Overview of Four ACLS Algorithm Protocols

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Objectives

- To review routes of administration for medications used in code blue emergencies
- To introduce several common ECG rhythms
- To familiarize the pharmacists with four ACLS algorithms
- To identify the most common drugs used by the ACLS algorithms

Routes of Medications

- IV Push
- Intravenous infusion
- Endotracheal

IV Push

- Route of most medications used
  - Convenient
  - Fast onset of action
  - Immediate bioavailability

Intravenous Infusion

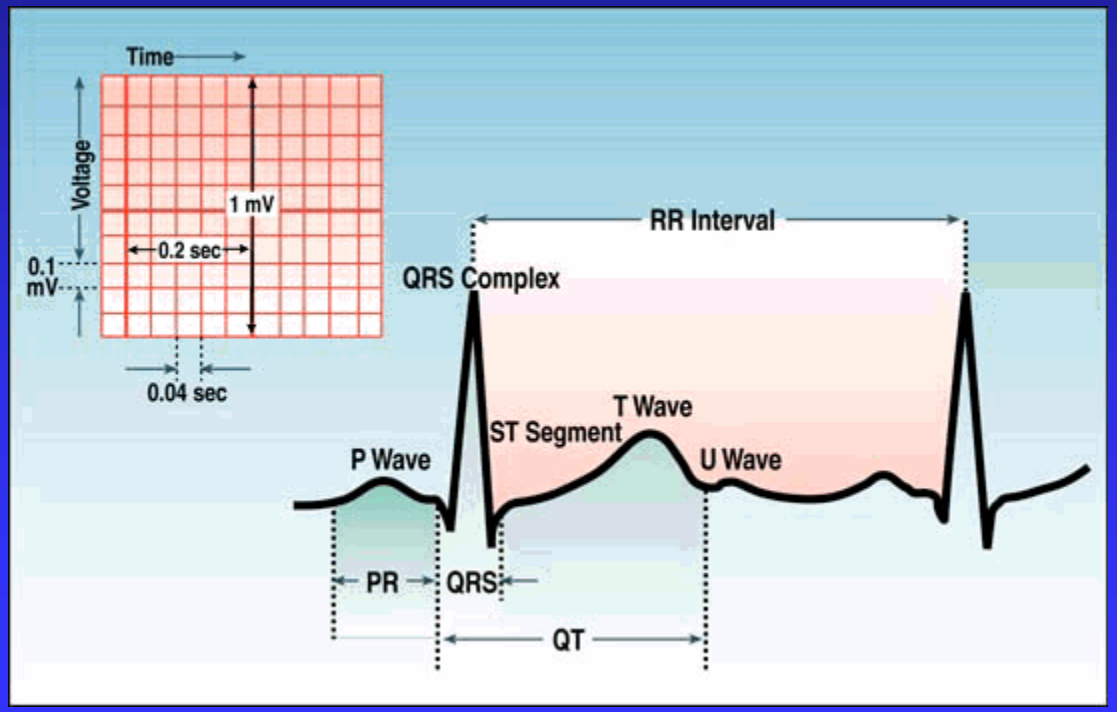
- Medications for continuous infusion only
  - P – procainamide
  - I – isoproterenol
  - N – norepinephrine
  - D – dopamine
- Medications given IV push or infusion
  - A – amiodarone
  - L – lidocaine
  - E – epinephrine

Endotracheal Administration

- Tracheal administration of medications
  - L – lidocaine (2-4 mg/kg)
  - E – epinephrine (2-2.5 mg)
  - A – atropine (2-3 mg)
  - N – naloxone (0.8-1.6 mg)
- Doses usually 2-2.5 times those given IVP
- Follow each dose with 10 ml NS flush down tracheal tube if not diluted to that volume for administration

