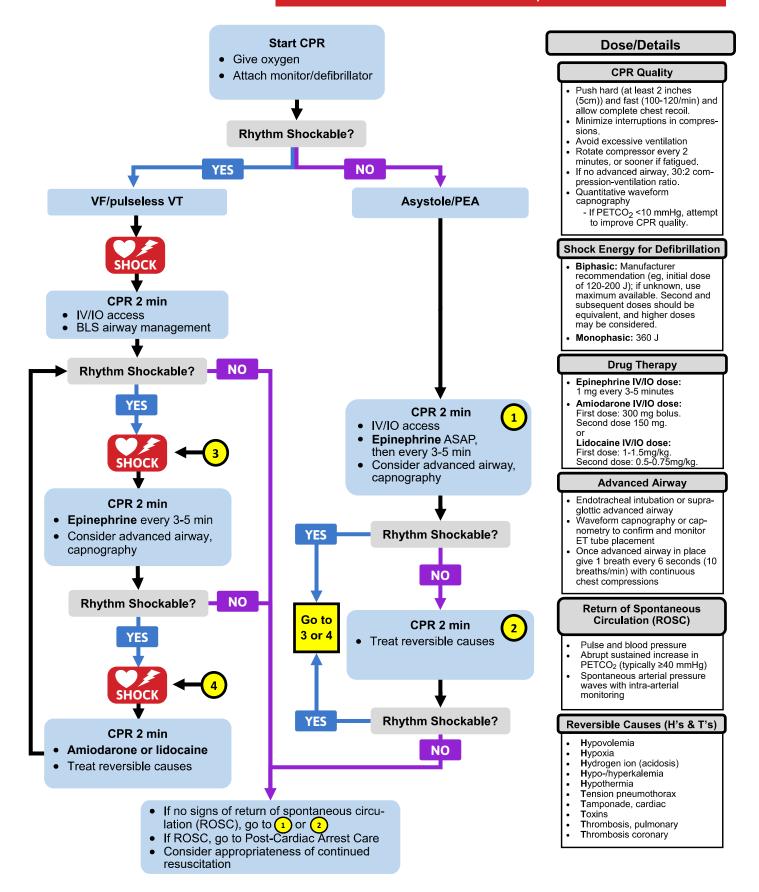


# ProACLS Adult Algorithm Cardiac Arrest

VF, Pulseless VT, Asystole, PEA





# ProACLS Adult Algorithm Bradycardia with a Pulse

Assess appropriateness for clinical condition. Heart rate typically <50/min if bradyarrhythmia.



#### **Identify and Treat Underlying Cause**

- Maintain patent airway
- · Assist with breathing and oxygen as needed
- · Cardiac monitor to identify rhythm; monitor blood pressure
- IV access
- 12-Lead ECG if no delay in therapy



### Persistent bradyarrhythmia causing:

- Hypotension?
- · Acutely altered mental status?
- · Signs of shock?
- · Ischemic chest discomfort?
- Acute heart failure?



Monitor and observe



### **Atropine**

Dose: 1 mg IV Push

#### If atropine ineffective:

Transcutaneous pacing

# AND/OR

• Dopamine IV infusion

## OR

• Epinephrine IV infusion



## Consider:

- Expert consultation
- Transvenous pacing

## **Dose/Details**

**Breathing:** 1 breath every 6 seconds. Oxygen titrate SpO<sub>2</sub> ≥94%.

Atropine: May repeat every 3-5 minutes. Maximum: 3 mg.

**Pacing:** Start rate bettween 60 and 80 bpm; increase current (mA) until electrical and mechanical capture.

**Dopamine:** 5-20 mcg/kg per minute. Titrate to patient response.

**Epinephrine:** 2-10 mcg per minute infusion. Titrate to patient response.

# Identify possible causes:

- -Myocardial ischemia/infarction
- -Drugs/toxicological (eg, calcium channel blockers, beta-blockers digoxin
- digoxin -Hypoxia
- -Electrolyte abnormality (eg, hyperkalemia)



# **ProACLS Adult Algorithm Immediate Post-Cardiac Arrest Care**

# Return of spontaneous circulation (ROSC) Optimize Airway, Breathing and Circulation Consider advanced airway if appropriate Start ventilations at 10/min to maintain: SpO<sub>2</sub> 92%-98% PaCO<sub>2</sub> 35-45 mmHg Maintain Systolic BP >90 mmHg and MAP at >65 mmHg **Obtain 12-lead ECG Consider Emergent Cardiac Interventions if:** • 12-lead shows STEMI or high suspicion of ACS • Mechanical circulatory support required · Unstable cardiogenic shock NO Awake and following commands? Other advanced critical care YES Initiate targeted temperature management Obtain brain CT and monitor EEG

#### Dose/Details

#### Circulation

Approximately 1-2 L normal saline, Lactated Ringers, or other crystalloid solutions.

