rhythm
Atrial flutter with 3:1 conduction
(6 second method)
RATE: Atrial: N/A Ventricular: 170
RHYTHM: Atrial: Regular Irregular Ventricular: Regular Irregular
P WAVES: N/A PR: N/A QRS: 0.08s QT: N/A or UTD
ST SEGMENT: Okay Elevated Depressed T WAVES: Flat/upright
UTD: Unable to determine
(6 second method)
RATE: Atrial: 70 Ventricular: 70
RHYTHM: Atrial: Regular Irregular Ventricular: Regular Irregular
P WAVES: Variable PR: Variable QRS: 0.08s QT: 0.32s
ST SEGMENT: Okay Elevated Depressed T WAVES: Upright
(6 second method)
RATE: Atrial: 280 Ventricular: 100
RHYTHM: Atrial: Regular Irregular Ventricular: Regular Irregular
P WAVES: Upright PR: UTD QRS: 0.08s QT: UTD
ST SEGMENT: Okay Elevated Depressed UTD T WAVES: UTD
(Small box method)
Ventricular: 100
UTD: Unable to determine
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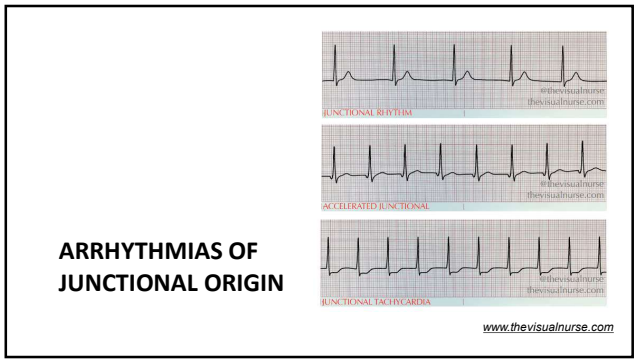
ARRHYTHMIAS OF JUNCTIONAL ORIGIN
JUNCTIONAL RHYTHM
ACCELERATED JUNCTIONAL
JUNCTIONAL TACHYCARDIA
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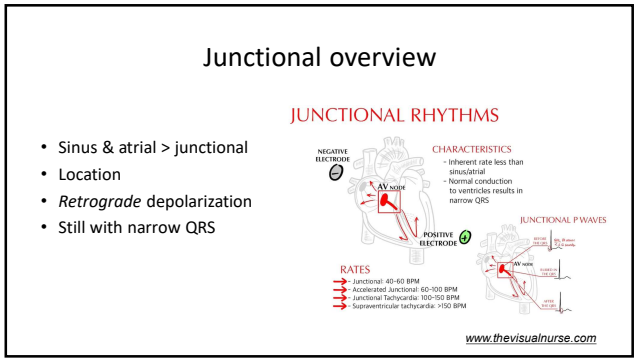
Junctional overview
• Sinus & atrial > junctional
• Location
• *Retrograde* depolarization
• Still with narrow QRS
JUNCTIONAL RHYTHMS
NEGATIVE ELECTRODE
AV NODE
POSITIVE ELECTRODE
CHARACTERISTICS
- Inherent rate less than sinus/atrial
- Normal conduction to ventricles results in narrow QRS
JUNCTIONAL P WAVES
RATES
- Junctional: 40-60 BPM
- Accelerated Junctional: 60-100 BPM
- Junctional Tachycardia: 100-150 BPM
- Supraventricular tachycardia: >150 BPM
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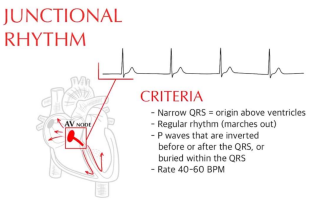
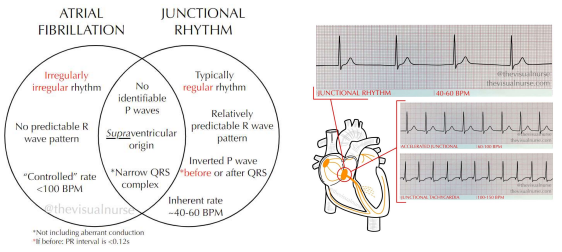
Junctional rhythm

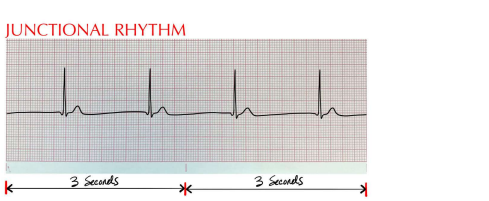
- Key characteristics
- Rhythm is coming from a defined pacemaker site *unlike* atrial fibrillation
- Difference between the two is regularity (junctional) versus irregularity (A-fib)



