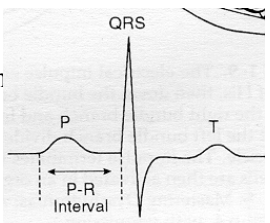


**EKG's: Interpretation**  
**Nursing Assistant 25**  
**Instructor: Fay Johnson**




---

---

---

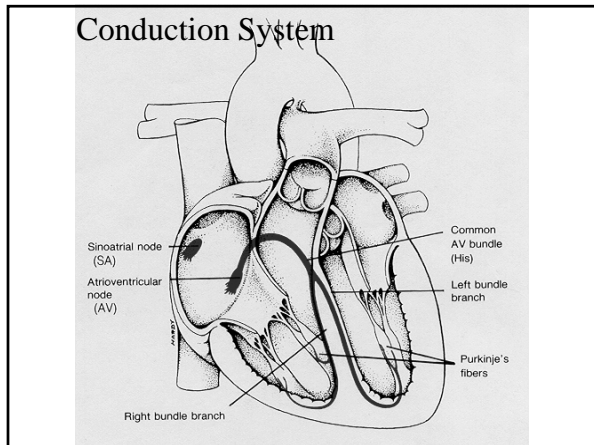
---

---

---

---

---




---

---

---

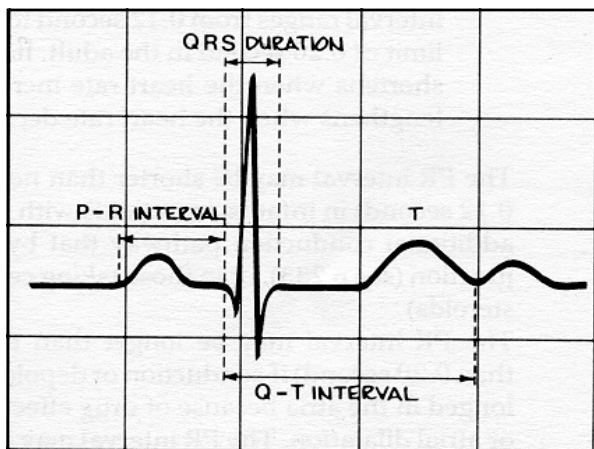
---

---

---

---

---




---

---

---

---

---

---

---

---

**Pathway of electric impulse through the heart:**

SA node → Internodal pathways → AV node →  
Bundle of His → Bundle branches → Purkinje Fibers

**SA:** Primary pacemaker for the healthy heart.

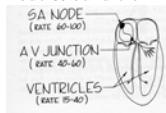
Fires impulses that contract the atria

**AV:** Gatekeeper; delays impulse for atrial contraction and emptying

Slows impulses coming too fast; generates one if none from above

**AV junction** = Area containing AV node & bundle of his

**Intrinsic Pacemaker Rates:**



**Depolarization / Repolarization:** Process of electrically stimulating cardiac cells resulting in muscle contraction and relaxation

(shifting of sodium, calcium, potassium ions leaving the cell positively or negatively charged)

---

---

---

---

---

---

---

---

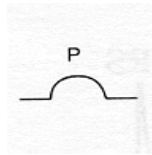
**P Wave**

Impulse travels from SA through internodals

Small, rounded, upright

Precedes QRS complex

Atrial depolarization



**PR Interval**

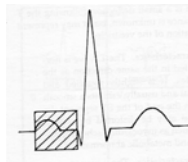
Measured from P to QRS complex

Impulse travels from SA through AV junction

Regular, unobstructed conduction is 0.12 - .20

seconds

>0.20 = slow conduction



---

---

---

---

---

---

---

---

**QRS Complex**

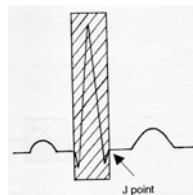
Impulse travels from Bundle Branches

through the Purkinje Fibers

Regular, unobstructed conduction is <.12 seconds

Depolarization of ventricles

- Q -- first downward deflection
- R -- first upright deflection
- S -- second downward deflection  
& return to baseline



