

# EKG BASICS REVIEW

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# Overview

- Use a systematic approach to analyze ECG's
- Use 6 second method to determine rate
- Identify the following heart rhythms:
  - Sinus rhythm
  - Sinus tachycardia
  - Sinus bradycardia
  - Sinus pause/arrest
  - Artifact
  - Premature atrial contractions
  - Supraventricular Tachycardia
  - Atrial fibrillation
  - Atrial flutter
  - Junctional rhythms (including accelerated and junctional tachycardia)
  - Premature ventricular contractions
  - Ventricular tachycardia
  - Ventricular fibrillation
  - Idioventricular rhythm
  - Asystole
  - AV blocks (including first degree, second degree type 1 and 2, and third degree)
  - Paced rhythm

# Systematic Approach to Rhythm Identification

Where do I begin?.....

- Regularity
- Rate
- P waves
- QRS complex
- PR interval

# Systematic Approach to Rhythm Identification

- Regularity
  - Is the rhythm regular or irregular?
    - Regular = Consistent R to R intervals
  - Are there any patterns to the irregularity?
  - Are there any ectopic early or late beats?



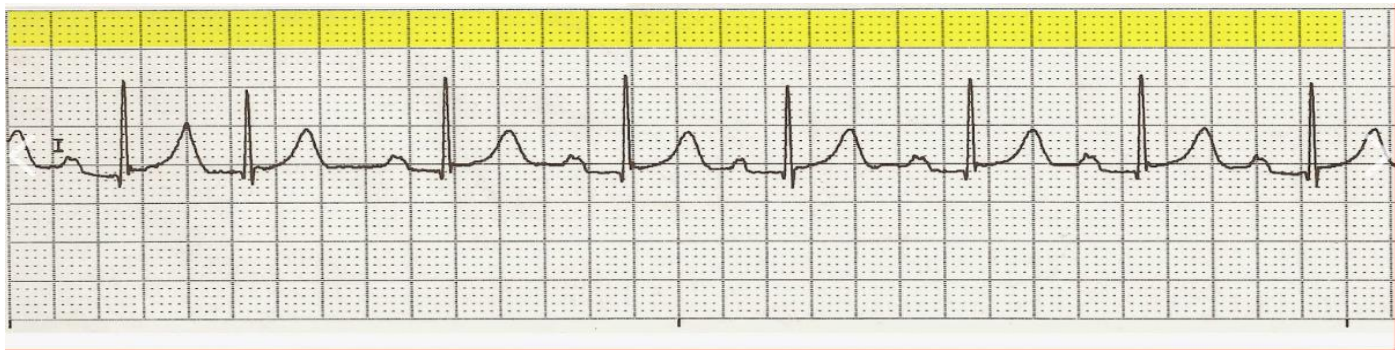
- Regular rhythm
- No ectopic beats

# Systematic Approach to Rhythm Identification

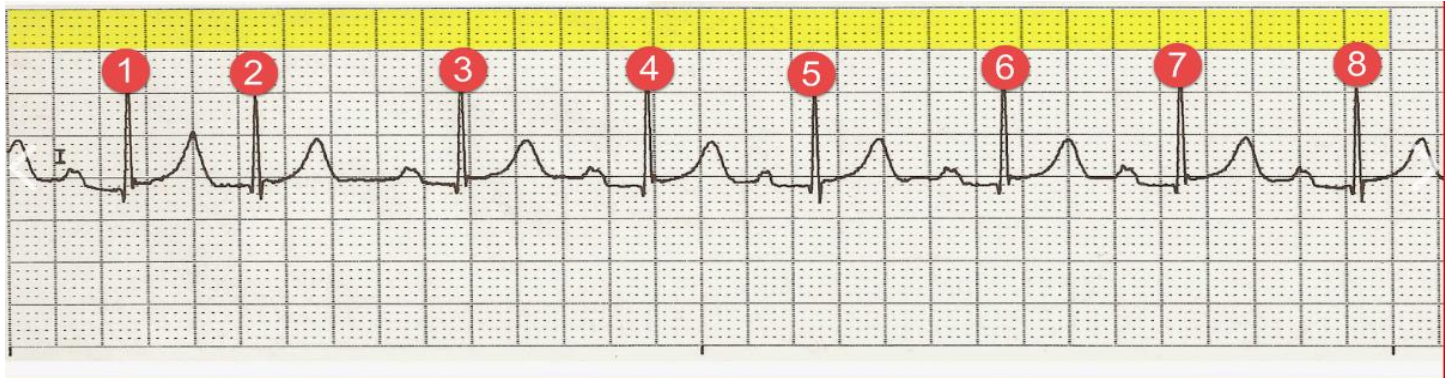
- Rate

- Use the 6 second method

1. 30 large boxes = 6 seconds



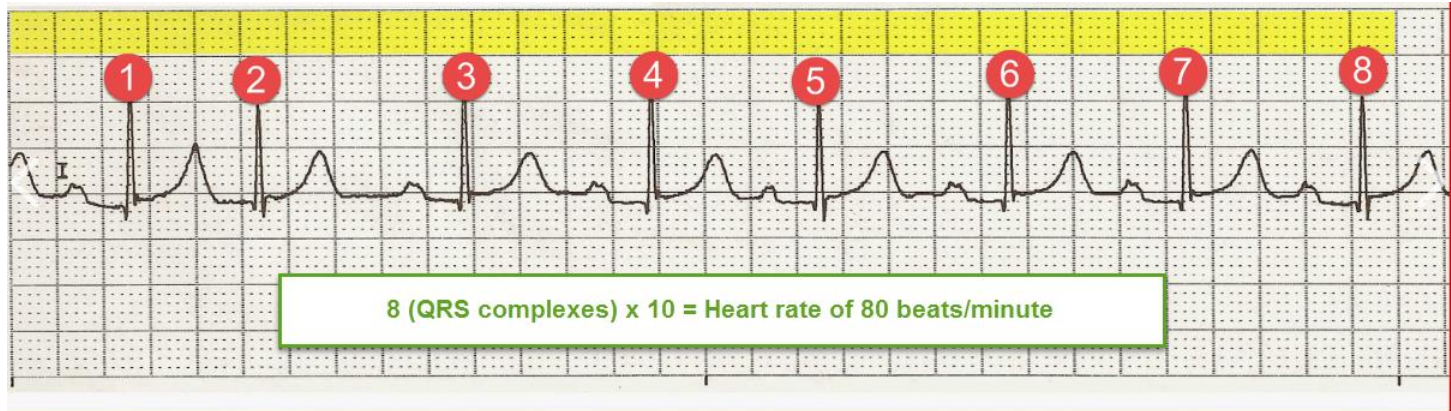
2. Count the number of QRS complexes in those 30 boxes (6 seconds)





# Systematic Approach to Rhythm Identification

3. Multiply the number of QRS complexes by 10



Practice:



# Systematic Approach to Rhythm Identification

- P Waves

- Are the P waves regular?
- Is there one P wave for every QRS?
- Where is the P wave located as compared to the QRS complex?
- Is the P wave normal and upright? Or inverted?
- Do all the P waves look alike?
- If there are early or late beats, do the P waves look different?