82



83



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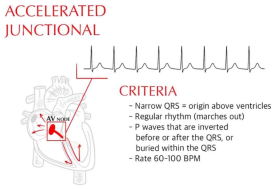
Accelerated junctional rhythm

- The older brother to normal junctional rhythms
- HR is the differentiating factor
- Understanding inherent pacemaker rate according to location



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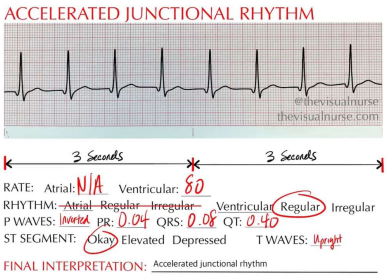
85



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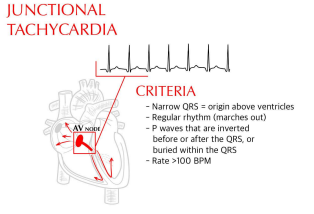
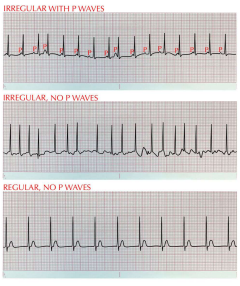
86

Junctional tachycardia





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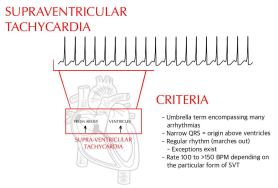
87

Supraventricular tachycardia

- An umbrella term encompassing a few rhythms
- Hallmark of SVT
- Not always regular rhythm but often will be for testing purposes



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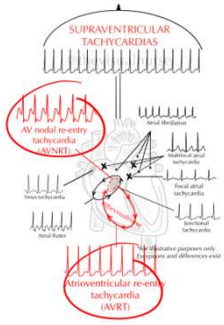
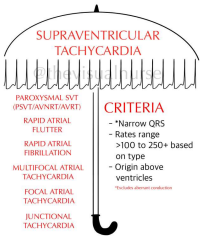
88





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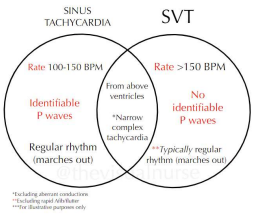
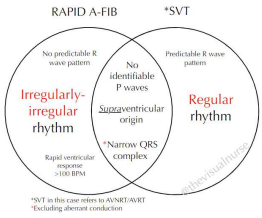
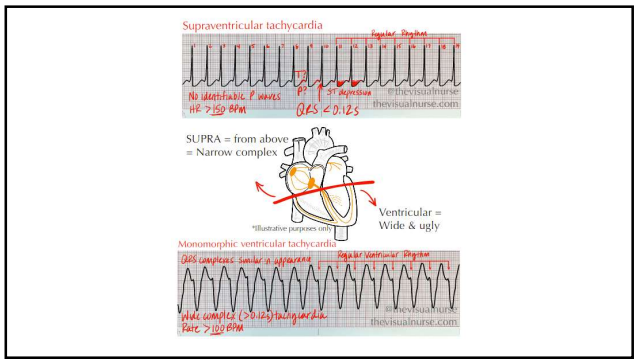




90


Supraventricular tachycardia
Regular Rhythm
No identifiable P waves
HR >150 BPM
P
ST depression
QRS < 0.12s
@thevisualnurse
thevisualnurse.com
SUPRA = from above
= Narrow complex
*Illustrative purposes only
Ventricular =
Wide & ugly
Monomorphic ventricular tachycardia
QRS complexes similar in appearance
Regular Ventricular Rhythm
Wide complex (>0.12) tachycardia
Rate >100 BPM
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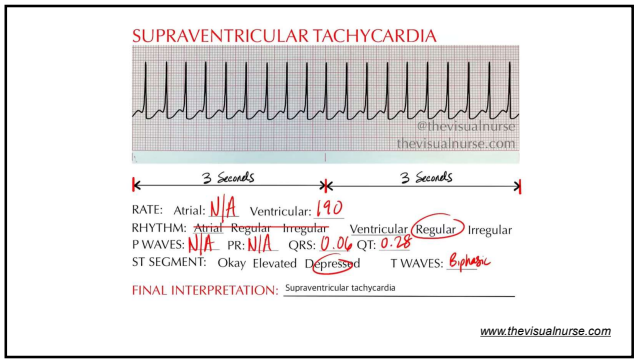
91


