



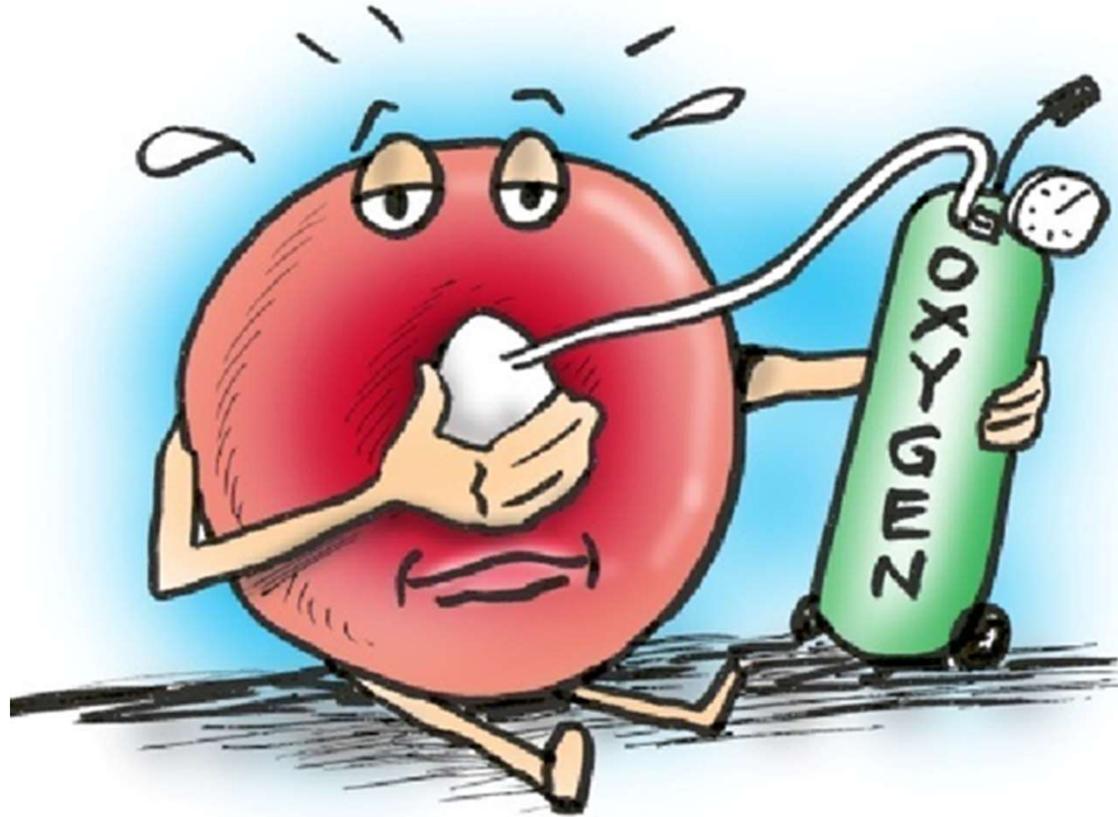
Here's
something to
think about.....



Moment-to-moment
sustenance of
human life depends
on a single external
substance

What is it?

OXYGEN



Its absence in the environment causes irreversible damage to the brain in approximately 6 minutes and death ultimately occurs.

Interesting Facts



- It is colorless, tasteless and odorless gas
- Plays a critical role in efficient cellular metabolism
- Not Flammable, supports combustion
- Constitutes 21% of atmospheric gases
 - Homeostasis is maintained at the 21% of oxygen in room, but if it drops, the metabolic rate is compromised
 - Hypoxemia
- $\frac{1}{3}$ of all patients in acute care settings receive O₂ therapy
 - Maintain adequate tissue oxygenation to decrease cardiopulmonary work
- Remember Pulse Oximeter Readout should be 95%-100%

Oxygen Therapy

- Primary clinical indications:
 - Hypoxemia, tissue hypoxia,
 - Tissue Hypoxia – inadequate amount of O₂ at the cellular (tissue) level
 - Most sensitive tissues: brain, heart, lungs, and liver
 - Alters homeostasis due to metabolic rate being compromised
 - To compensate for this, the patient feels short of breath and has to work harder to breathe this is the body's adaptive response to maintain homeostasis



Did you know Oxygen is a DRUG?