# Systematic Approach to Rhythm Identification

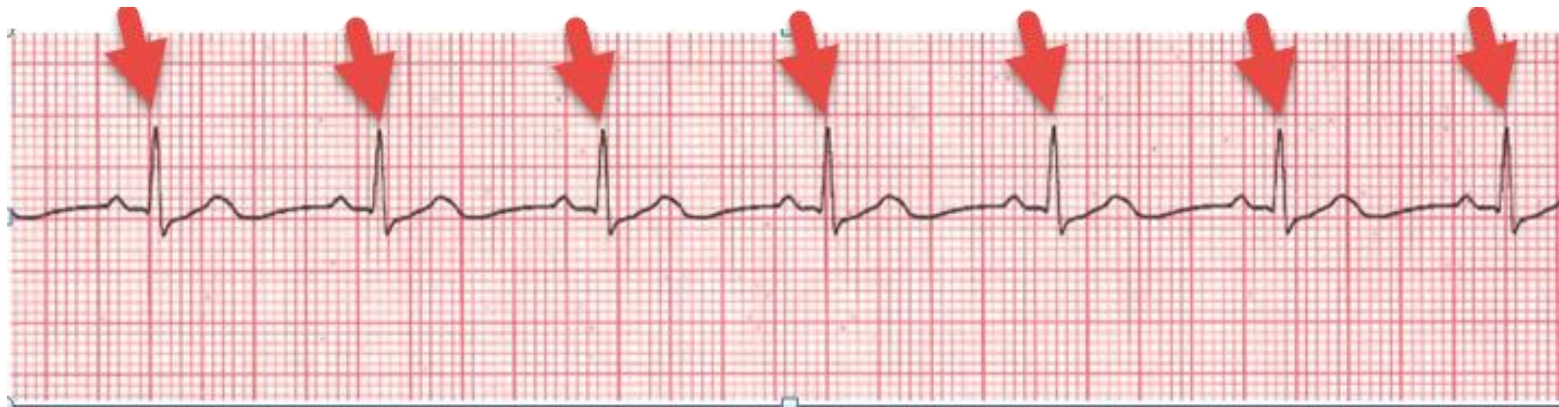
- P Waves
  - Practice:





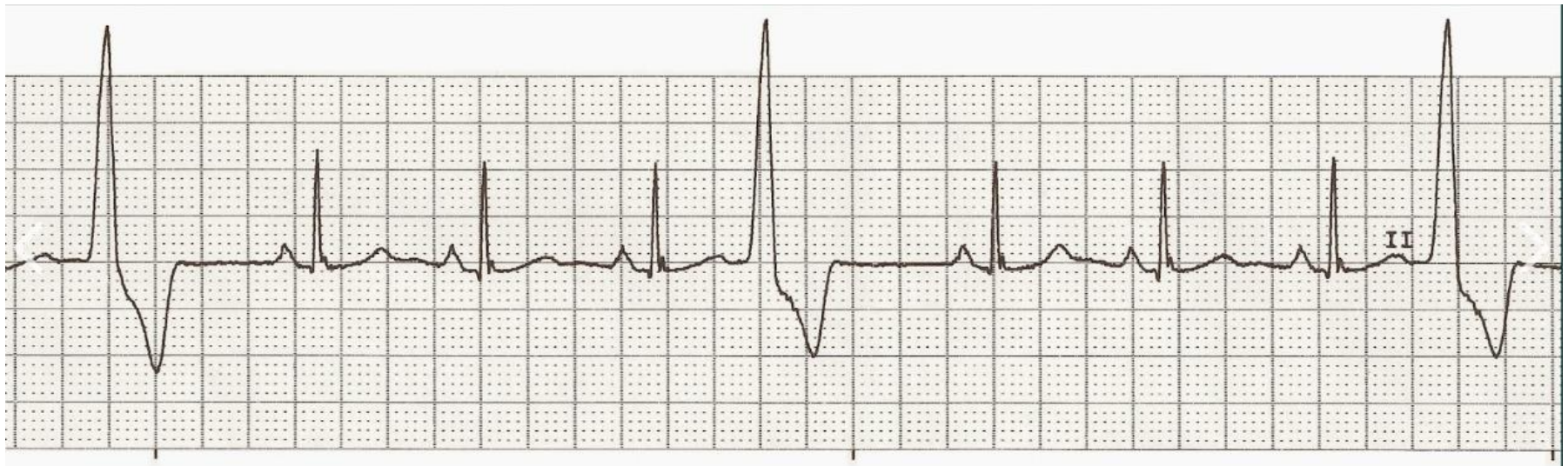
# Systematic Approach to Rhythm Identification

- QRS complex
  - Do the QRS complexes appear to be within normal limits?
  - Do all the QRS complexes look alike?



# Systematic Approach to Rhythm Identification

- QRS Complex
  - Practice:



# Systematic Approach to Rhythm Identification

- PR Interval
  - Are all the PR intervals constant?
  - Does the PR interval measurement appear to be within normal range?