SUPRAVENTRICULAR TACHYCARDIA
@thevisualnurse
thevisualnurse.com
3 Seconds
3 Seconds
RATE: Atrial: N/A Ventricular: 190
RHYTHM: Atrial Regular Irregular Ventricular Regular Irregular
P WAVES: N/A PR: N/A QRS: 0.06 QT: 0.28
ST SEGMENT: Okay Elevated Depressed T WAVES: Biphasic
FINAL INTERPRETATION: Supraventricular tachycardia
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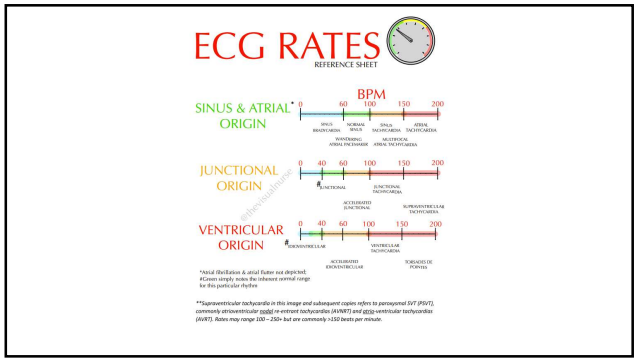
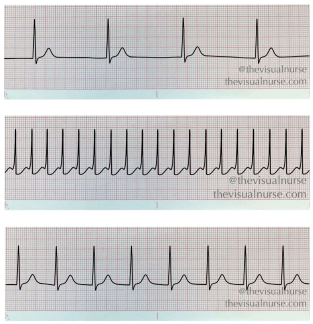
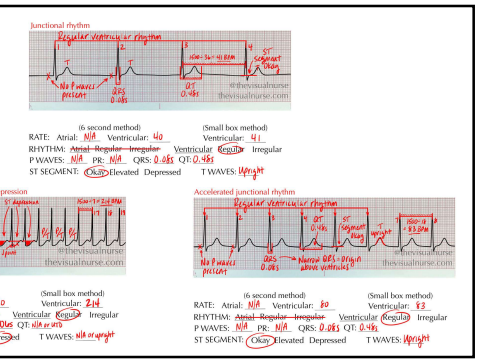
92


ECG RATES
REFERENCE SHEET
BPM
SINUS & ATRIAL ORIGIN
JUNCTIONAL ORIGIN
VENTRICULAR ORIGIN
0
40
60
100
150
200

93

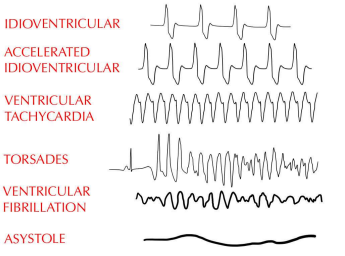


94



95

ARRHYTHMIAS OF VENTRICULAR ORIGIN



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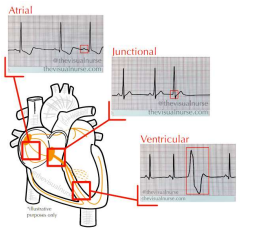
96

Ventricular origin overview

- Can be categorized as single or multiple site
- Inherent rate ~20-40 BPM
- Key characteristics
- Let's begin with ventricular ectopy before transitioning into ventricular rhythms



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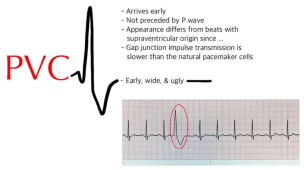
97

Premature ventricular contractions

- Early, wide, and ugly
- Why is the impulse wide?
- Potential causes



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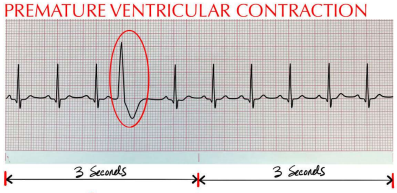
PREMATURE VENTRICULAR CONTRACTION



RATE: Atrial: 90 Ventricular: 90
RHYTHM: Atrial (Regular) Irregular Ventricular (Regular) Irregular
P WAVES: Upright PR: 0.16 QRS: 0.12 QT: 0.32
ST SEGMENT: (Okay) Elevated Depressed T WAVES: Upright