# **Epinephrine IV infusion:**

2-10 mcg per minute

# Dopamine IV infusion:

5-20 mcg/kg per minute

# Norepinephrine IV infusion:

0.1-0.5 mcg/kg per minute - titrate to response (in 70-kg adult: 7-35 mcg per minute)

#### Reversible Causes (H's & T's)

- **H**ypovolemia
- **H**ypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- **H**ypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis coronary

**Targeted Temperature Management** Start as soon as possible. 32-36 degrees C for 24 hours.

Follows the updated 2020 ECC Guidelines for Advanced Healthcare Providers



# ProACLS Adult Algorithm **Tachycardia with a Pulse**

Assess appropriateness for clinical condition. Heart rate typically ≥ 150/min if tachyarrhythmia.



## **Identify and Treat Underlying Cause**

- Maintain patent airway; assist breathing as necessary
- Oxygen (if O<sub>2</sub> sat < 94%)</li>
- · Cardiac monitor to identify rhythm; monitor blood pressure and oximetry

#### Persistent Tachyarrhythmia Causing: Synchronized cardioversion: Hypotension? Acutely altered mental status? Consider sedation, if reasonable If regular narrow complex, Signs of shock? consider adenosine. Ischemic chest discomfort? Acute heart failure? NO Initiate IV access 12-lead ECG Consider: · Adenosine only if regular and Wide ORS? YES monomorphic ≥ 0.12 seconds Antiarrhythmic infusion Expert consultation NO If Refactory, Consider: Vagal maneuvers (if regular) Underlying cause • Adenosine (if regular) Need to increase energy level for cardioversion • β-Blocker or calcium channel blocker Addition of anti-arrhythmic drug

#### **Dose/Details**

Synchronized cardioversion: Recommended doses are based on manufacture recommendations.

Consider expert consultation

#### Adenosine IV dose:

First dose: 6 mg rapid IV push; follow with NS flush. Second dose: 12 mg if required.

#### Antiarrhythmic Infusions for Stable Wide-QRS Tachycardia

#### Procainamide IV dose:

20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases >50%, or maximum dose 17 mg/kg given. Maintenance infusion: 1-4 mg/min. Avoid if prolonged QT or CHF.

Consider expert consultation

#### Amiodarone IV dose:

First dose: 150 mg over 10 minutes. Repeat as needed if VT recurs. Follow by maintenance infusion of 1 mg/min for first 6 hours.

#### Sotalol IV dose:

100 mg (1.5 mg/kg) over 5 minutes. Avoid if prolonged QT.



# ProACLS Adult Algorithm **Acute Coronary Syndrome**

#### Assess appropriateness for clinical condition. Immediate general treatment: · Assess and manage ABCs and vitals; Establish IV Access • Nitroglycerin sublingual tablet or spray 0.3-0.4 mg If O<sub>2</sub> sat <90% start oxygen at 4 L/min, titrate Morphine IV If discomfort not relieved by nitroglycerin. Aspirin 162 to 325 mg Initial dose 2-4 mg IV • Obtain 12-lead ECG ED Assessment (<10 minutes): **EMS** · Monitor, support ABC's. Be prepared to Notified hospital should mobilize hospital resources to provide CPR and defibrillation respond to STEMI If 12-lead ECG shows ST elevation, notify Perform brief, targeted history, physical exam receiving hospital with transmission or Review/complete fibrinolytic checklist; check interpretation; note time onset and first contraindications medical contact · Obtain initial cardiac marker levels, Initial electrolyte and If considering fibrinolysis, review/complete coagulation studies fibrinolytic checklist • Obtain portable chest x-ray (<30 minutes) Do not delay transport to cath lab Consider administration of P2Y<sub>12</sub> inhibitors **ECG Interpretation** ST elevation or new or presumably new N-STEMI- Determine risk using validated LBBB; strongly suspicious for injury scoring such as TIMI or GRACE ST-elevation MI (STEMI) High-risk ACS from ST depression or Low/Intermediate-risk ACS dynamic T-wave inversion; strongly Normal or non-diagnostic changes Start adjunctive therapies suspicious for ischemia in ST segment or T-wave as indicated Do not delay reperfusion NO Time from onset Consider admission to ED chest Troponin elevated or high-risk patient, of symptoms pain unit or to appropriate bed consider early invasive strategy if: ≤12 hours? for further monitoring and Refractory ischemic chest discomfort possible intervention. Recurrent/persistent ST deviation Ventricular tachycardia Hemodynamic instability Signs of heart failure Reperfusion goals: Therapy defined by patient and Start adjunctive therapies center criteria. (eg, nitroglycerin, heparin) as indicated First medical contact to balloon-See AHA/ACC NSTE-ACS Guidelines inflation (PCI) goal of 90 minutes Door to-needle (fibrinolysis) goal of 30 minutes