- Listed in the *U.S. Pharmacopeia*
- Defined as a drug in the Federal Food, Drug, and Cosmetic Act of 1962
- Has both good and bad biologic effects
- **PHYSICIAN MUST PRESCRIBE**
 - Ordered in:
 - Liters per minute (LPM)
 - Concentration
 - Percentage such as 24%
 - Fractional concentration of oxygen (F_{iO_2}) such as 0.24
 - Once desired dosage maintained, the patient's response is continually monitored



Oxygen Devices

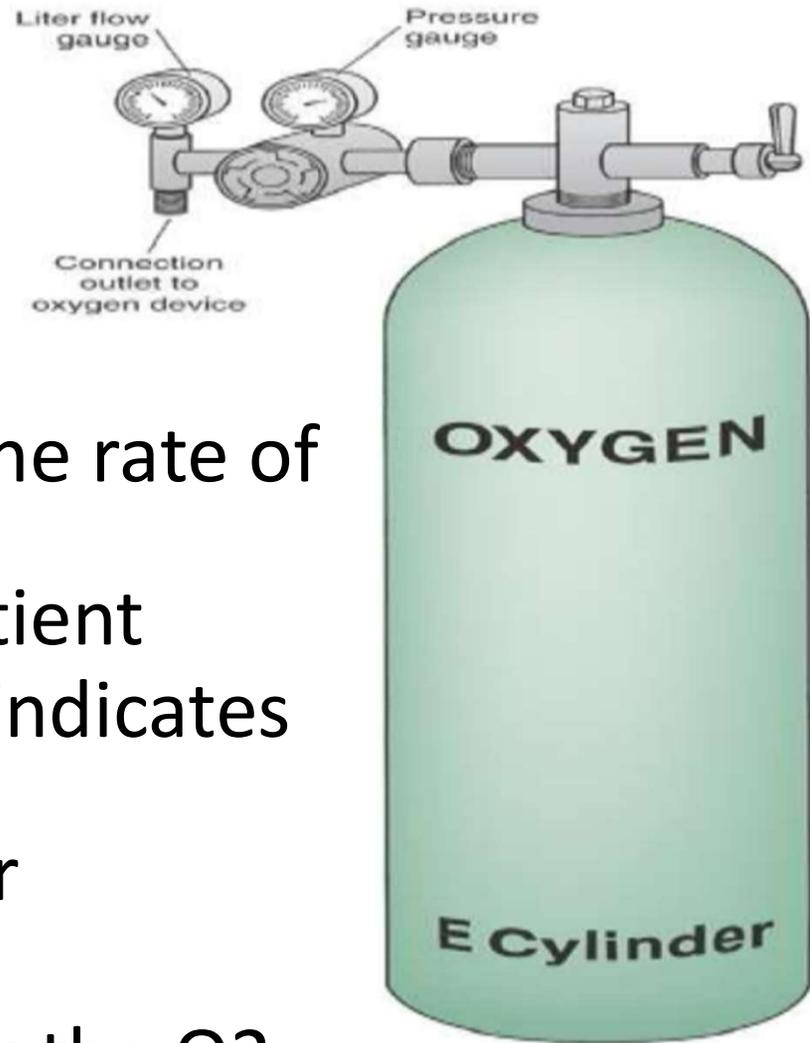


- Radiologic Technologist facts to remember in clinical:
 - There are a lot of devices but they should not hinder your x-ray
 - Watch out for tubing it can show up on images – reposition it
 - If you need to move the O₂, make sure tubing is not kinked or disconnected
 - When the patient arrives to the Department they should be connected to the wall oxygen
 - UNDER NO CIRCUMSTANCES SHOULD O₂ BE COMPLETELY REMOVED TO TAKE A X-RAY, unless there is consent or supervision of a physician, respiratory care practitioner or attending nurse

Oxygen Delivery Devices

- Designed to operate at a certain liters per minute (LPM) value
- Oxygen flowmeter – reducing valve that permits flows (LPM) safe for patient use
 - Its green (or has a label) and has the word OXYGEN on it
 - Attached to the wall outlet





- Portable systems
 - Flowmeter – operates the rate of O₂ flow in liters per minute (LPM) to the patient
 - Pressure manometer – indicates pressure or volume of O₂ inside the canister
- Prior to transport, check the O₂ system to ensure adequate O₂ is available

Oxygen Delivery Devices

- Low-flow (variable –oxygen concentration)
 - Amount of inhaled O₂ varies with patient respirations
 - More concentrated with short, shallow breaths
- High-flow (fixed or precise oxygen concentration)
 - Meets or exceeds oxygen needs of patient
 - Oxygen concentration remains consistent with each breath
 - Flow meter should not be adjusted with different breathing patterns

Refer to Table 15-2 on pg 178 to see a summary of Oxygen Devices and the LPM and FiO₂.