FINAL INTERPRETATION: Sinus rhythm with a PVC

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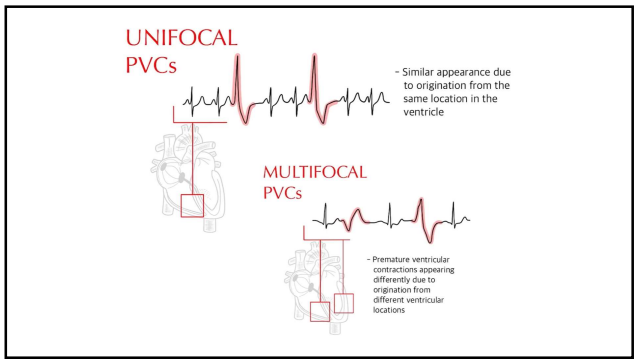
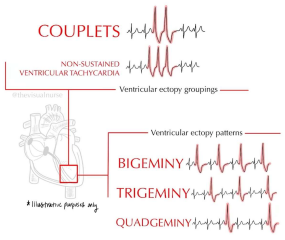


100

Ventricular ectopic groups & patterns

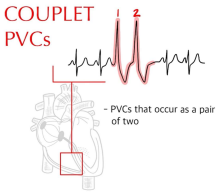
- With or without identifiable patterns
- Groupings
- Patterns

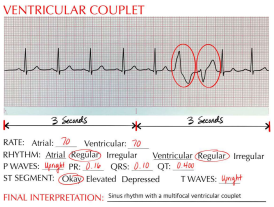


101

Couplet PVCs

- Do not confuse with ventricular bigeminy

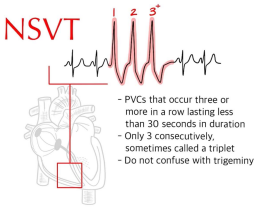




102

Non-sustained ventricular tachycardia

- What is the term "non-sustained" indicating?
- Sustained VT
- May be monomorphic or polymorphic (multifocal)
- Assess and report



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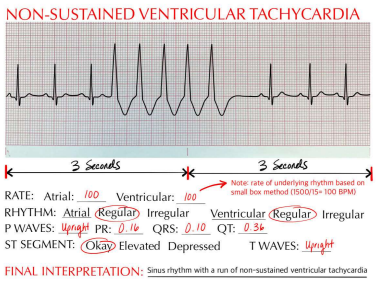

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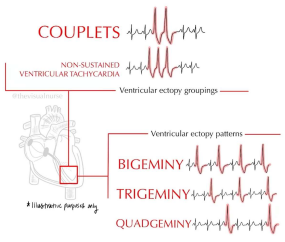
104

Ventricular *groupings* → *patterns*

- Couplets versus bigeminy
- Triplets versus trigeminy
- Just remember to ask yourself: *"Is it a grouping or a pattern?"*



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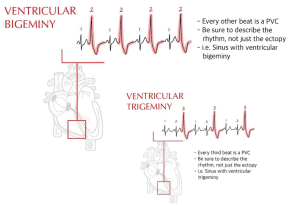
105

Bigeminy, trigeminy, & quadgeminy

- *Bi*geminy: every *second* beat is a PVC
- Trigeminy = every *third*
- Quadrigeminy = every *fourth*
- Describing the underlying rhythm
- Assess and report



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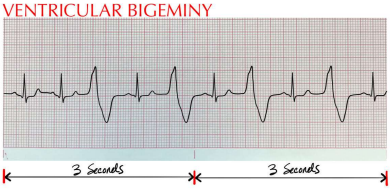
106

VENTRICULAR BIGEMINY



RATE: Atrial: 60 Ventricular: 60
RHYTHM: Atrial Regular Irregular Ventricular Regular Irregular
P WAVES: Upright PR: 0.16 QRS: 0.12 QT: 0.36
ST SEGMENT: Okay Elevated Depressed T WAVES: Upright

FINAL INTERPRETATION: Sinus rhythm with ventricular bigeminy

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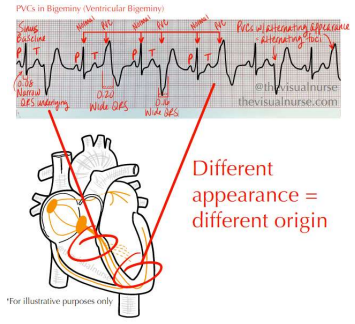
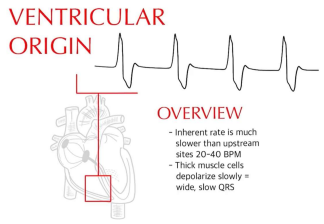
107



108

Ventricular *rhythms & arrhythmias*

- Single site rhythms
- Multi-site rhythms



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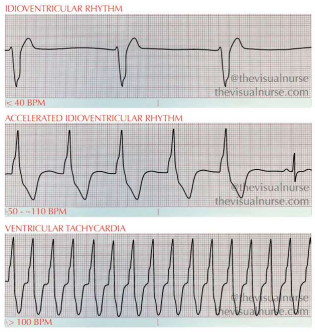
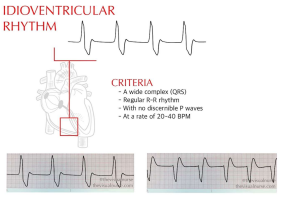
109