# ProACLS Adult Algorithm **Suspected Stroke**

#### Identify signs and symptoms of possible stroke Activate Emergency Response



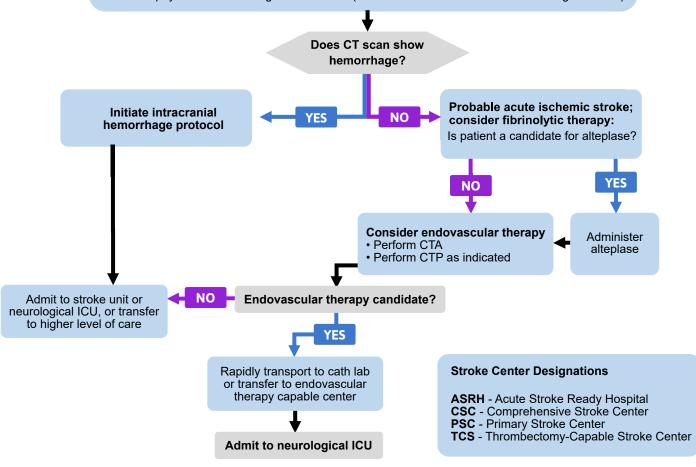
#### Critical EMS assessments and actions:

- Assess and support ABCs; give oxygen if SpO<sub>2</sub> is < 94%</li>
  Following stroke protocol, perform prehospital stroke assessment and physical exam
- Establish time of symptom onset (last normal)
- Triage to most appropriate stroke center (ASRH, CSC, PSC, or TCS)
- Check glucose and treat if indicated
- Alert hospital; consider direct transfer to CT scan



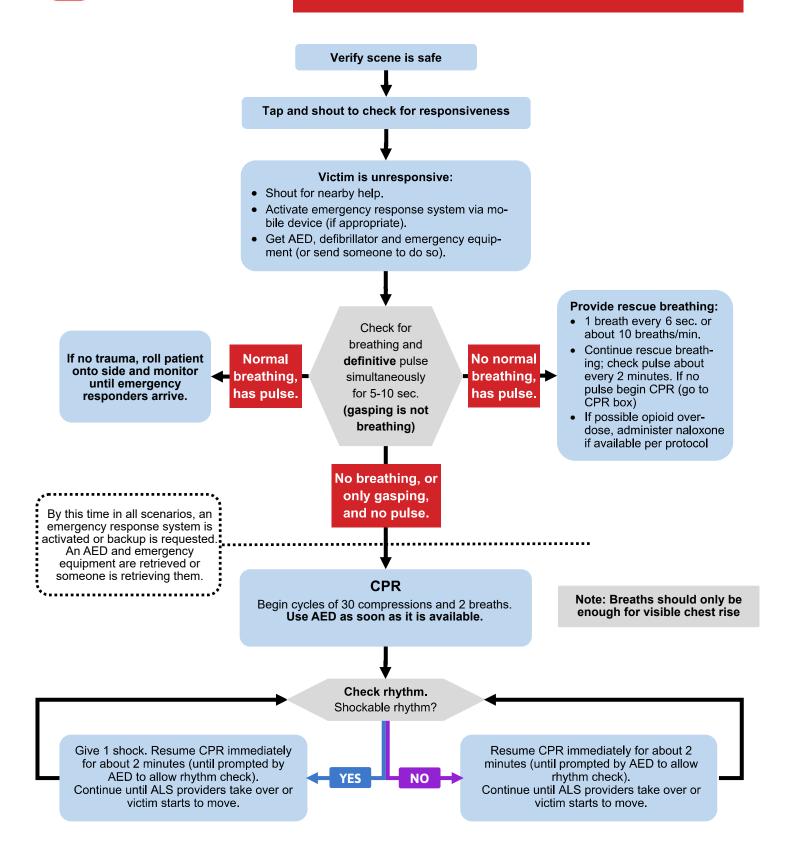
#### Immediate emergency department or stroke team general assessment and stabilization:

- Activate stroke team for EMS arrival
- Order and prepare emergent CT scan or MRI of brain
- Bypassing emergency department and going directly to brain imaging suite is best practice
- Assess and support ABCs; give oxygen if SpO2 is < 94%</li>
- Obtain IV access and perform laboratory assessments
- Check glucose and treat if indicated
- Review patient's medical history, medications, procedures
- Confirm last known normal or time of symptom onset
- Perform physical and neurologic examination (NIH Stroke Scale or Canadian Neurological Scale)



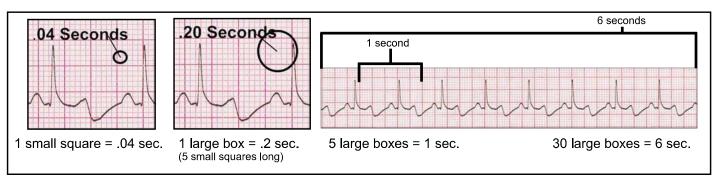


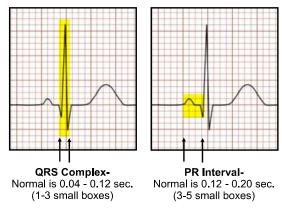
# ProACLS Adult Algorithm BLS Cardiac Arrest

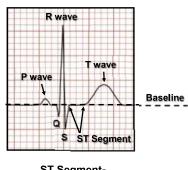




# ProACLS **ECG Interpretation**







ST Segment-Normally level with baseline. If higher, possible ST elevation MI. 12 lead ECG is needed to properly evaluate ST elevation.



# Normal Sinus Rhythm

Rhythm: Regular

Rate: 80 bpm (normal range= 60-100 bpm)

P Waves: Upright and regular

P-R Interval: 0.16 sec (normal range= 0.12-0.20), one P wave for each QRS

QRS: 0.08 sec (normal range= 0.04-0.12)

Clinical Significance: Unless the patient has no pulse or other serious signs or symptoms, there is no significance to this cardiac rhythm.

# **Dysrhythmias Originating in the SA Node**



### Sinus Bradycardia

Rhvthm: Regular

Rate: 50 bpm (normal range= 60-100 bpm)

P Waves: Upright and regular

P-R Interval: 0.16 sec (normal range= 0.12-0.20), one P wave for each QRS

QRS: 0.08 sec (normal range= 0.04-0.12)

Clinical Significance: A decreased heart rate can result in decreased cardiac output, hypotension, or other serious problems depending on the cause of the bradycardia. Unless the patient has hypotension or other serious signs or symptoms, no treatment is necessary. For hypotension or other serious symptoms, Atropine 0.5mg can be given every 3-5 minutes. If atropine is ineffective, transcutaneous pacing should be done. Other treatments include Dopamine 2 to 20 mcg/kg per minute or Epinephrine 2 to 10 mcg/min.



#### Sinus Tachycardia

Rhythm: Regular

Rate: 130 bpm (normal range= 60-100 bpm)

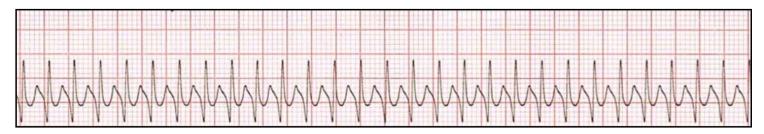
P Waves: Upright and regular

P-R Interval: 0.16 sec (normal range= 0.12-0.20), one P wave for each QRS

QRS: 0.04 sec (normal range= 0.04-0.12)

Clinical Significance: Typically sinus tachycardia needs no treatment. It is most often a compensatory mechanism to an underlying cause such as fever, anxiety, hypovolemia, or shock. It is most important to identify and treat the underlying cause as needed. Rates less than 150bpm do not usually cause serious signs and symptoms. Rates over 150bpm may cause reduced cardiac output and may require treatment. Synchronized cardioversion is the first choice. If regular narrow QRS complex, consider adenosine.