ECG Rhythms

- Wave forms



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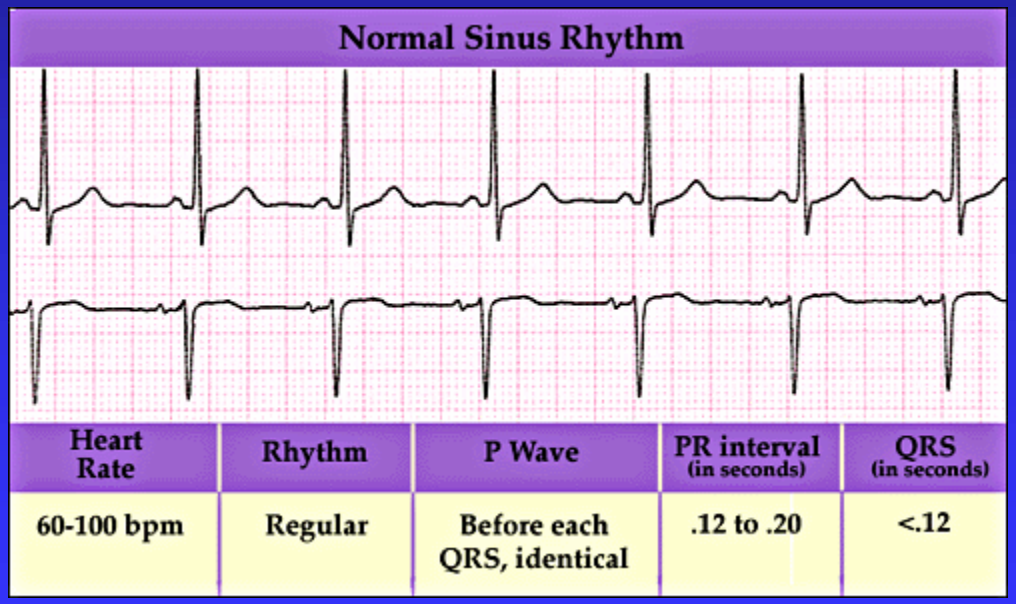
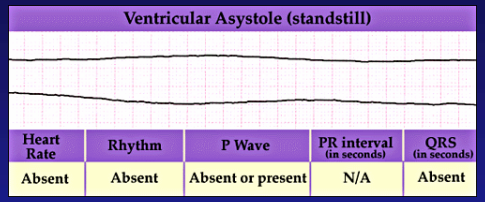
ECG Rhythms