Low Flow Devices



- Nasal Cannula

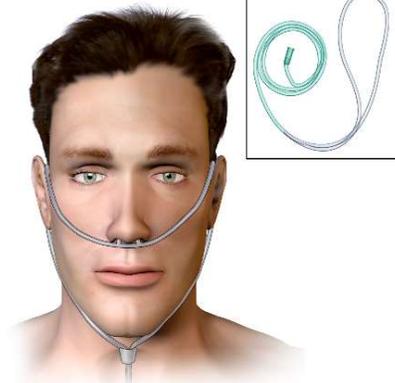
- Short prongs inserted into the nares
- Usual rates 1-4 LPM
- Delivers 24%-36% O₂
- Talking, eating and sleeping are not hindered



- Masks

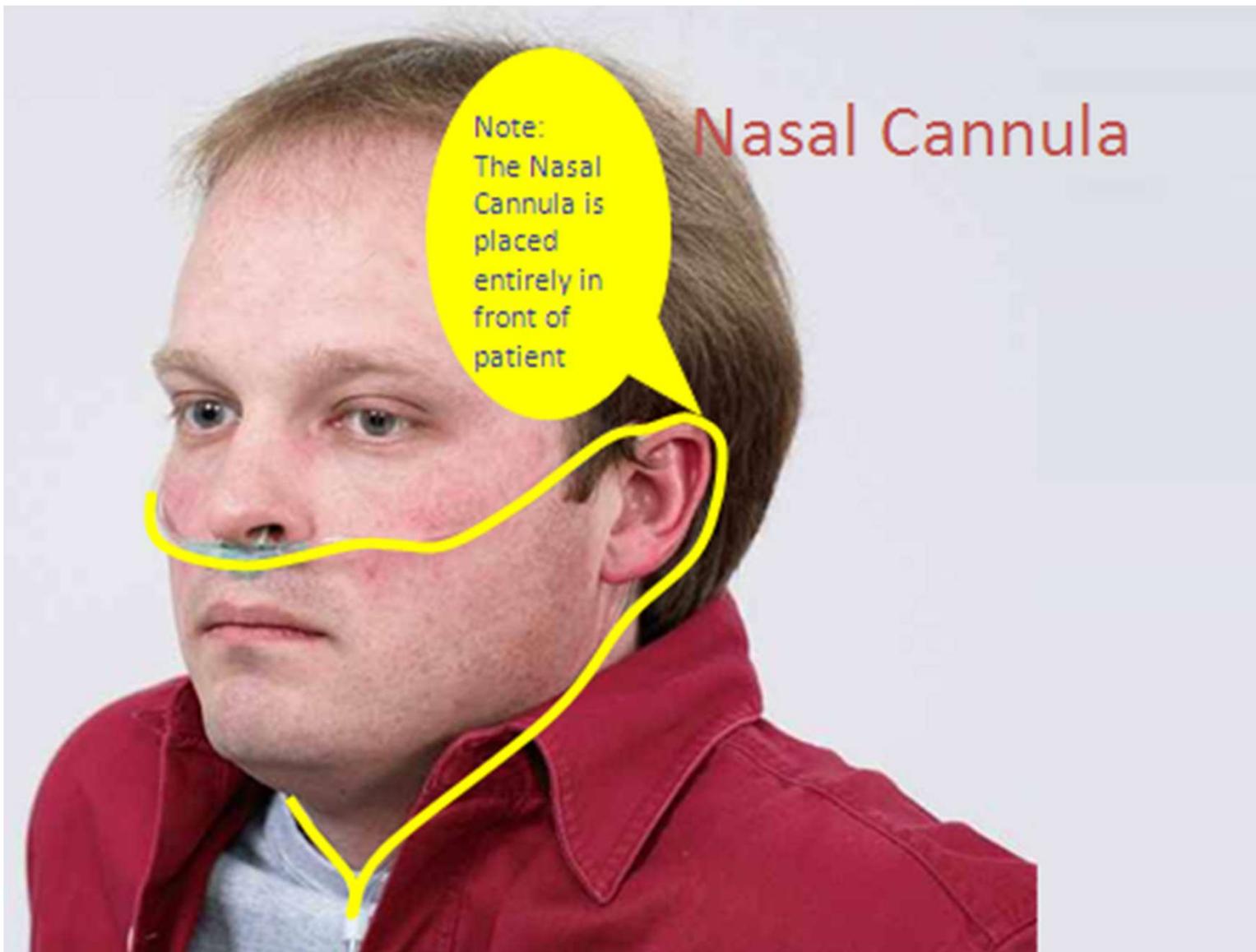
- Simple, nonrebreathing, partial rebreathing
- Masks deliver more accurate concentrations of oxygen than cannula
- Drawbacks
 - Hot
 - Stick to face
 - Need to be removed to eat
 - Muffle speech
 - Don't fit well
 - Masks may fall off while patient sleeps
 - Increase risk of aspiration