# **Dysrhythmias Originating in the Atria**



## Supraventricular Tachycardia

Rhythm: Regular

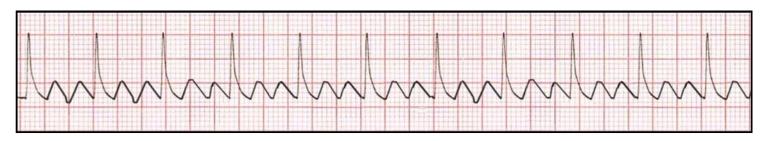
Rate: 280 bpm (SVT is defined as >100bpm. Typically under 150bpm has no symptoms.)

P Waves: Present but difficult to see on the end of the T wave because of rapid rate

P-R Interval: 0.12 sec (normal range= 0.12-0.20), one P wave for each QRS, again difficult to see

QRS: 0.04 sec (normal range= 0.04-0.12)

Clinical Significance: SVT usually has an abrupt onset and termination in patients with high levels of stress, over exertion, high levels of caffeine, Wolff-Parkinson-White (WPW) syndrome, etc... and can usually be tolerated for short periods of time. Runs of SVT are often felt as palpitations. Treatment is not normally needed for self-terminating SVT. If the patient is unstable, rapid treatment must be given to correct the SVT. Synchronized cardioversion at 50-100 joules with a monophasic or biphasic defibrillator should be given immediately. For symptomatic, but stable SVT, Vagal maneuvers should be tried first. If unsuccessful, then 6mg Adenosine rapid IV push would be given. 12mg Adenosine may be tried if the first dose did not convert the rhythm.



### **Atrial Flutter**

Rhythm: Regular (Can be irregular)

Rate: 110 bpm (Atrial rate is 210. Typical "sawtooth" pattern of atrial flutter.)

P Waves: Flutter waves, or F waves, are present.

P-R Interval: F waves are consistent, 2 for every QRS (2:1 or 3:1 is typical)

QRS: 0.12 sec (normal range= 0.04-0.12)

Clinical Significance: Treatment is not normally necessary. Rather an expert consultation is required. Patients will often feel weak or dizzy. Treatment is necessary if there is a rapid ventricular rate that creates hemodynamic instability. For an unstable patient, perform synchronized cardioversion with 50 to 100 J with a monophasic or biphasic defibrillator. Pharmacologic therapy should be done only upon expert consultation or medical control direction.



# **Atrial Fibrillation**

Rhythm: Irregular

Rate: 90 bpm (Atrial rate is very fast and chaotic, and cannot be counted) P

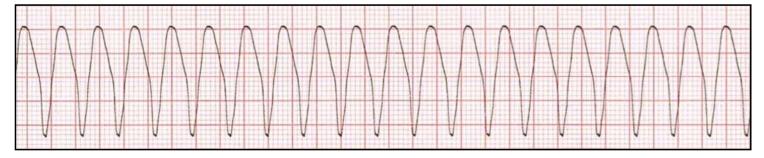
Waves: Not discernible. Chaotic.

P-R Interval: None

QRS: 0.08 sec (normal range= 0.04-0.12)

Clinical Significance: Treatment is not normally necessary. Rather an expert consultation is required. Patients will often feel weak or dizzy. For an unstable patient, perform synchronized cardioversion with 200 Joules with a monophasic or 120 to 200 joules with a biphasic defibrillator. Pharmacologic therapy should be done only upon expert consultation or medical control direction.

# **Dysrhythmias Originating in the Ventricles**



# Ventricular Tachycardia (V-tach)

Rhythm: Regular (Can be slightly irregular)
Rate: 200 bpm (Typically between 100-250)

P Waves: Absent P-R Interval: Absent

QRS: Wide, 0.32 sec (usually wide and bizarre)

Clinical Significance: Ventricular tachycardia severely compromises cardiac output and coronary artery perfusion. V-tach May be perfusing or non-perfusing. If there is a pulse and patient is stable, then Procainamide or Amiodarone may be administered. If unstable with a pulse, then synchronized cardioversion is needed. If pulseless, then defibrillate with an initial unsynchronized dose of 360 joules monophasic or 120-200 joules biphasic.