110

Idioventricular rhythm & AIVR

- Share similar characteristics seen in the image to the right
- Rate is the major difference between the two
- Often transient



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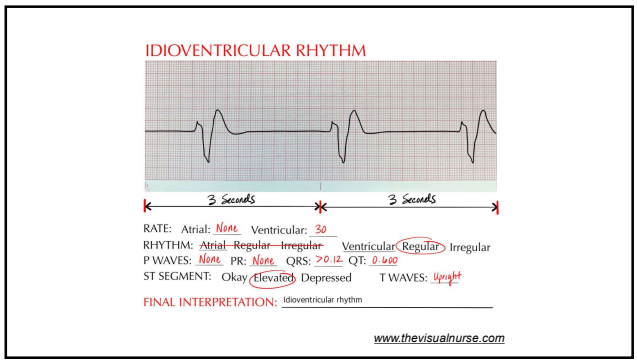
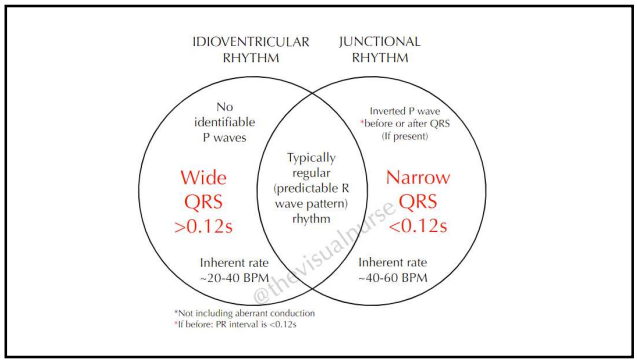


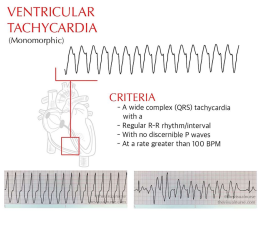
112



113

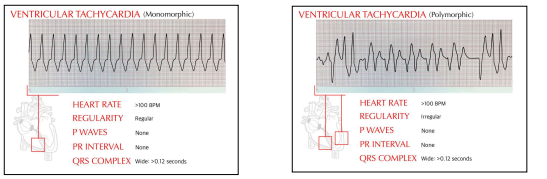
Ventricular tachycardia

- Monomorphic versus polymorphic
- Impaired filling and contraction
- Cardiac workloads
- Patient may or may not have a pulse



114

Ventricular tachycardia



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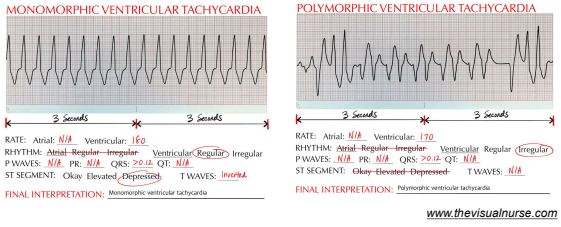
115

Ventricular tachycardia



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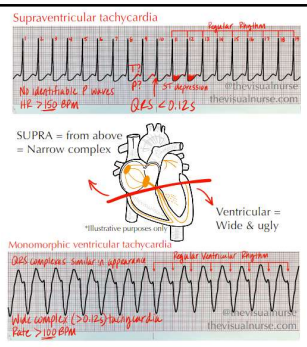
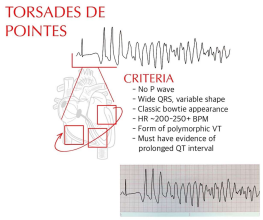
116



117

Torsades de pointes

- A *form of* polymorphic VT
- Electrical focus is rotating around the heart
- Remember your cardiac vectors
- Bowtie appearance
- Hallmark causes
- Long QT syndromes
- R on T phenomenon



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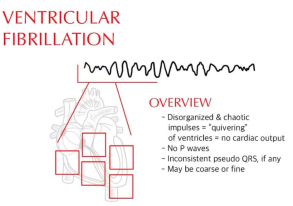
118

Ventricular fibrillation

- Fibrillation = quivering
- Cardiac output is next to *zero*
- Immediate CPR and ACLS
- Defibrillation and early shocking
- H's & T's