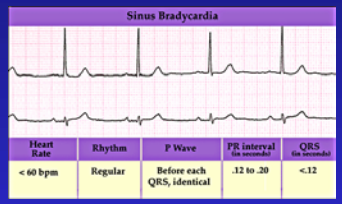
- Normal sinus rhythm

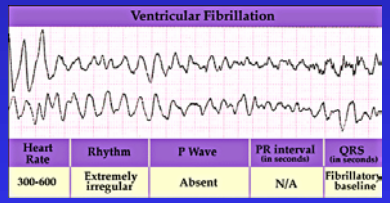


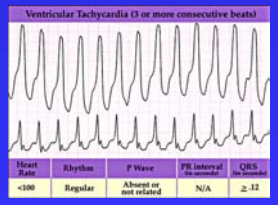
ECG Rhythms

- Asystole
- Bradycardia
- Ventricular fibrillation
- Ventricular tachycardia



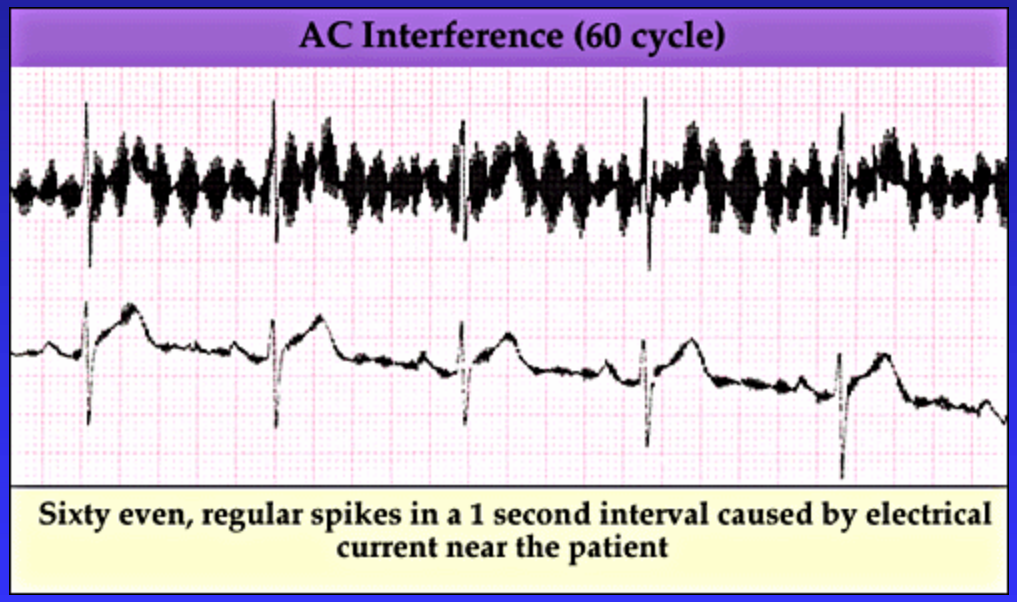






ECG Rhythms

- Artifact (waveform interference)



Use of Algorithms

- Meant to treat broadest range possible of patients
- Meant to be good memory aids
- Meant to be used “wisely,” not blindly
- Not meant to replace clinical judgment

Algorithms Found

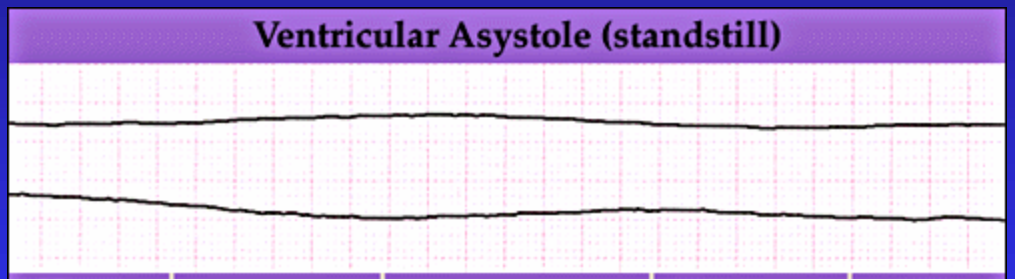
- American Heart Association
- Attached to each crash cart
- Included in DMC Tier 2 policy
- ACLS.net on the web

Asystole

- Asystole is a cardiac standstill, i.e., flatline
- Many asystole patients do not survive
- Asystole usually means the patient's life has ended
- Do not shock asystole

ECG Rhythms

- Ventricular asystole



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

Asystole Algorithm

- "Asystole….Check me in another lead, then let's have a cup of TEA."
  - T – transcutaneous pacing
  - E – epinephrine
  - A – atropine

Asystole Algorithm

Asystole

⇓

Primary ABCD

⇓

Secondary ABCD

⇓

Transcutaneous Pacing

⇓

Epinephrine

1mg IVP, repeat q 3-5 min

⇓

Atropine

1mg IVP, repeat q3-5 min
up to a total of 0.04mg/kg

Primary ABCD

- A - Airway – open the airway
- B - Breathing – provide ventilations
- C - Circulation – give chest compressions
- C - Confirm – true asystole
- D - Defibrillation – assess for VF/pulseless VT; shock if indicated

Secondary ABCD

- A - Airway
- B - Breathing
- B - Breathing
- B - Breathing
- C - Circulation
- C - Circulation
- C - Circulation
- C - Circulation
- C - Circulation
- D - Differential Diagnosis

Reversible Causes of Asystole

- 5 H's
  - Hypovolemia
  - Hypoxia
  - Hydrogen ion—acidosis
  - Hyperkalemia or hypokalemia
  - Hypothermia
- 5 T's
  - Tablets
  - Tamponade (cardiac)
  - Tension pneumothorax
  - Thrombosis (ACS)
  - Thrombosis (PE)