# **Torsade's De Pointes**

Rhythm: 210
Rate: Irregular
P Waves: Absent
P-R Interval: Absent
QRS: Wide

Clinical Significance: A person with Torsade's will be unstable, but may present with or without a pulse. Torsade's is a polymorphic ventricular tachycardia with the characteristic illusion of a twisting of the QRS complex around the baseline. Magnesium Sulfate should be administered. Either should be treated as with V-fib.



# **Ventricular Fibrillation (V-fib)**

Rhythm: Chaotic Rate: Chaotic P Waves: Absent P-R Interval: Absent QRS: Absent

Clinical Significance: Ventricular fibrillation is lethal with no cardiac output. Defibrillate with an initial unsynchronized dose of 360 joules monophasic or 120-200 joules biphasic. 1mg Ephinephrine 1:10,000 is the drug of choice given every 3-5 minutes.



# <u>Asystole</u>

Rhythm: None
Rate: None
P Waves: Absent
P-R Interval: Absent
QRS: Absent

Clinical Significance: Asystole is cardiac arrest with no electrical activity. Treat with high quality CPR and 1mg Epinephrine 1:10,000 given every 3-5 minutes. Try to correct underlying causes such as H's and T's.

# **Atrioventricular (AV) Heart Blocks**



## First-Degree AV Block

Rhythm: Regular (can be slightly irregular)

Rate: 90
P Waves: Normal

P-R Interval: 0.24 sec (normal range= 0.12-0.20), one P wave for each QRS

QRS: 0.04 sec (normal range= 0.04-0.12)

Clinical Significance: The prolonged P-R interval with one P wave for each QRS is the most identifiable sign to recognize first-degree AV block. Although first-degree block is not usually serious by itself, it can be a precursor to a more serious type of block. Usually treatment is not needed unless other serious signs or symptoms are evident.



### Second-Degree AV Block Mobitz Type I – Wenckebach

Rhythm: Ventricular rhythm is irregular; Atrial rhythm is Regular

Rate: 70 (typically normal or slow)

P Waves: Normal; Some are not followed by QRS complexes P-R Interval: Becomes progressively longer until QRS is dropped. QRS: 0.04 sec (usually within normal range= 0.04-0.12)

Clinical Significance: If beats are frequently dropped, cardiac output can be compromised. This can cause syncope and angina. Usually treatment is not needed immediately unless other serious signs or symptoms are evident. If symptomatic bradycardia occurs, then 0.5mg of Atropine should be administered IV. If atropine fails, transcutaneous pacing should be administered.



# Second-Degree AV Block Mobitz Type II

Rhythm: Ventricular rhythm is irregular; Atrial rhythm is Regular

Rate: 60 (typically bradycardic)

P Waves: Normal; Some are not followed by QRS complexes

P-R Interval: Constant for p-waves followed by a QRS

QRS: 0.04 sec (can be longer than normal range= 0.04-0.12)

Clinical Significance: Regular P-waves with a regular P-R interval and occasional dropped QRS complexes is the most identifiable characteristic of second-degree AV block type II. If beats are frequently dropped, cardiac output can be compromised. This can cause syncope and angina. Usually treatment is not needed immediately unless other serious signs or symptoms are evident. If symptomatic bradycardia occurs, then transcutaneous pacing should be the first choice. Atropine is more likely to be ineffective as it can accelerate the atrial rate but worsen the AV block in a second-degree type II block. Atropine may be used, but with caution.



### **Third-Degree AV Block**

Rhythm: Ventricular rhythm is regular; Atrial rhythm is regular

Rate: 60 (typically bradycardic)

P Waves: Normal: Some are hard to see and buried in QRS complexes

P-R Interval: Varies; disassociated from QRS

QRS: 0.16 sec (normal range is= 0.04-0.12)

Clinical Significance: A third degree block is an absence of conduction between the atria and the ventricles. There is a complete electrical block between the two and they pace the heart independent of each other. Cardiac output is severely compromised. If symptomatic bradycardia is present, then transcutaneous pacing should be the first choice. Atropine is more likely to be ineffective as it can accelerate the atrial rate but worsen the AV block in a third-degree block. Atropine may be used, but with caution.