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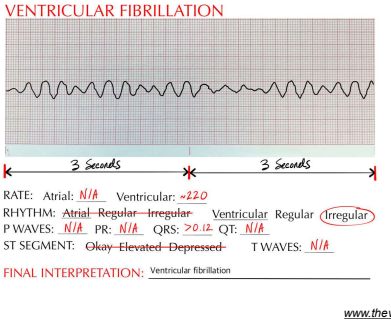
119



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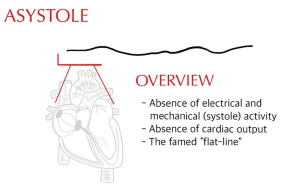
120

Asystole

- Absence of electrical and mechanical activity
- Confirm in more than one lead
- ACLS protocols
- H's & T's



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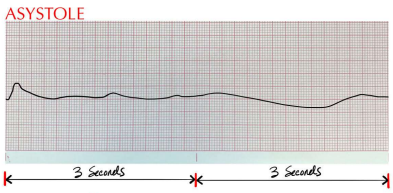
121



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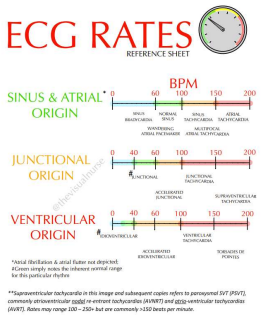
122



123

Review

- Non-sustained ventricular tachycardia (NSVT) is defined as 3 or more successive ventricular-origin beats lasting *less than*:
  - 15 beats
  - 20 beats
  - 30 seconds
  - 1 minute
- This pattern describes a rhythm in which every *second* beat is a premature ventricular contraction (PVC):
  - Ventricular couplets
  - Ventricular bigeminy
  - Ventricular trigeminy
  - Ventricular quadgeminy

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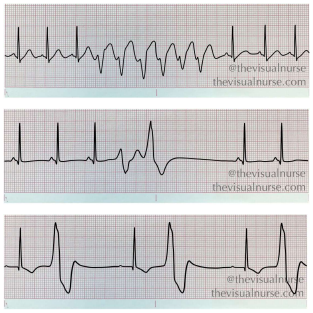
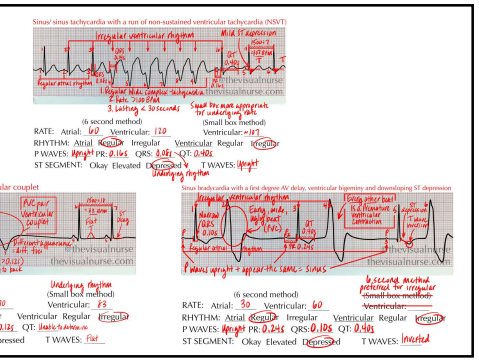
124



125



126

ATRIOVENTRICULAR BLOCKS

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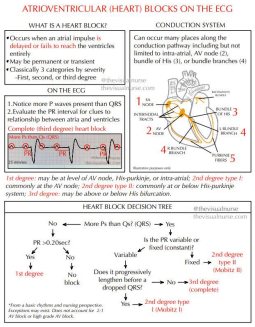
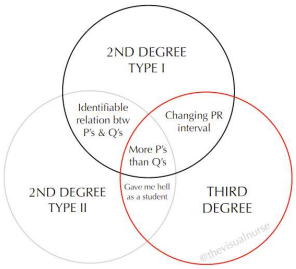


127

HEART BLOCKS



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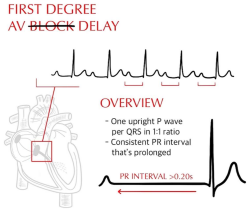
128

First degree AV *delay*

- Natural function of the AV node
- Normal PR interval
- Consider patient population



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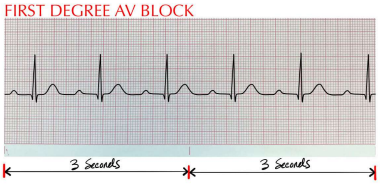
FIRST DEGREE AV BLOCK



RATE: Atrial: 60 Ventricular: 60
RHYTHM: Atrial (Regular) Irregular Ventricular (Regular) Irregular
P WAVES: Upright PR: 0.36 QRS: 0.12 QT: 0.48
ST SEGMENT: (Okay) Elevated Depressed T WAVES: Upright

FINAL INTERPRETATION: Sinus rhythm with first degree AV block

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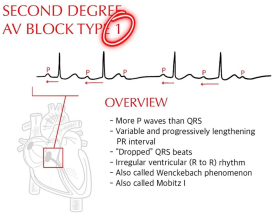
Second degree Type I AVB

- Normal conduction review
- Common causes
- A fatiguing AV node?
- Differentiating between Type II