---

---

---

---

---

---

---

---

## ST Segment & T Wave

### ST Wave

End of QRS to T

Isoelectric

Altered with ischemia,

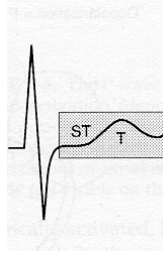
### T Wave

Repolarization of ventricles

Rounded, upright

Follows QRS wave

Altered with labs



---

---

---

---

---

---

---

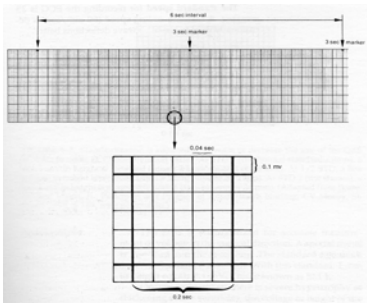
---

## EKG Graph Paper

Count boxes to determine time in seconds

Examples: PR interval of 4 small boxes = .16 seconds

QRS of 2 small boxes = 0.8 seconds



---

---

---

---

---

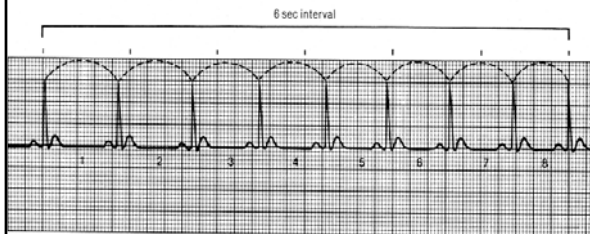
---

---

---

## Determining the rate - method 1

Count R waves in 6 seconds and multiply by 10



---

---

---

---

---

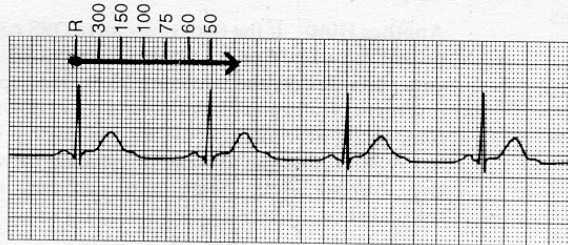
---

---

---

## Finding the rate - Method 2

Count-down from 300 using dark lines (big boxes between R waves)



---

---

---

---

---

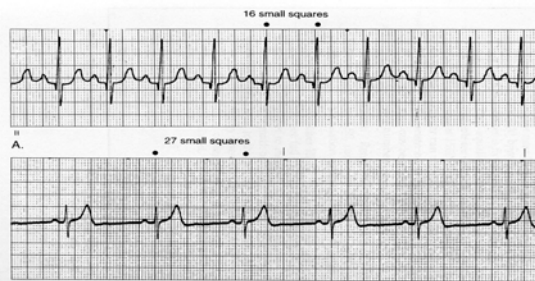
---

---

---

## Determining the rate - Method 3

$1500 \div \text{number of small boxes between R waves} = \text{rate}$



---

---

---

---

---

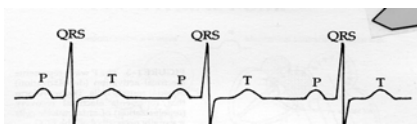
---

---

---

## Finding the waveforms...

- Every patient's waves look slightly different.
- The QRS is the easiest to find, so look for it first.
- Look before it: that should be the P wave.
- Look after it: that should be the T wave.