# Systematic Approach to Rhythm Identification

- PR Interval
  - Practice:





# Sinus Rhythms

- Normal sinus rhythm
  - Regular rhythm
  - Rate: 60-100
  - P waves: Present and same configuration
  - QRS: normal duration (width), if wide may indicate BBB
  - PR interval: constant and p waves precede each QRS complex



# Sinus Rhythms

- Sinus Bradycardia

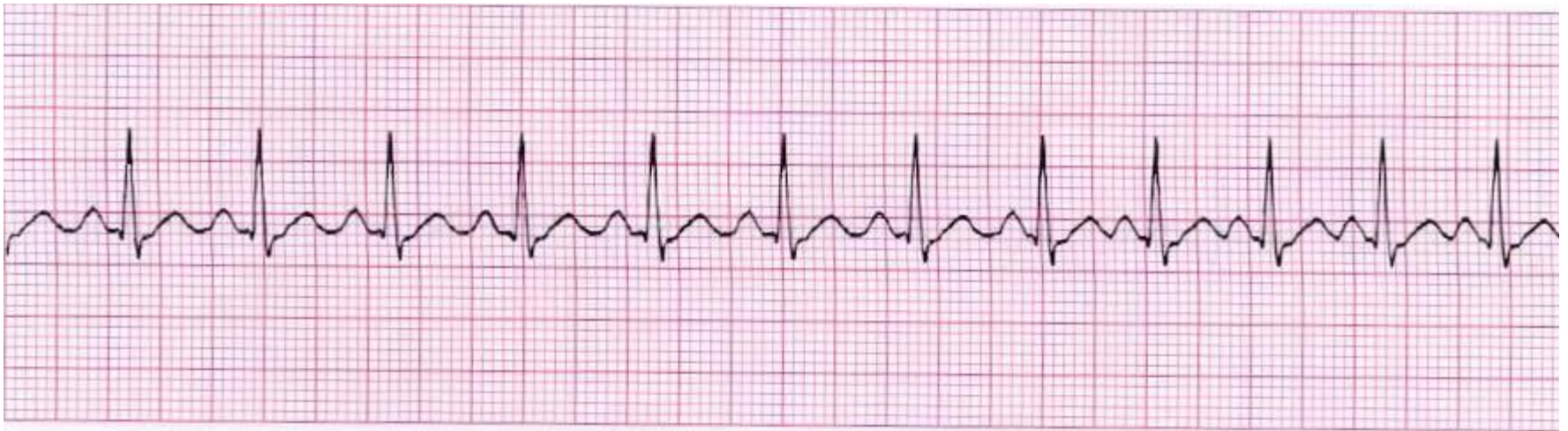
- Regular rhythm
- Rate: **Less than 60** beats per minute
- P waves: present and same configuration
- QRS: normal duration (width), if wide may indicate BBB
- PR interval: constant and p waves precede each QRS complex



# Sinus Rhythms

- Sinus Tachycardia

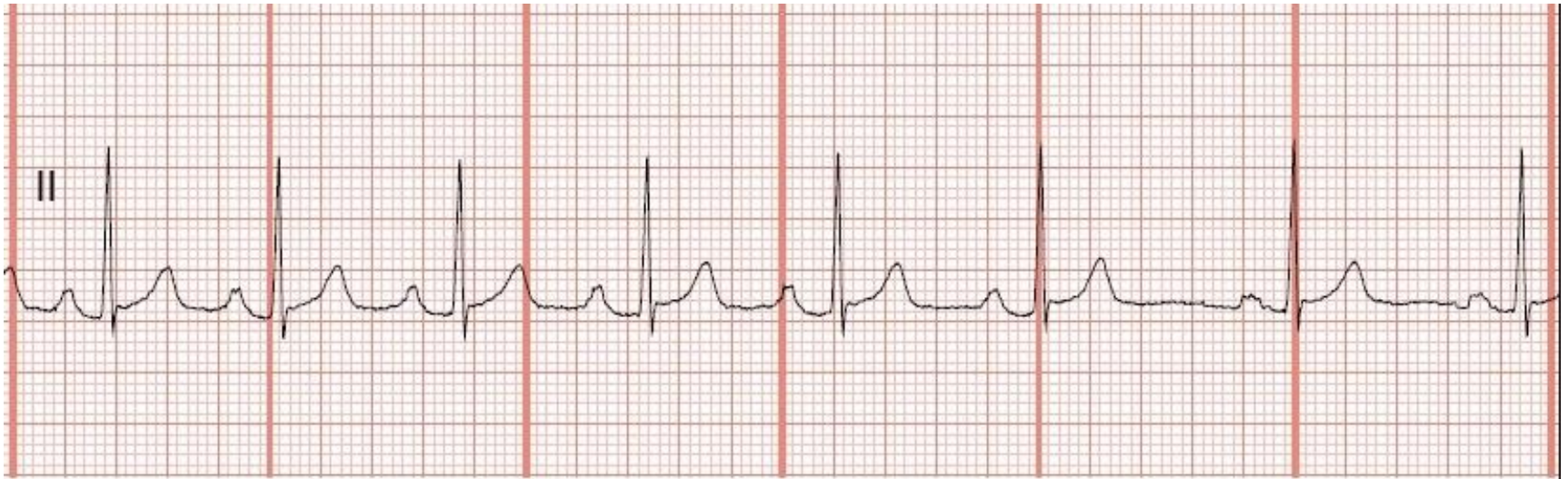
- Regular rhythm
- Rate: **Greater than 100** beats per minute
- P waves: present and same configuration
- QRS: normal duration (width), if wide may indicate BBB
- PR interval: constant and p waves precede each QRS complex





# Sinus Rhythms

- Sinus Arrhythmia (dysrhythmia)
  - Irregular rhythm: R to R intervals vary
  - Rate: usually normal 60-100, but may be slow (40-60)
  - P waves: Present and same configuration
  - QRS: normal duration (width), if wide may indicate BBB
  - PR interval: constant and p waves precede each QRS complex

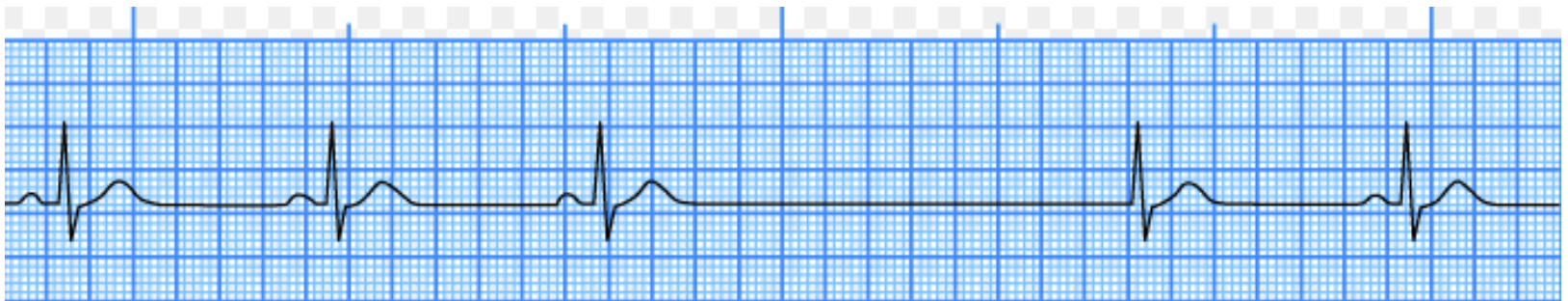




# Sinus Rhythms

- Sinus Pause (Arrest)