Nasal Cannula



Nasal Cannula

Note:
The Nasal Cannula is placed entirely in front of patient



- Simple oxygen masks require rate $> 6\text{LPM}$ to prevent carbon dioxide buildup
 - Provide 35-50% oxygen
- Nonrebreathing mask delivers higher percentage of oxygen than a simple mask
 - Attached bag called a reservoir
 - Filled with oxygen—must stay inflated!
 - Contains one-way valve at top which prevents exhaled air from being rebreathed
 - Delivers 60-80% oxygen
 - Adjust flow rate to keep reservoir from collapsing completely when victim inhales





High-Flow



- Nebulizer
 - Aerosol mist with precise O₂ concentrations
 - Can be used via corrugated tubing to aerosol face mask, tracheostomy mask or collar, or T-piece endotracheal tubes
 - At least 8 LPM (28%-100%)
 - Filled with 0.45 saline, 0.9 normal saline, or sterile water
 - CAUTION: The mist condensates in the tubing, careful when moving patient

- Can be used to administer medications also

High-Flow



- Air-entrainment
 - Propels high velocity of oxygen into mask through narrow opening
 - Room air also drawn into mask
 - Provides consistent concentrations of O₂
 - O₂ values of 24%, 28%, 35%, 40% and 50%



Other Oxygen Delivering Devices

- Tent and Oxyhood
 - Used for pediatrics for O₂ therapy or additional humidity
 - Tent – difficult controlling O₂ concentrations (opening and closing)
 - O₂ supports combustion, make sure our x-ray equipment is functioning properly
 - Oxyhood – used on infants, box that fits over infant's head
 - O₂ concentrations of 21-100%



- Ventilator
 - Artificial airway due to a patient being unable to supply adequate O₂ to tissues
 - Delivers a minimum set respiratory rate, preset inspiratory volume, and consistent FiO₂
 - X-ray used to determine whether airway is in the proper place
 - DO NOT DISLodge AIRWAY when positioning patient
 - CAUTION: moisture collects in tubing and could be passed into patients lungs
 - DO NOT: flex or extend neck could adversely influence the airway placement
 - DO NOT: silence alarms or alter them
- Watch for rise and fall of the chest for inspiration and expiration

Endotracheal tube goes through patient's mouth and into the windpipe

Nasogastric tube goes through patient's nose and into the stomach

Mechanical ventilator blows air, or air with increased oxygen, through tubes into the patient's airways

Nurse periodically checks the patient.

Air flowing to the patient passes through a humidifier, which warms and moistens the air

Exhaled air flowing away from the patient





Oxygen Safety

- <http://www.youtube.com/watch?v=ejEJGNLTo84>
(mythbusters)
- <http://www.youtube.com/watch?v=7g5UVrOt2CI> (MRI)
- <http://www.youtube.com/watch?v=IEJ2notNLo0> (MRI)



- Oxygen tanks cannot be stored within 5 feet of an electrical outlet
- Tanks must be secured on a rack or portable carrier
- Dropping or cracking tank can be dangerous
 - Cause regulator to act as a dangerous projectile
- Holding racks in storage area must be labeled as “FULL” or “EMPTY”
- A cylinder with less than 1000 psi (pounds per square inch) may not be used for transport
- Never take regular Oxygen tank into MRI

Some information obtained from Medline Plus, Mayo Clinic

*NORMAL
RANGES OF
LAB DATA*



Blood Urea Nitrogen (BUN)

- Reveals important information about how well your kidneys and liver are working
- Healthy kidneys take urea out of the blood and put it in the urine.
- If a person's kidneys are not working well, the urea will stay in the blood.

NORMAL: Adult: 10-20 mg/dL

- Elderly: slightly higher than adult
- Infant & Infant: 5-18 mg/dL
- Newborn: 3-12 mg/dL

Creatinine

- Chemical waste product that's produced by your muscle metabolism and to a smaller extent by eating meat
- A high serum (blood) creatinine level indicates kidney damage.

NORMAL : Adult: 0.6-1.2 mg/dL

CRITICAL VALUE: > 4 mg/dL but any increase will be investigated prior to providing contrast medium.