---

---

---

---

---

---

---

---

## Normal Sinus Rhythm

- **Atrial rate:** Between 60 to 100 beats per minute
- **Ventricular rate:** Between 60 to 100 beats per minute
- **Rhythm:** Regular
- **P wave:** Same shape, size and configuration
- **PR interval:** .12 to .20 seconds
- **QRS interval:** <.12 seconds
- **T wave:** Present, regular after each QRS



---

---

---

---

---

---

---

---

## Sinus Arrhythmia



---

---

---

---

---

---

---

---

## Sinus Bradycardia



---

---

---

---

---

---

---

---

## Sinus Tachycardia

**Atrial rate:** > 100

**Ventricular rate:** > 100

**Rhythm:** Regular

**P Waves:** Same shape, size and configuration

**PR interval:** .12 - .20 seconds

**QRS interval:** <.12 seconds

**T wave:** Regular; can hide p wave in fast rates



---

---

---

---

---

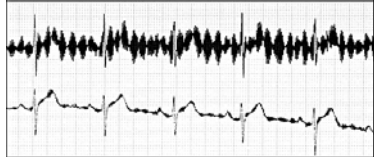
---

---

---

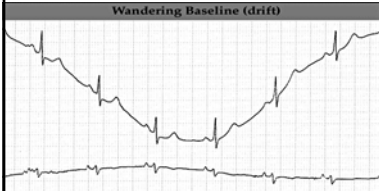
## Artifact

AC Interference (60 cycle)



Sixty even, regular spikes in a 1 second interval caused by electrical current near the patient

Wandering Baseline (drift)



An undulating baseline with waveform present.

---

---

---

---

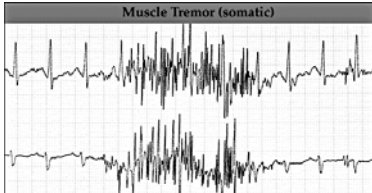
---

---

---

---

Muscle Tremor (somatic)



Electrical interference caused by the patient's tensed muscles.

---

---

---

---

---

---

---

---

### Ectopic Beats

Originate from a site other than the SA node.  
Therefore ectopic beats **look different** – the different component tells where the impulse originated.  
Occur when an oxygen-deprived, irritable, frustrated cell fires on its own.  
Ectopic beats come at an **unexpected time**  
Premature beats: overtake SA and come early  
Escape beats: Sense when no other impulse has been initiated and fire late

---

---

---

---

---

---

---

---

### Premature Atrial Complex “PAC”

Ectopic impulse somewhere in atria  
Has a P which comes early, Conducts a normal looking QRS  
Impulse site close to SA will resembles P; closer to AV will have shorter PR and different appearance

- Atrial rate: Varies
- Ventricular rate: Varies
- Rhythm: Irregular
- P Waves: Early, may look different or merge with “T”
- PR interval: .12 - .20 seconds
- QRS interval: <.12 seconds
- T wave: Regular



---

---

---

---

---

---

---

---

### Premature Ventricular Complex “PVC”

Ectopic impulse somewhere in ventricle  
Has no P, appears a wide and bizarre QRS  
One impulse site produces Unifocal PVC's  
More than one ectopic focus produces Multifocal PVC's

- Rhythm: Irregular
- P wave: Absent
- PR interval: None
- QRS interval: Early, wide & bizarre, >.12 seconds
- T wave: Deflects in opposite direction
- Dangerous because can precipitate worsening ventricular rhythms



---

---

---

---

---

---

---

---

## More Multifocal PVC's



---

---

---

---

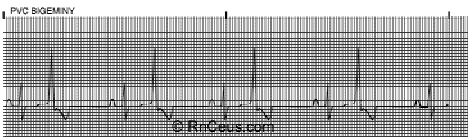
---

---

---

---

## Bigeminy Every other beat is ventricular



---

---

---

---

---

---

---

---

## PJC Premature Junctional Complex

(Nodal or Junctional)

The AV node becomes irritable and fires on its own

An inverted or absent P wave result (retrograde conduction)

A normal duration QRS and T



Figure 5-3. Sinus rhythm with frequent premature junctional complexes (PJCs). Beats 3 and 6 are PJCs. Note the retrograde P waves.