T = Transcutaneous Pacing

- Used to speed up a cardiac rhythm that is too slow
- If considered, start immediately
- To be effective, must be performed early and combined with drug therapy

Transcutaneous Pacing Apparatus

E = Epinephrine

- 1mg IVP every 3-5 minutes to cause
  - Vasoconstriction
  - Increased diastolic pressure
  - Increased blood flow to brain
  - Some blood flow to the coronary arteries

A = Atropine

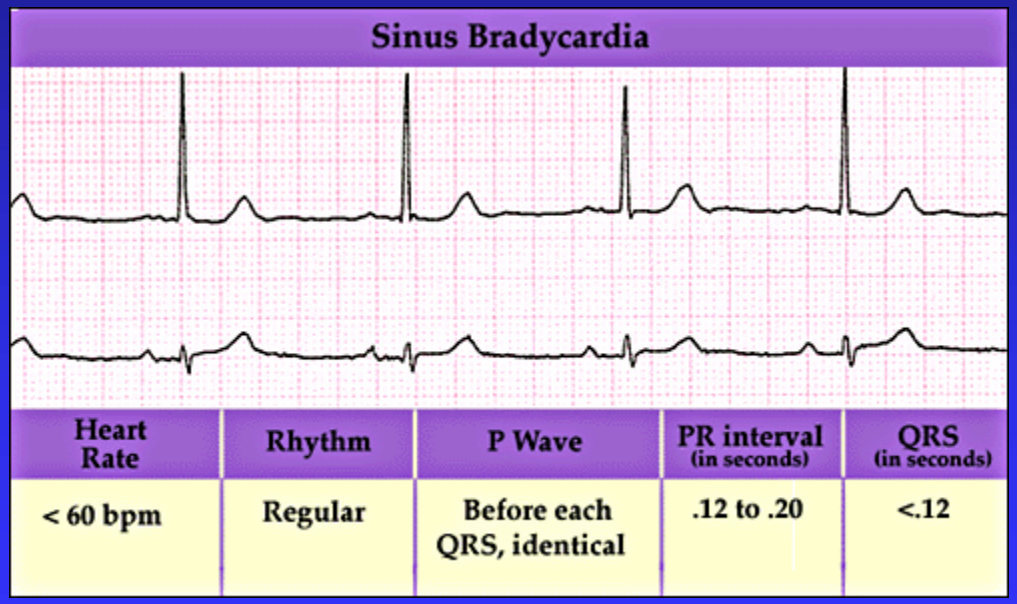
- 1mg IVP every 3-5 minutes up to a total of 0.04mg/kg
  - Excessive parasympathetic tone may play a role in stopping ventricular and supraventricular pacemaker activity
  - Avoid if lack of cardiac activity has a clear explanation such as hypothermia

Bradycardia

- Bradycardia is when the heart is < 60 beats/minute or when the heart rate is slower than expected
- Signs and symptoms might include:
  - Chest pain, shortness of breath
  - Hypotension, pulmonary edema, congestive heart failure

ECG Rhythms

- Sinus bradycardia



Bradycardia Algorithm

- All Trained Dogs Eat Iams”
  - A – atropine
  - T – transcutaneous pacing
  - D – dopamine
  - E – epinephrine
  - I – isoproterenol

Bradycardia Algorithm

Bradycardia

⇓

Primary ABCD Survey

⇓

Secondary ABCD Survey

⇓

Serious signs or symptoms due to bradycardia?