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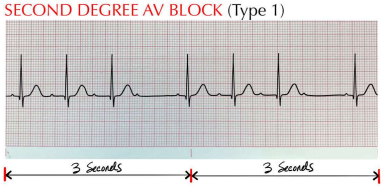
SECOND DEGREE AV BLOCK (Type 1)



RATE: Atrial: 90 Ventricular: 70
RHYTHM: Atrial (Regular) Irregular Ventricular Regular (Irregular)
P WAVES: Upright PR: Varies QRS: 0.12 QT: 0.44
ST SEGMENT: (Okay) Elevated Depressed T WAVES: Upright

FINAL INTERPRETATION: Sinus rhythm with second degree type 1 AV block

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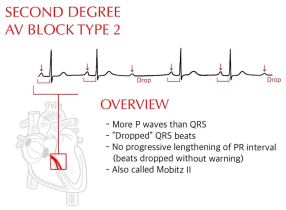
Second degree Type II AVB

- Comparing to Type I
- Rapid identification
- Patient presentation



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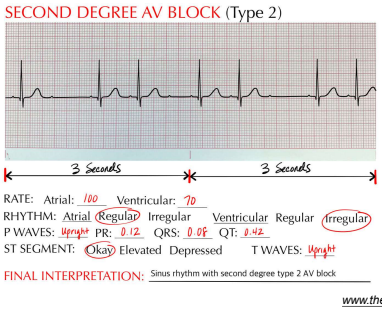

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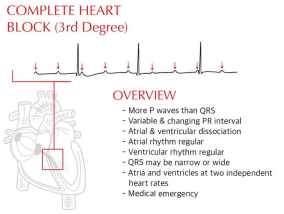
Third degree AVB (Complete heart block)

- Sinus & ventricular rate review
- Independent upper and lower activity
- Result
- Careful PR interval consideration



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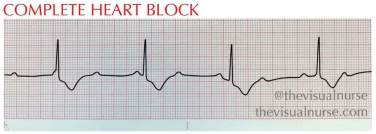
COMPLETE HEART BLOCK



RATE: Atrial: 90 Ventricular: 40
RHYTHM: Atrial (Regular) Irregular Ventricular (Regular) Irregular
P WAVES: Upright PR: Variable QRS: 0.06 QT: 0.48
ST SEGMENT: Okay Elevated (Depressed) T WAVES: Inverted
FINAL INTERPRETATION: Complete heart block

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COMPLETE HEART BLOCK:
the QRS isn't always wide

If the AV junction initiates the escape rhythm → QRS may appear narrow

If the ventricles initiate the escape rhythm → QRS may appear wide

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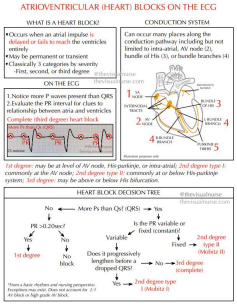
Review

- Which of the following heart (AV) blocks are associated with a variable (changing) PR interval?
  - First degree
  - Second degree Type I
  - Second degree Type II
  - Third degree (CHB)



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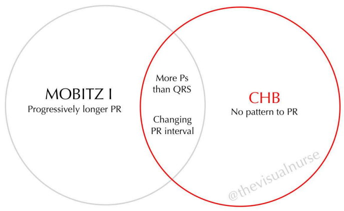

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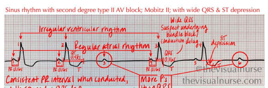
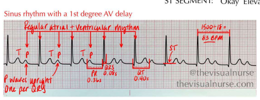
Sinus rhythm with second degree type II AV block; Mobitz II; with wide QRS & ST depression



(6 second method)
RATE: Atrial: 60 Ventricular: 40
6 second method preferred for irregular
~~(Small box method)~~
~~Ventricular:~~
RHYTHM: Atrial Regular Irregular Ventricular Regular Irregular
P WAVES: Upright PR: 0.16s QRS: 0.16s QT: 0.48s
ST SEGMENT: Okay Elevated Depressed T WAVES: Inverted

Sinus rhythm with a 1st degree AV delay



(6 second method) (Small box method)
RATE: Atrial: 80 Ventricular: 80 Ventricular: 83
RHYTHM: Atrial Regular Irregular Ventricular Regular Irregular
P WAVES: upright PR: 0.36s QRS: 0.08s QT: 0.40s
ST SEGMENT: Okay Elevated Depressed T WAVES: upright

Sinus rhythm with second degree type I AV block; Mobitz I; Wenckebach & isolated PVC