---

---

---

---

---

---

---

---

## Atrial Flutter

**Atrial rate:** Very rapid (usually between 250 –300)

**Ventricular rate:** Regular (rare = irregular)

**Rhythm:** Regular

**P wave:** Saw-toothed flutter waves

**PR interval:** None

**QRS interval:** <.12 seconds

**T wave:** Present, regular after each QRS

Can be 2:1, 3:1, 4:1 conduction...



---

---

---

---

---

---

---

---

## Atrial Fibrillation

**Atrial rate:** Very rapid (usually over 300)

**Ventricular rate:** Irregular (rarely regular)

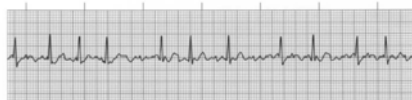
**Rhythm:** Irregular

**P wave:** Squiggly, very rapid, vary in size and shape

**PR interval:** None

**QRS interval:** < 0.12 seconds

**T wave:** Present, regular after each QRS



---

---

---

---

---

---

---

---

## Supraventricular Tachycardia SVT aka Atrial Tachycardia

**Atrial rate:** 160 – 250 beats per minute

**Ventricular rate:** 160 – 250 beats per minute

**Rhythm:** Regular

**P Waves:** May be absent or buried in previous beat

**PR interval:** .12 - .20 seconds

**QRS interval:** <.12 seconds

**T wave:** Regular; can hide p wave in fast rates



---

---

---

---

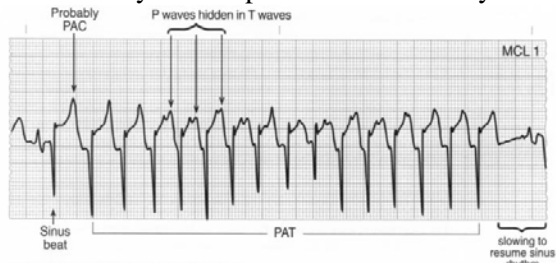
---

---

---

---

## Paroxysmal Atrial Tachycardia aka Paroxysmal Supraventricular Tachycardia



**Rate:** The rate of the PAT is about 180-190 bpm.  
**Regularity:** Beginning of PAT is slightly irregular, then it becomes more regular. PAT starts and stops suddenly, it is probably initiated by PAC.  
**Waveforms:**  
**PR:** 0.16 seconds in sinus beat.  
**QRS:** 0.06 seconds in sinus beats and PAT.  
 The underlying rhythm is NSR. The rapid rhythm that starts and stops suddenly is PAT because P waves are hidden in the T waves and the QRS is narrower or the same as in

---

---

---

---

---

---

---

---

---

---

## Ventricular Tachycardia – “V Tach”

- Atrial rate:** none
- Ventricular rate:** 100 – 250 beats per minute
- Rhythm:** Regular; Only wide, tall, bizarre complexes
- P Waves:** none
- PR interval:** none
- QRS interval:** >.12 seconds wide and weird looking
- T wave:** May or may not be seen




---

---

---

---

---

---

---

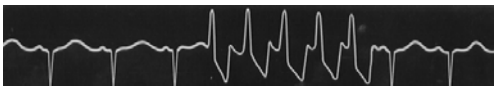
---

---

---

## More V Tach examples:

Beats can come in “runs”



or be “sustained”



- \*Stable V Tach has a pulse
- \*Unstable V Tach has no pulse

---

---

---

---

---

---

---

---

---

---

## Ventricular Fibrillation “V Fib”

1. Rapid, uncoordinated firing of the ventricles, like a bag of worms
2. Asymmetric quivering line with no complexes identifiable