⇓

If yes: intervention sequence

- Atropine 0.5-1 mg
- Transcutaneous pacing if available
- Dopamine 5-20 mcg/kg/minute
- Epinephrine 2-10 mcg/minute
- Isoproterenol 2-10 mcg/minute

ABCD Surveys

- Primary Survey
  - Assess ABCs
  - Secure airway noninvasively
  - Ensure monitor/ defibrillator is available
- Secondary Survey
  - Assess secondary ABCs
  - Oxygen—IV access
  - Vital signs
  - 12 lead ECG
  - Portable CXR
  - Problem focused history & physical
  - Consider Causes

Bradycardia Doses

- Atropine: 0.5-1 mg IVP q3-5 minutes with maximum dose of 0.03-0.04 mg/kg
- TCP: use immediately with severely symptomatic patients
- Dopamine: 5-20 mcg/kg/min
- Epinephrine: 2-10 mcg/min
- Isoproterenol: 2-10 mcg/min

PEA Algorithm

- PEA is pulseless electrical activity
  - P – problem
  - E – epinephrine
  - A – atropine

PEA Algorithm

Pulseless Electrical Activity

⇓

Primary ABCD Survey

⇓

Secondary ABCD Survey

⇓

Review for most frequent causes

⇓

Epinephrine

1mg IVP, repeat q 3-5 min

⇓

Atropine

1mg IVP, repeat q3-5 min prn
up to a total of 0.04mg/kg

ABCD Surveys

- Primary Survey
  - A - Airway
  - B - Breathing
  - C - Circulation
  - D - Defibrillation
- Secondary Survey
  - A - Airway
  - B - Breathing x3
  - C - Circulation x4
  - D - Differential diagnosis

Most Frequent Causes of PEA

- 5 H's
  - Hypovolemia
  - Hypoxia
  - Hydrogen ion—acidosis
  - Hyperkalemia or hypokalemia
  - Hypothermia
- 5 T's
  - Tablets
  - Tamponade (cardiac)
  - Tension pneumothorax
  - Thrombosis (ACS)
  - Thrombosis (PE)