Other normal values:

- Elderly: not reliable due to less muscle
- Infant: 0.2-0.4 mg/dL
- Child: 0.3-0.7 mg/dL

Glomerular Filtration Rate (GFR)

<http://www.nephron.com/>

- Test used to check how well the kidneys are working
- Estimates how much blood passes through the tiny filters in the kidneys, called glomeruli, each minute

NORMAL: 90-120 mL/min.

< 60 mL/min. indicated chronic kidney disease

- GFR is the milliliters of kidney filtrate per minute
- GFR is the best indicator of renal function because it is determined by a mathematical computation
- GFR is used to stage renal disease - A GFR less than 15 is kidney failure

Hemoglobin

- A protein in red blood cells that carries oxygen
- Normal results vary, but in general are:
 - Male: 13.8 to 17.2 gm/dL
 - Female: 12.1 to 15.1 gm/dL
 - gm/dL = grams per deciliter



Red Blood Cells

- Blood test that tells how many red blood cells (RBCs) you have
- NORMAL:
 - Male: 4.7 to 6.1 million cells per microliter (cells/mcL)
 - Female: 4.2 to 5.4 million cells/mcL
- Child: different normal levels

Platelets

- Test to measure how many platelets you have in your blood.
- Platelets help the blood clot.
- They are smaller than red or white blood cells.
- 150,000 - 400,000 platelets per microliter (mcL).

Oxygen Saturation

- Oxygen is bound to special molecules on red blood cells called hemoglobin, which let it travel in the blood to the tissues that need it.
- Arterial blood gas test, involves inserting a needle into an artery, most often one in your wrist
- Arterial Lines can be placed and used to measure O₂ saturation
- When a blood cell is carrying a normal load of oxygen, it is said to be "saturated." Optimally, 95 to 100 percent of your blood cells are saturated with oxygen
- Hypoxemia occurs if too low

Prothrombin

- Test measures how quickly your blood clots
- The normal range for someone who is not taking a blood thinner medication is 11 - 13.5 seconds

Partial Thromboplastin Time

- Blood test that looks at how long it takes for blood to clot. It can help tell if you have bleeding or clotting problems
- In general, clotting should occur between 25 - 35 seconds. If the person is taking blood thinners, clotting takes up to two and a half times longer.

*Why are
we
concerned
with these
lab values?*

Contrast-Induced Nephropathy

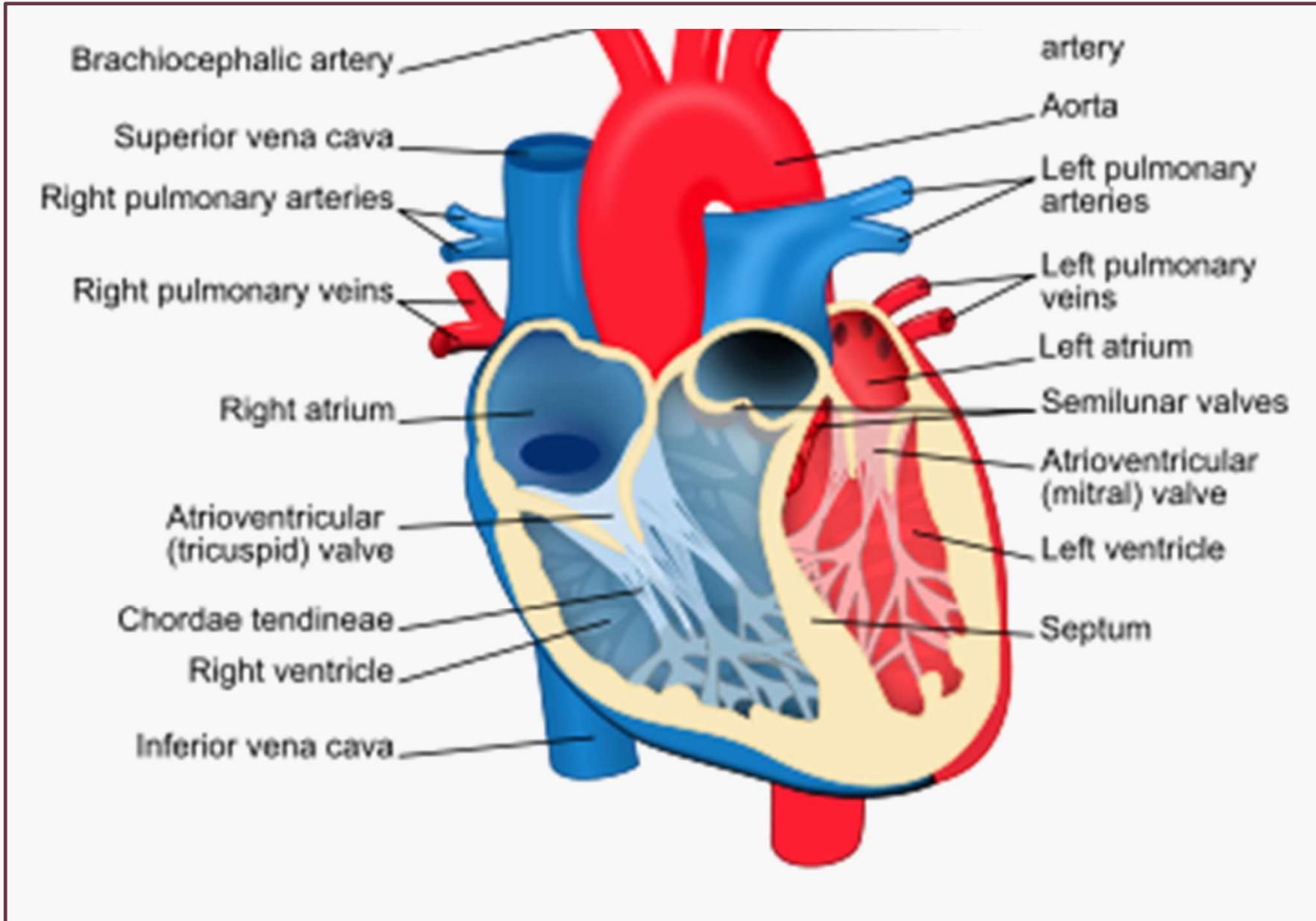
- Patients with impaired kidney (renal) function should be given special consideration before receiving iodine-based contrast materials by vein or artery.
- Such patients are at risk for developing contrast-induced nephropathy, in which the pre-existing kidney damage is worsened.