- Brief interruption of the normal rhythm due to the SA node failure to initiate an impulse resulting in a pause
- Rhythm is usually regular except when the sinus pause (arrest) occurs
- Rate: usually normal, but may be slow (40-60)
- P waves: Present and same configuration
- QRS: normal duration (width), if wide may indicate BBB
- PR interval: constant and p waves precede each QRS complex



# Artifact

- Irregular movements in the baseline of the EKG tracing which interfere with interpretation of the rhythm
  - Unable to determine rate or underlying rhythm



# Atrial Arrhythmias

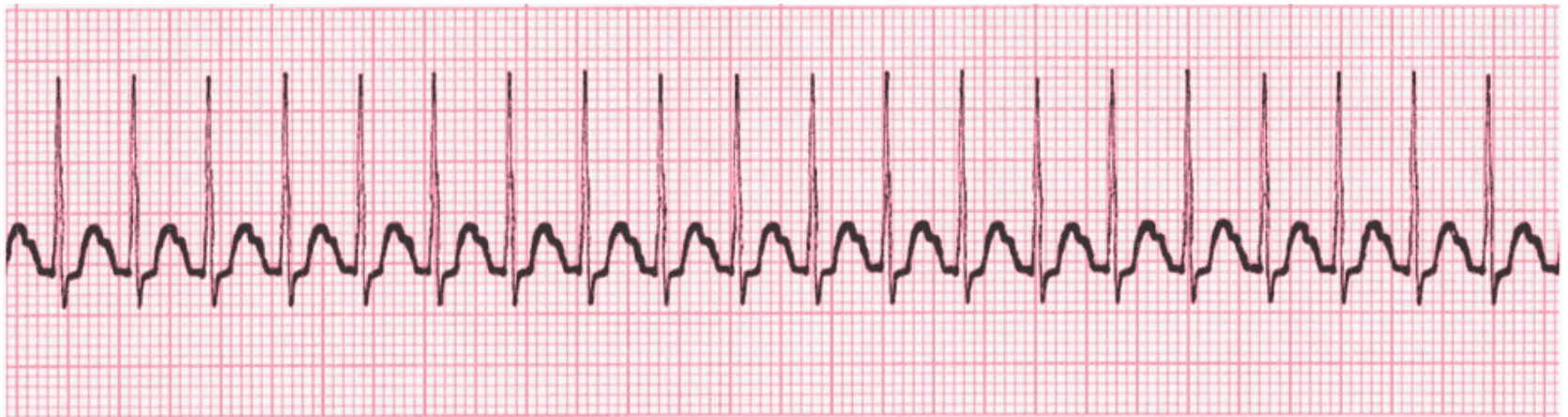
\*Identify underlying rhythm and the type of ectopic beat

- Premature Atrial Contractions (PAC's) - Beats that originate in the atria and arrive early in the cardiac cycle
  - Regularity: the beat arrives early, interrupting the regularity of the underlying rhythm, usually followed by a pause
  - Rate: Depends on the rate of the underlying rhythm
  - P waves: present but have abnormal shape, size, or deflection; may be superimposed on the previous T wave
  - QRS: normal duration (width), if wide may indicate BBB
  - PR interval: normal to shortened



# Atrial Arrhythmias

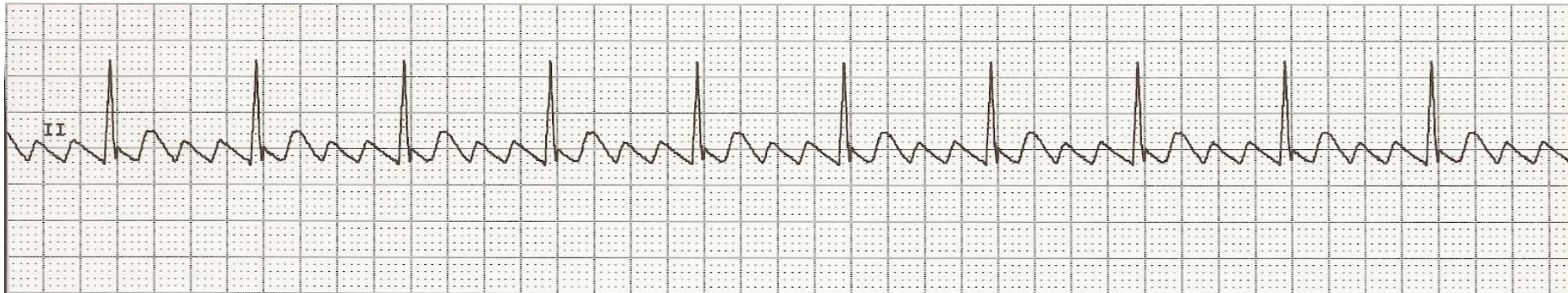
- Supraventricular Tachycardia (SVT)- Impulses originate at a rapid pace in the atria rather than in the SA node
  - Regularity: Regular
  - Rate: Greater than 150
  - P waves: Present but may be difficult to locate if the heart rate is very fast
  - QRS: Normal duration
  - PR interval: P wave for every QRS and normal duration





# Atrial Arrhythmias

- Atrial Flutter – Atria are firing 250-350 times per minute
  - Rhythm: atrial rhythm is regular; ventricular rhythm is usually irregular, but may be regular
  - Rate: atria 250-350 beats per minute, ventricles usually  $\frac{1}{4}$  to  $\frac{1}{2}$  atrial rate; to determine heart rate still count QRS complexes
  - P waves: **Saw tooth appearance**, more P's than QRS complexes
  - QRS: normal duration (width), if wide may indicate BBB
  - PR Interval: Not able to measure