Early, wide, ugly premature ventricular contraction
Irregular ventricular rhythm
Regular atrial rhythm
ST okay
Progressive PR lengthening until a QRS is dropped
More P's than QRS
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(6 second method)
RATE: Atrial: 60 Ventricular: 60
6 second method preferred for irregular
~~(Small box method)~~
~~Ventricular:~~
RHYTHM: Atrial Regular* Irregular Ventricular Regular Irregular
P WAVES: Upright PR: Variable QRS: 0.10s QT: 0.42s
ST SEGMENT: Okay Elevated Depressed T WAVES: Upright
*Underlying rhythm

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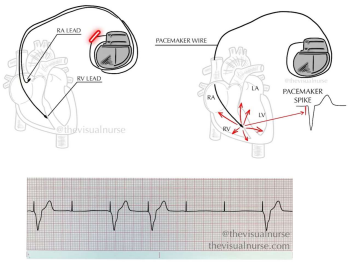
PACEMAKERS



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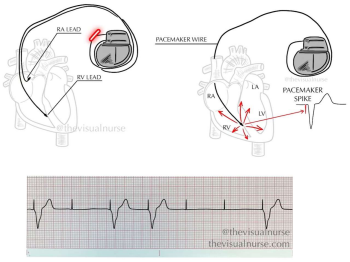
Pacemakers

- Types of pacemakers
- Uses
- Artificial pacemakers
- Capture



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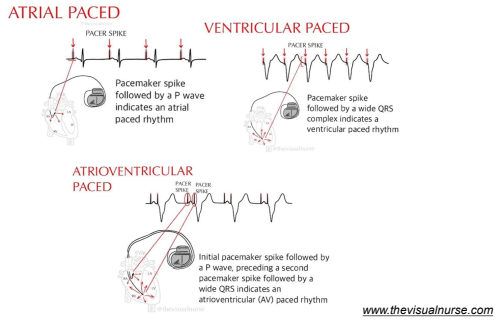

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ATRIAL PACED RHYTHM
3 Seconds
3 Seconds
RATE: Atrial: 70 Ventricular: 70
RHYTHM: Atrial Regular Irregular Ventricular Regular Irregular
P WAVES: Upright PR: 0.20 QRS: 0.12 QT: 0.52
ST SEGMENT: Okay Elevated Depressed T WAVES: Upright
FINAL INTERPRETATION: Atrial paced rhythm
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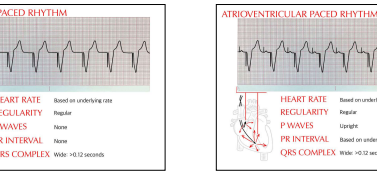
Ventricular & AV pacing
VENTRICULAR PACED RHYTHM
HEART RATE Based on underlying rate
REGULARITY Regular
P WAVES None
PR INTERVAL None
QRS COMPLEX Wide: >0.12 seconds
ATRIOVENTRICULAR PACED RHYTHM
HEART RATE Based on underlying rate
REGULARITY Regular
P WAVES Upright
PR INTERVAL Based on underlying conduction
QRS COMPLEX Wide: >0.12 seconds
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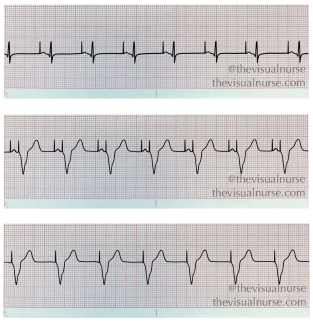
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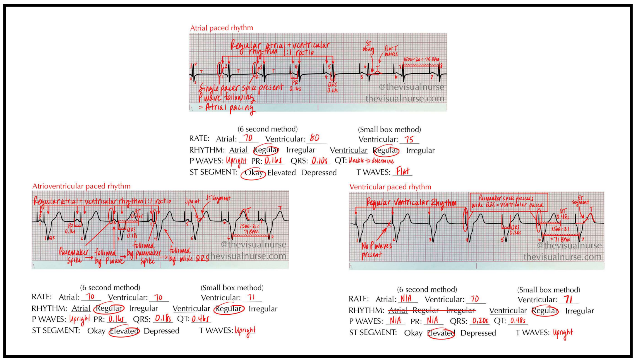

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That's it! Thank you!

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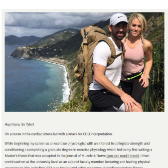

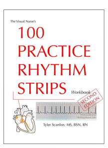

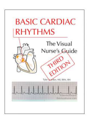

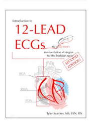

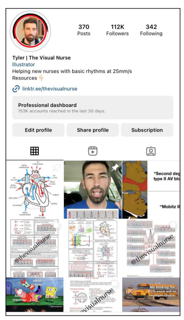

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