- How efficiently the kidneys filter blood.
- Early kidney disease may not show symptoms.
- National Kidney Foundation recommends simple tests to screen for kidney disease:
 - A blood pressure measurement
 - A spot check for protein or albumin in the urine, and a
 - Calculation of glomerular filtration rate (GFR) based on a serum creatinine measurement.
 - Measuring urea nitrogen (BUN) in the blood provides additional information.

Kidney (Renal) Function



BASIC CARDIAC MONITORING



CARDIAC OUTPUT



- Vital event necessary to maintain blood flow throughout the cardiovascular system
- To accomplish, a person needs
 1. Adequate blood volume
 2. A regular cycle of muscular relaxation and contraction
- Assessment by an electrocardiogram (EKG or ECG)

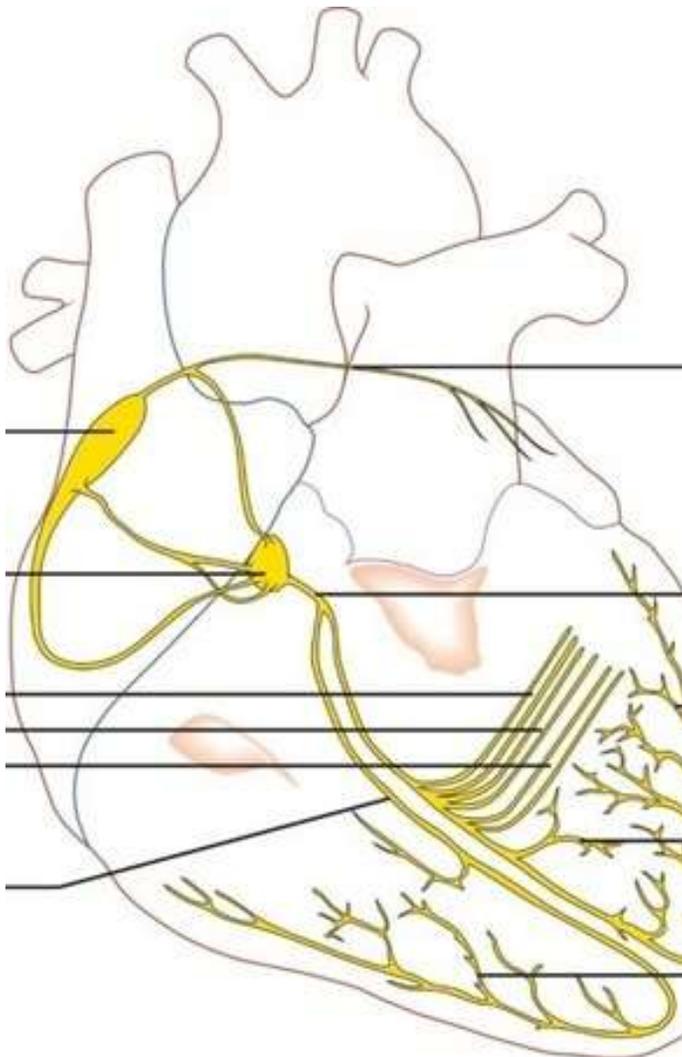
PRINCIPLES OF CARDIAC FUNCTION

To pump blood through vessels to vital organs and tissues

- Systolic– when heart pumps blood
- Diastolic – when ventricles fill with blood during rest
- Assessed by stethoscope and sphygmomanometer