---

---

---

---

---

---

---

---

## Junctional Rhythm/ aka Nodal Rhythm

originates in the AV junction

**Atrial rate:** Varies

**Ventricular rate:** 40 – 60 bpm

**Rhythm:** Regular

**P wave:** Inverted, absent, or blends w/ QRS

**PR interval:** Short or absent

**QRS interval:** <.12 seconds

**T wave:** Present, regular after each QRS



---

---

---

---

---

---

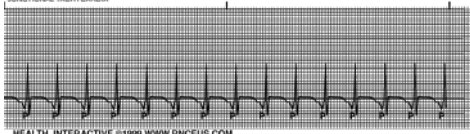
---

---

## More Junctional Rhythms



JUNCTIONAL TACHYCARDIA



---

---

---

---

---

---

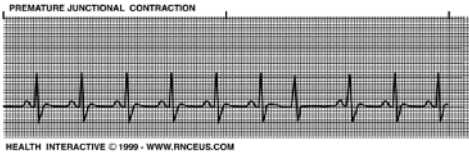
---

---

### Premature Junctional Complex "PJC"

Early ectopic beat from the AV junction  
 The AV node becomes irritable and fires on its own  
 An inverted or absent P wave result (retrograde conduction)  
 A normal duration QRS and T

- Rhythm:** Irregular caused by occ'l early beats
- P wave:** Early, inverted, absent, or hidden in QRS
- PR interval:** Short or absent
- QRS interval:** <.12 seconds
- T wave:** Present, regular after each QRS



HEALTH INTERACTIVE © 1999 - WWW.RNCEUS.COM

---

---

---

---

---

---

---

---

---

---

### Junctional Escape Beat

Late ectopic beat originating in the AV junction

- Rhythm:** Irregular caused by occ'l late beat
- P wave:** Inverted, absent, or hidden in QRS
- PR interval:** Short or absent
- QRS interval:** <.12 seconds
- T wave:** Present, regular after each QRS



Beats 3 and 7 are junctional escape beats

---

---

---

---

---

---

---

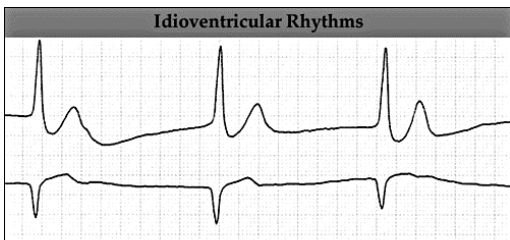
---

---

---

### Idioventricular Rhythm

Intrinsic pacemaker from ventricle  
 Ventricular complexes only



Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
20-40	Regular	Absent or not related	N/A	≥ .12

---

---

---

---

---

---

---

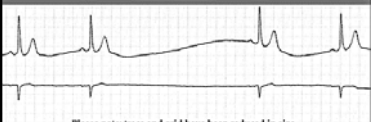
---

---

---

## Sinus Arrest


Sinus Arrest



Please note: trace and grid have been reduced in size

Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
N/A	Irregular	Before each QRS identical. New rhythm begins after a pause. The P to P interval is disturbed.	.12 to .20	<.12

SINUS PAUSE, ARREST



HEALTH INTERACTIVE © 1999 - WWW.RNCEUS.COM

---

---

---

---

---

---

---

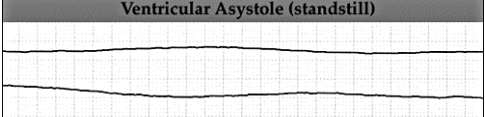
---

## Asystole

### Cardiac standstill, Flatline

No pulse - patient needs CPR and ACLS  
No complexes are associated with this rhythm

Ventricular Asystole (standstill)



Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
Absent	Absent	Absent or present	N/A	Absent

---

---

---

---

---


---

---

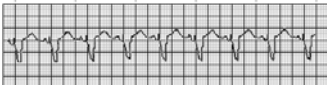
---

## Paced Rhythms


Pacemaker spikes appear as a vertical spike before a p or qrs  
Pacemaker beats are very often wide and distorted



Atrial



Ventricular



Dual

---

---

---

---

---

---

---

---