# Atrial Arrhythmias

- Atrial Fibrillation – multiple irritable foci in the atria, which causes a quivering or fibrillation of the atria
  - Atria and ventricles are irregular
  - Rate: Variable; goal is to keep a-fib controlled with rates  $<100$
  - P waves: Not present, chaotic electrical activity in atria
  - QRS: normal duration (width), if wide may indicate BBB
  - PR Interval: Not able to measure due to absence of P waves



# Junctional Rhythms

- Junctional Rhythm

- Usually regular
- Rate: **40-60** beats per minute
- P waves: Inverted or absent due to being buried in the QRS
- QRS: May be normal duration (width) or distorted if P wave buried
- PR interval: Shortened or may be absent if P wave following or buried in QRS

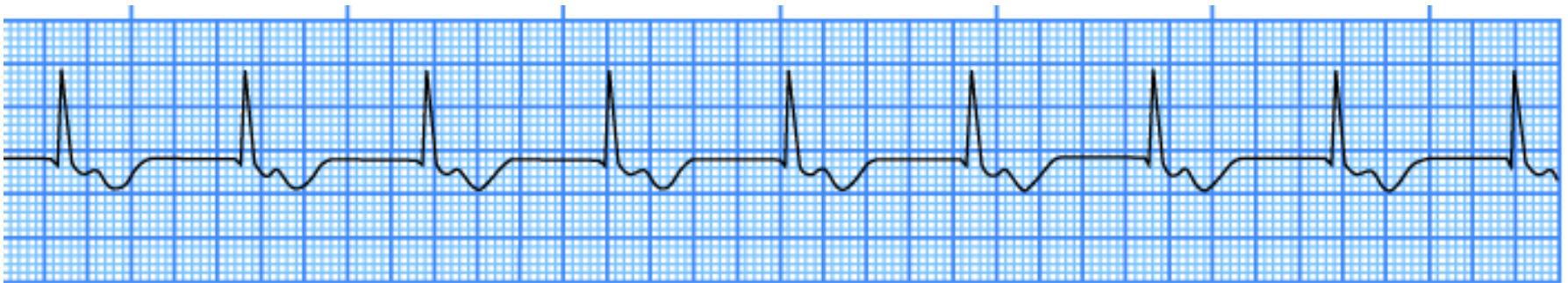




# Junctional Rhythms

- Accelerated Junctional Rhythm

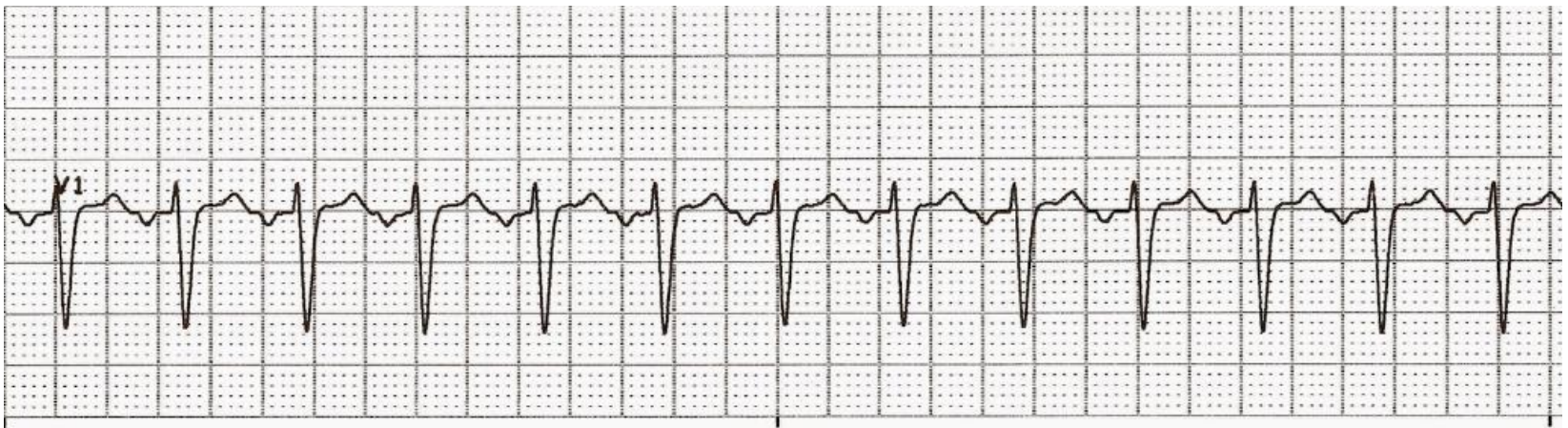
- Usually regular
- Rate: **60-100** beats per minute
- P waves: Inverted or absent due to being buried in the QRS
- QRS: May be normal duration (width) or distorted if P wave buried
- PR interval: Shortened or may be absent if P wave following or buried in QRS



# Junctional Rhythms

- Junctional Tachycardia

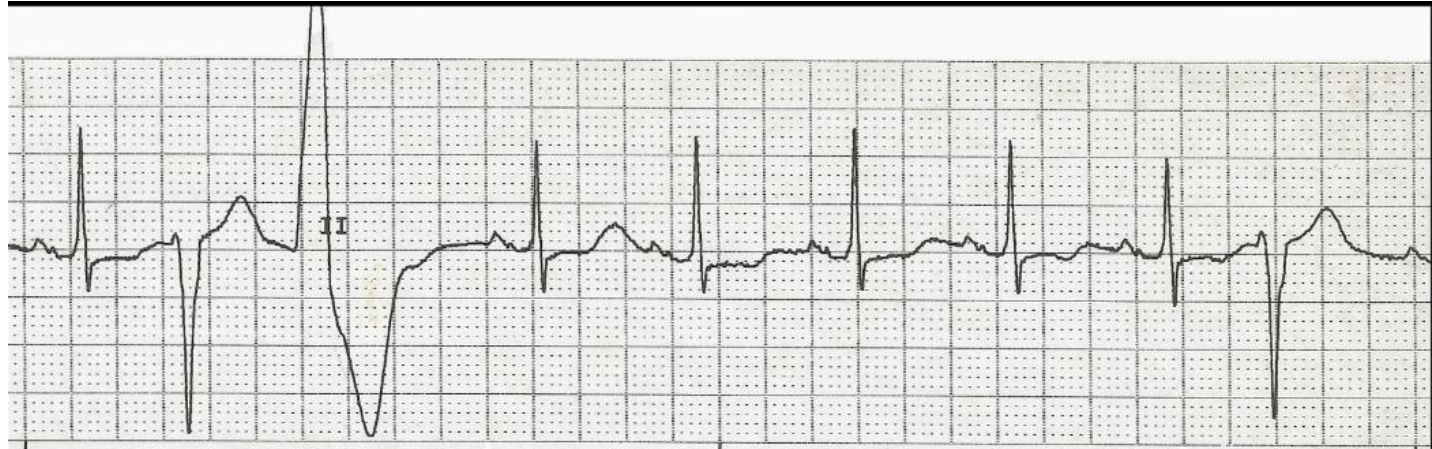
- Usually regular
- Rate: **greater than 100** beats per minute
- P waves: Inverted or absent due to being buried in the QRS
- QRS: May be normal duration (width) or distorted if P wave buried
- PR interval: Shortened or may be absent if P wave following or buried in QRS