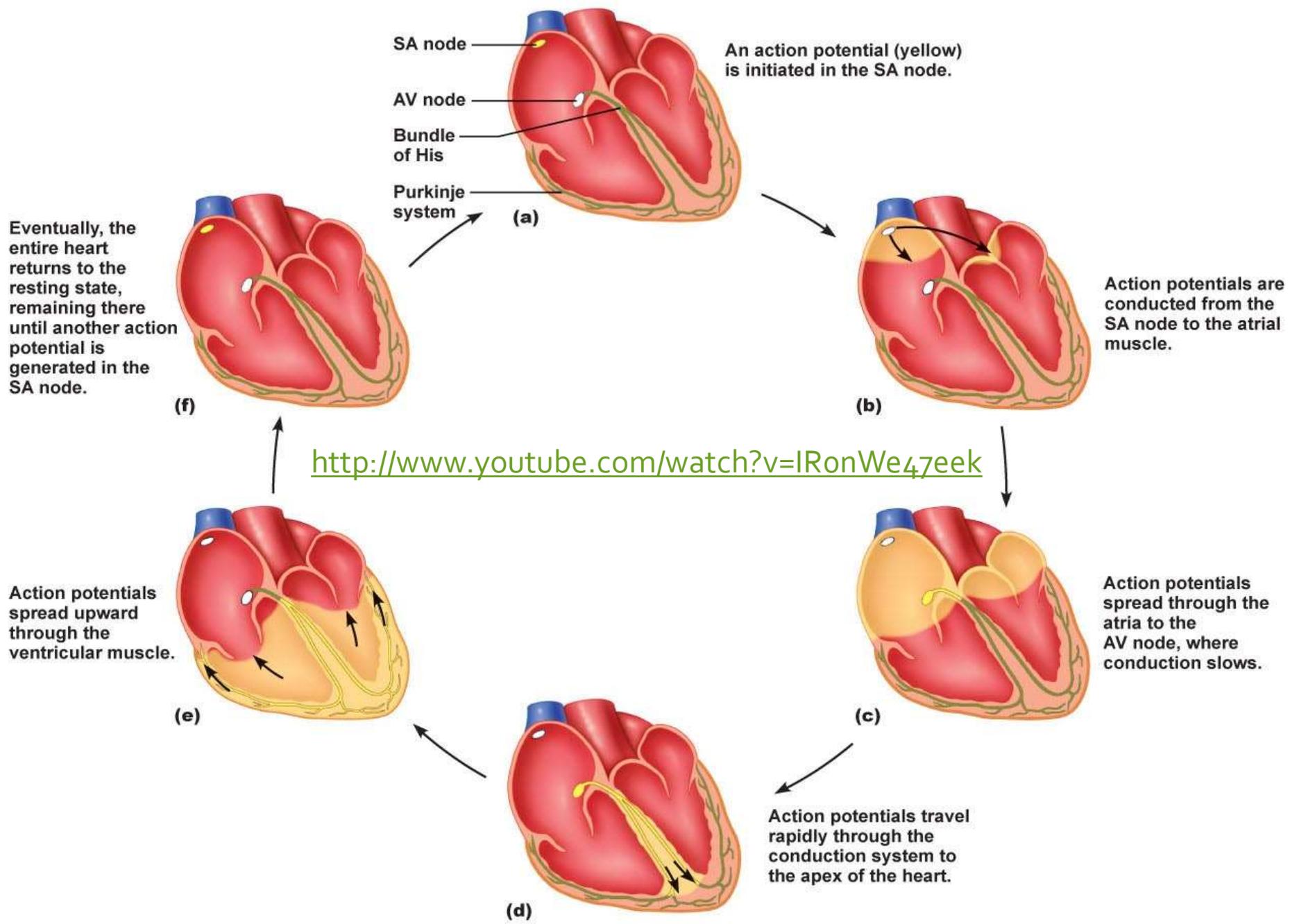


CARDIAC CYCLE – EVENTS THAT OCCUR FROM THE BEGINNING OF ONE VENTRICULAR CONTRACTION (SYSTOLE) UNTIL THE BEGINNING OF ANOTHER