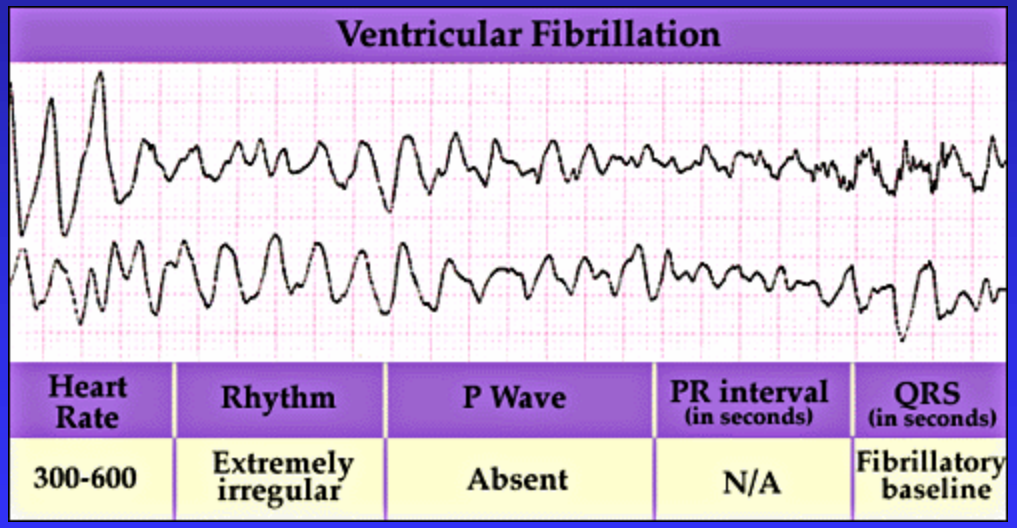
VF/PVT Algorithm

- Please Shock-Shock-Shock, EVerybody Shock, And Let's Make Patients Better

- VF – ventricular fibrillation
- PVT – pulseless ventricular tachycardia

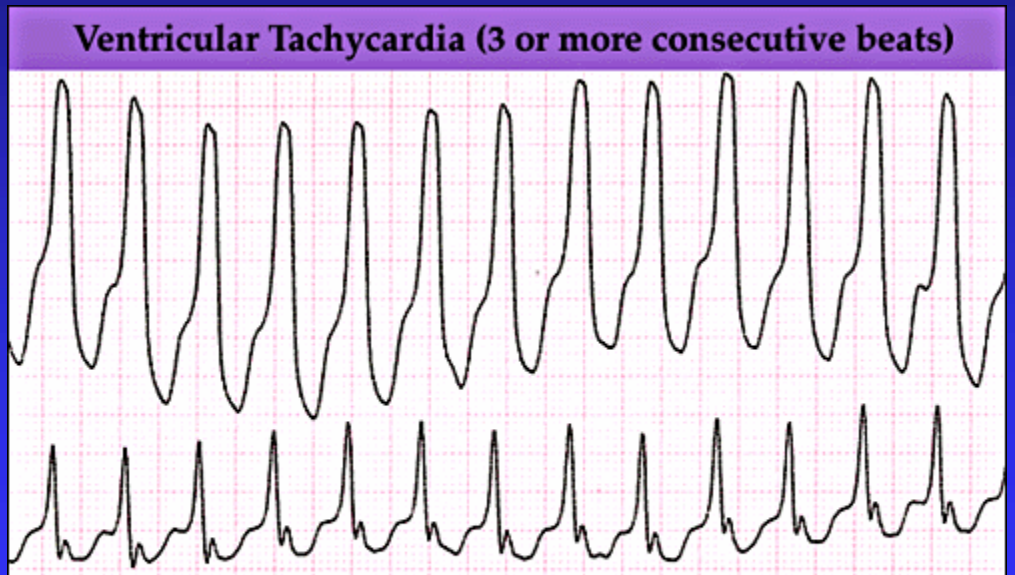
ECG Rhythms

- Ventricular fibrillation



ECG Rhythms

- Ventricular tachycardia



Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
<100	Regular	Absent or not related	N/A	≥ .12

VF/PVT Algorithm

Primary ABCD Survey

⇓

Rhythm after first 3 shocks?

⇓

Persistent or recurrent VF/PVT

⇓

Secondary ABCD Survey

⇓

VF/PVT Algorithm (continued)

Epinephrine

1mg IVP, repeat q3-5 min

Or

Vasopressin

40 Units IVP X1 only

⇓

Resume attempts to defibrillate (shock)

⇓

Consider antiarrhythmics

- Amiodarone
- Lidocaine
- Magnesium
- Procainamide

⇓

Resume attempts to defibrillate

Mnemonic

Please	Primary ABCD Survey: Airway, Breathing, Circulation, Defibrillation
Shock	200 Joules
Shock	200-300 Joules
Shock	360 Joules

Mnemonic

Implement secondary ABCD survey (A, Bx3, Cx3, D). Do not continue if an intervention results in return of spontaneous circulation	
Everybody	Epinephrine 1mg IVP q3-5 min, or
EVerybody	Vasopressin 40mg IVP X1
Shock	360 Joules

Mnemonic

And	Amiodarone	Cardiac arrest from VF or pulseless VT that persists after multiple shocks
Lets	Lidocaine	Cardiac arrest from VF or pulseless VT that persists after multiple shocks
Make	Magnesium	In torsades de pointes or when it is suspected that the arrhythmia is caused by a hypomagnesemic state
Patients	Procainamide	In patients who respond to shocks with intermittent return of a pulse of a non-VF rhythm, but then VF/VT recurrs
Better	Bicarbonate	In patients with known preexisting hyperkalemia or bicarb-responsive acidosis, TCA or ASA overdose, after a long arrest interval

Mnemonic Doses

And	Amiodarone	300mg IVP (diluted in 20-30 ml D_5W). May repeat once at 150 mg in 3-5 min. Maximum cumulative dose 2.2 gm over 24hrs IV
Lets	Lidocaine	1-1.5 mg/kg IVP. May repeat in 3-5 min. Maximum loading dose of 3 mg/kg.
Make	Magnesium	1-2 grams IVP (over 2 minutes) for suspected hypomagnesemia or torsades de pointes.
Patients	Procainamide	20 mg/min or 100mg IV q5 min for refractory VF. Maximum loading dose of 17 mg/kg.
Better	Bicarbonate	1 mEq/kg IVP