# Ventricular Rhythms

\*Identify underlying rhythm and the type of ectopic beat

- Premature Ventricular Contractions- beats that originate within the ventricles and arrive early in the cardiac cycle
  - Regularity: The beat arrives early, interrupting the regularity of the underlying rhythm, usually followed by a pause
  - Rate: Depends on the rate of the underlying rhythm
  - P waves: No p wave with PVC
  - QRS: Wide and may look different from QRS complexes in underlying rhythm
  - PR interval: Unable to measure



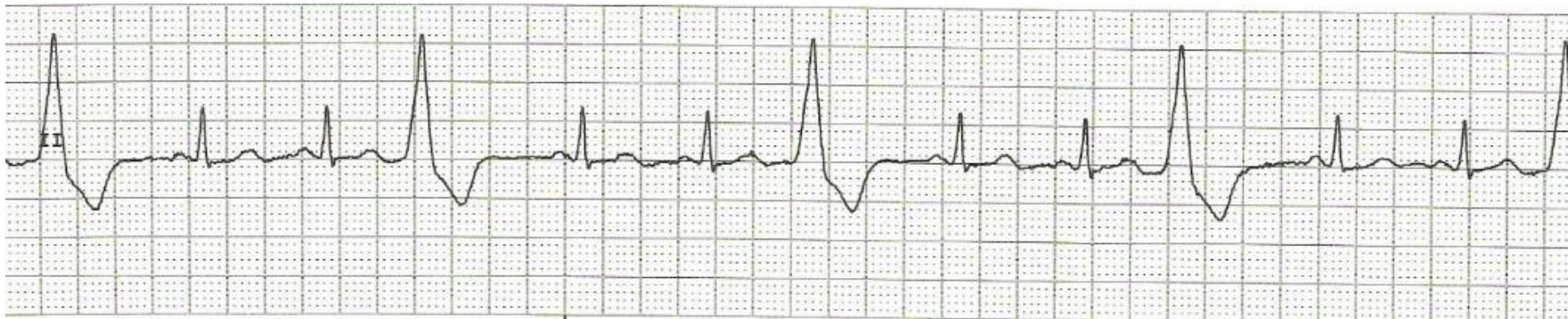


# Ventricular Rhythms

- Premature Ventricular Contractions
  - Bigeminy: Every other beat is a PVC



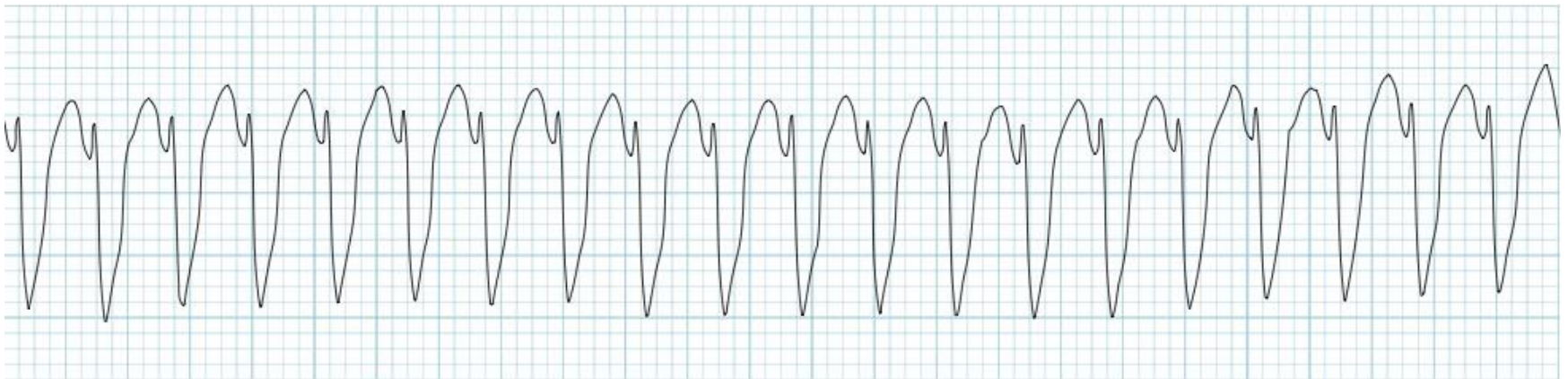
- Trigeminy: Every third beat is a PVC



# Ventricular Rhythms

- Ventricular Tachycardia
  - Usually regular, but may be slightly irregular
  - Rate: 150-250 beats per minute
  - P waves: No p waves preceding QRS complexes
  - QRS: Always wide ( $>.12$  seconds)
  - PR interval: Not measureable

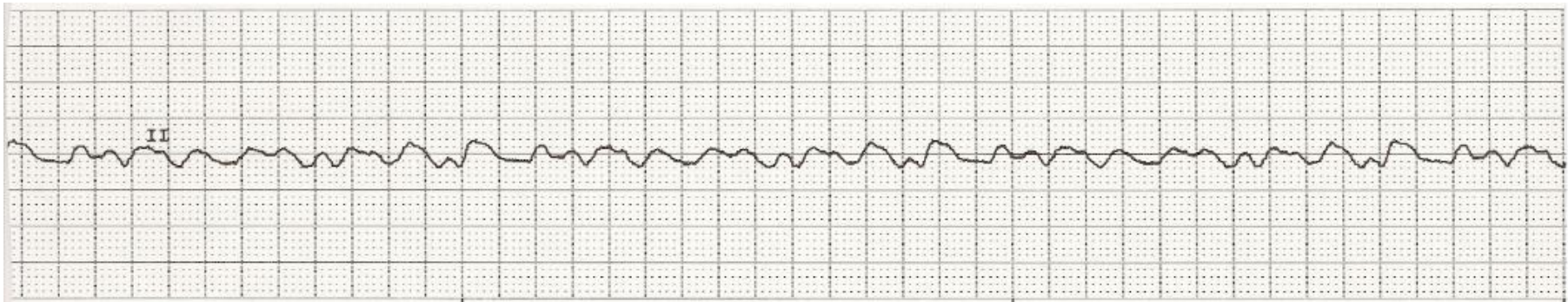
Lethal Rhythm!



# Ventricular Rhythms

- Ventricular Fibrillation
  - Completely irregular
  - Rate: Cannot be determined
  - P waves: None
  - QRS: None
  - PR interval: None

Lethal Rhythm!



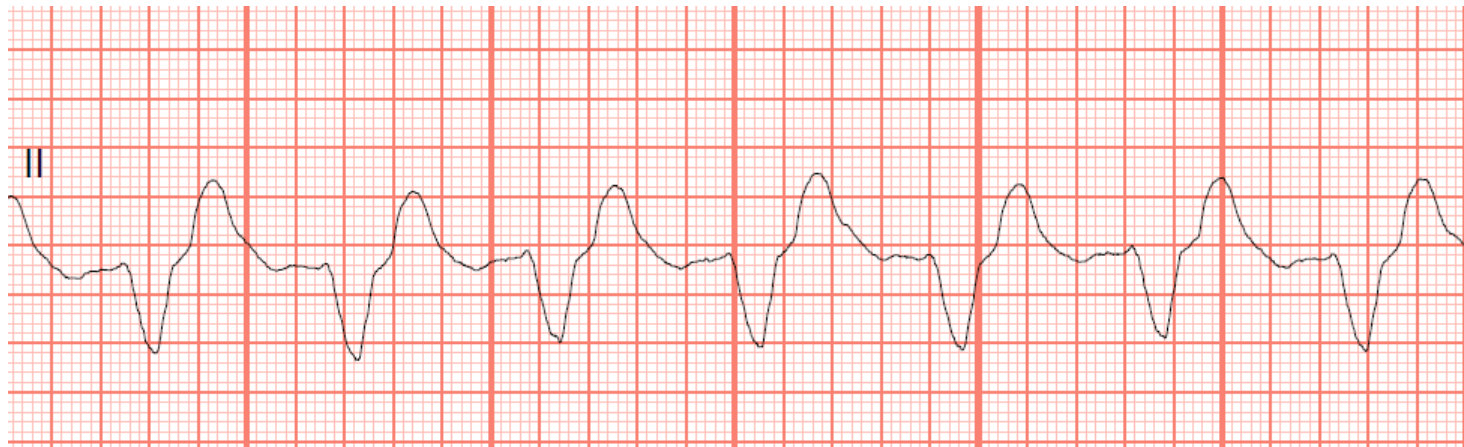


# Ventricular Rhythms

- Idioventricular Rhythm

- Usually regular
- Rate: 20-40 beats per minute
  - If rate 40-100 it is an accelerated idioventricular rhythm
- P waves: None
- QRS: Always wide ( $>.12$  seconds)
- PR interval: None

What is the difference  
between an  
idioventricular and  
junctional rhythm?



# Ventricular Rhythms

- Asystole – total absence of electrical and mechanical activity
  - No rhythm to measure
  - Rate: None
  - P waves: Usually none present
  - QRS: None
  - PR interval: None

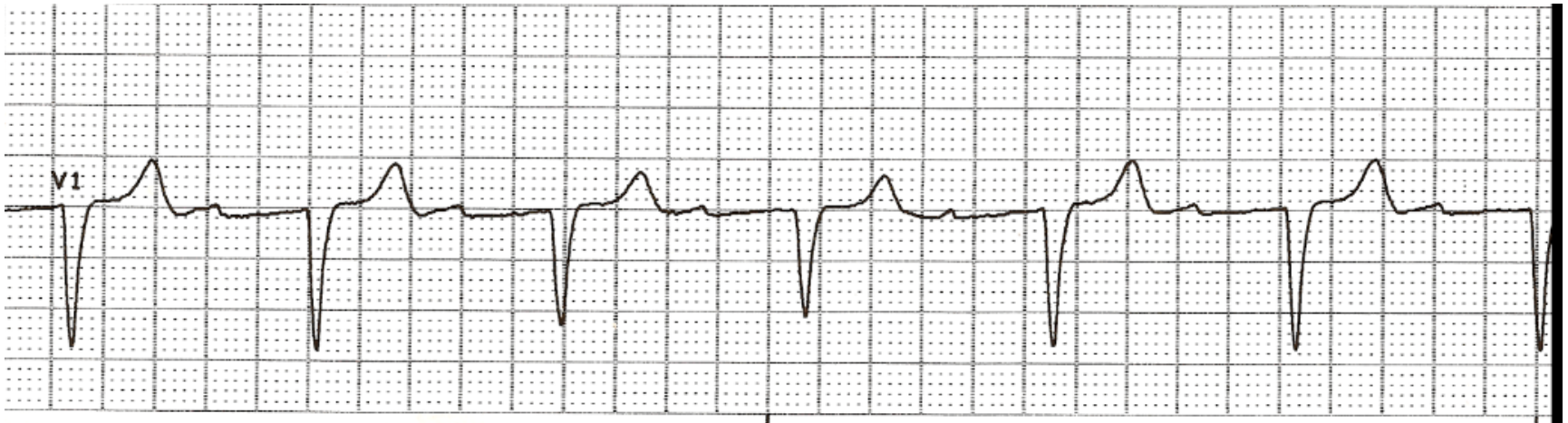
Lethal Rhythm!