Take Away Points

- Cardiac arrest rhythms
  - VF/PVT
  - PEA
  - Asystole
- Most frequently used medications
  - Epinephrine: asystole, bradycardia, PEA, VF/PVT
  - Atropine: asystole, bradycardia, PEA

Take Away Points

- Medications IVPB only
  - Procainamide
  - Isoproterenol
  - Norepinephrine
  - Dopamine
- Medications IVP or IVPB
  - Amiodarone
  - Lidocaine
  - Epinephrine

Take Away Points

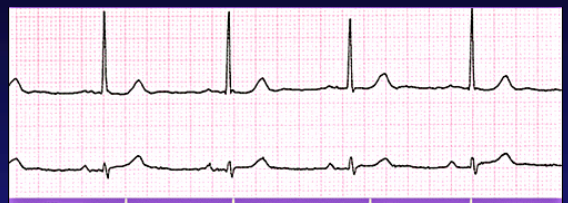
- Tracheal administration of medications
  - L – lidocaine
  - E – epinephrine
  - A – atropine
  - N – naloxone
- Doses usually 2-2.5 times those given IVP
- Follow each dose with 10 ml NS flush down tracheal tube if not diluted to that volume for administration

Take Away Points

- Asystole: TEA
- Bradycardia: All Trained Dogs Eat Iams
- PEA
- VF/pulseless VT: Please Shock, Shock, Shock, EVerybody, Shock and Lets Make Patients Better

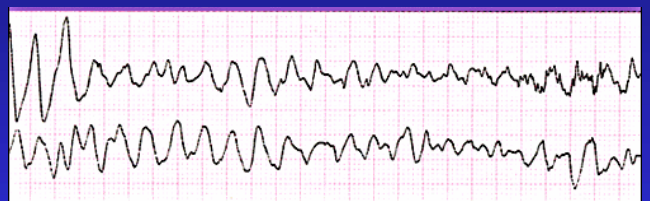
ECG Rhythms

C



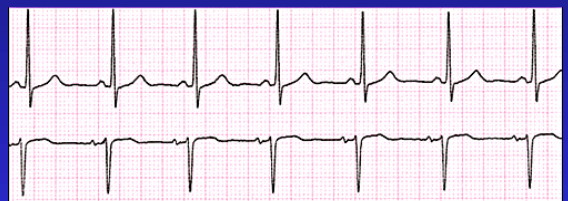
Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
< 60 bpm	Regular	Before each QRS, identical	.12 to .20	<.12

A



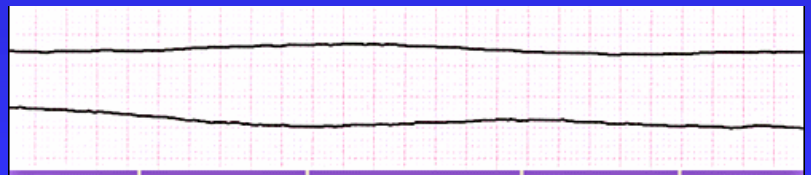
Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
300-600	Extremely irregular	Absent	N/A	Fibrillatory baseline

D



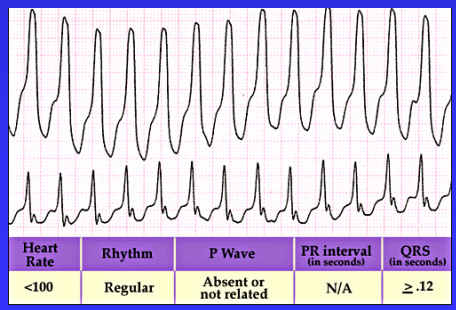
Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
60-100 bpm	Regular	Before each QRS, identical	.12 to .20	<.12

B



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

E



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