# AV Blocks

- First Degree AV Block

- Usually regular
- Rate: May vary, but usually 60-100 beats per minute
- P waves: Normal in size and configuration, one before each QRS
- QRS: normal duration (width)
- PR interval: Prolonged and consistent with each beat





# AV Blocks

- Second Degree AV Block: Mobitz Type I (Wenckebach)
  - Irregular rhythm
  - Rate: Usually normal, 60-100 beats per minute
  - P waves: Upright and uniform, more P waves than QRS complexes
  - QRS: normal duration (width)
  - PR interval: Becomes progressively longer until a P wave is not conducted and the QRS is dropped



# AV Blocks

- Second Degree AV Block: Mobitz Type II
  - Atrial is usually regular, ventricular may be irregular or regular
  - Rate: atrial usually 60-100 beats per minute, ventricular rate slower depending on number of beats conducted
  - P waves: Upright and uniform, more P waves than QRS complexes
  - QRS: normal duration (width) or widened
  - PR interval: May be normal or prolonged, but is constant



# AV Blocks

- Third Degree AV Block (Complete Heart Block)
  - Atrial rhythm is regular and ventricular rhythm is regular
  - Rate: Atrial 60-100 beats per minute, ventricular rate is slow
  - P waves: Upright and uniform, more P waves than QRS complexes
  - QRS: normal duration (width) or widened
  - PR interval: Varies; no relationship between P's and QRS's



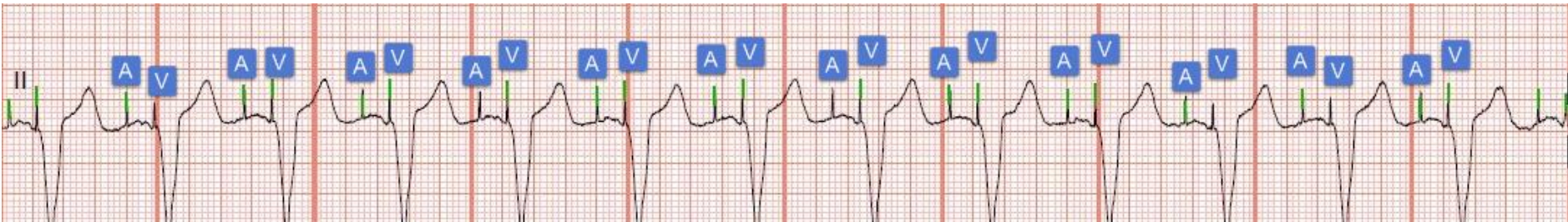
# Paced Rhythm

- AV Paced= Atrium and ventricles paced, V paced= Ventricles paced, A Paced= Atrium paced
  - Usually regular, may have a heart rate above paced settings
  - Rate: Is dependent on the rate at which the pacer is set
  - P waves
    1. Ventricular pacemaker: P waves, fibrillation or flutter waves may be present
    2. AV pacemaker: P wave following atrial pacer spike
  - QRS: With ventricular pacemaker, wide QRS ( $>.12$  sec), QRS complex follows each pacing spike
  - PR interval:
    1. Not measured in a ventricular demand pacemaker
    2. Usually normal in an AV pacemaker

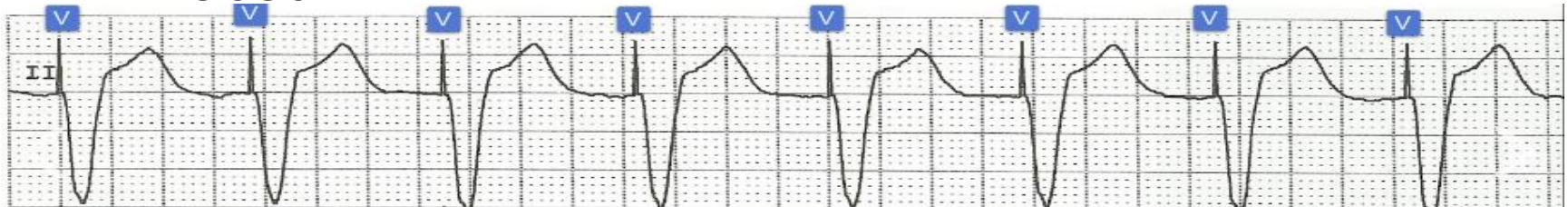


# Paced Rhythm

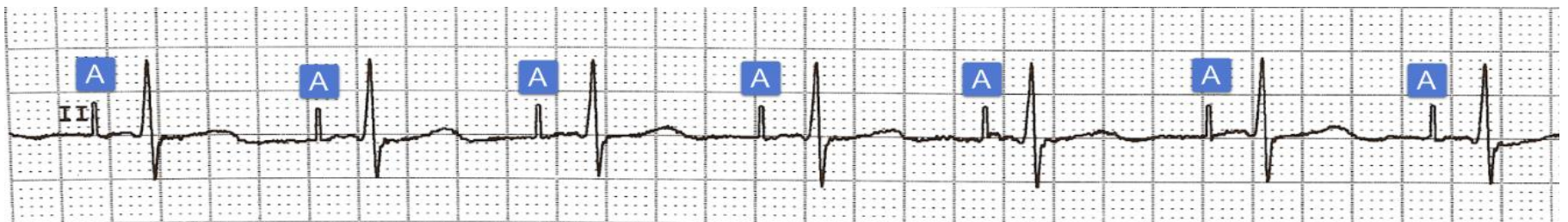
- AV Paced



- V Paced

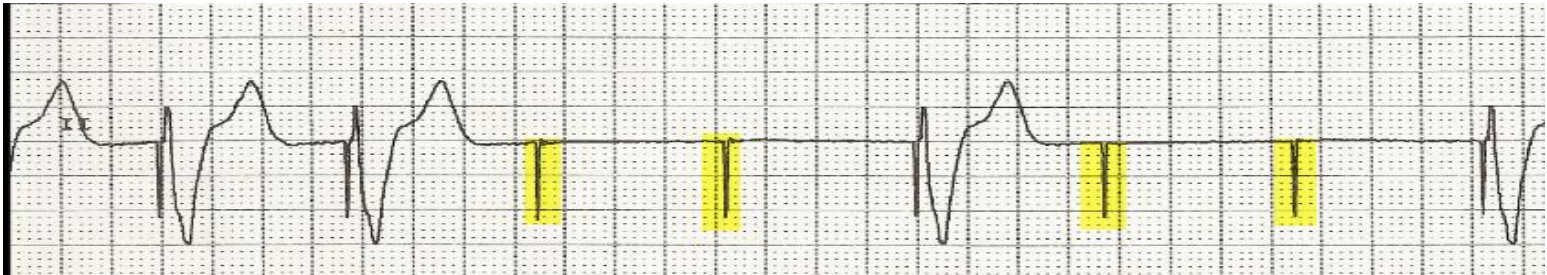


- A Paced



# Paced Rhythm

- Loss of capture



- Patient's intrinsic pacing is above the rate set for the pacemaker