Heart composed of 2 principal cell types:

- Working cardiac cells
 - Myocardium of aorta and atria and ventricles
- Specialized neural conductive cells
 - (Transmit electrical pulses across the myocardium and regulate the rhythm of a cardiac cycle)
 - Sinoatrial (SA) node (pacemaker)
 - AV node (atrioventricular)
 - Bundle of His
 - Purkinje fibers
- Abnormalities within the neural conduction system are called arrhythmias or dysrhythmias



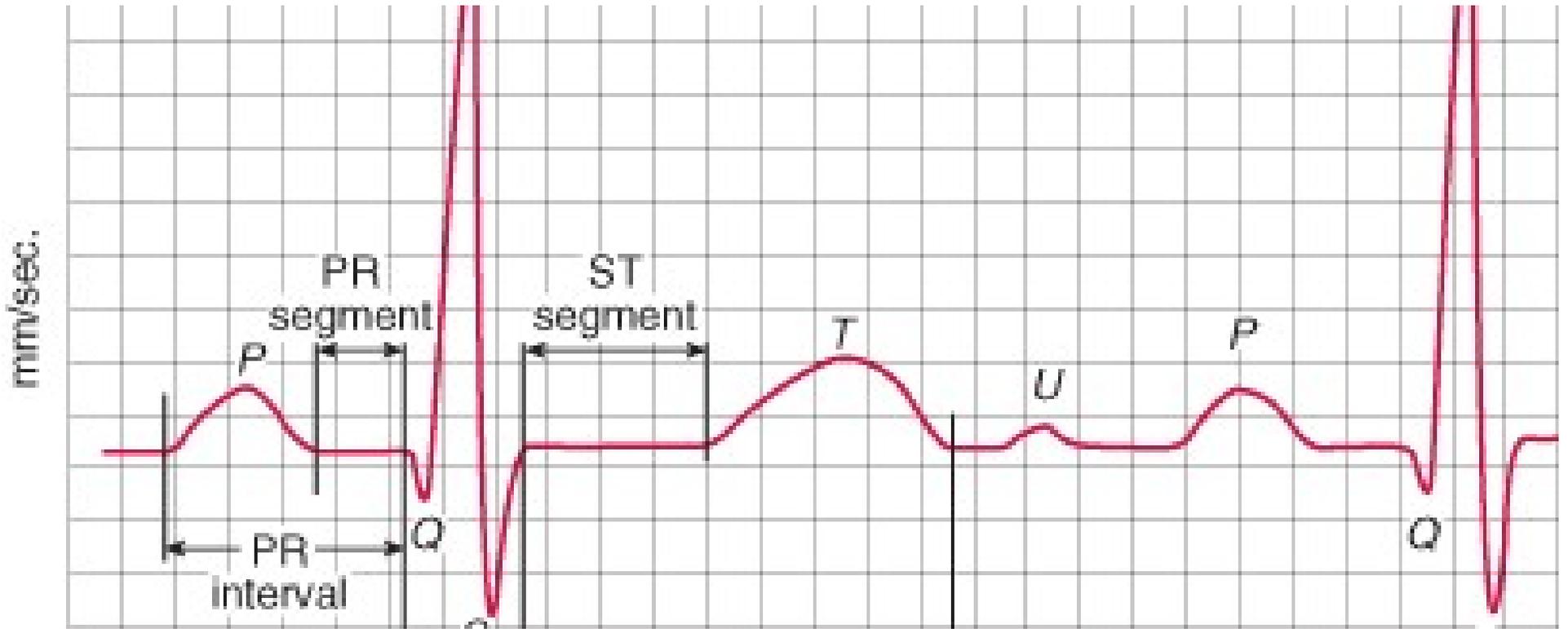
<http://www.youtube.com/watch?v=IRonWe47eek>

Electrocardiograph Tracing

[HTTPS://WWW.YOUTUBE.COM/WATCH?V=RYZ4DAFWMA8](https://www.youtube.com/watch?v=RYZ4DAFWMA8)

[HTTP://WWW.YOUTUBE.COM/WATCH?V=ITHFLVVMFII](http://www.youtube.com/watch?v=ITHFLVVMFII)





ELECTROCARDIOGRAPH TRACING



NORMAL SINUS RHYTHM

See page 191 for another example

- Rhythm - Regular
- Rate - (60-100 bpm)
- QRS Duration - Normal
- P Wave - Visible before each QRS complex
- P-R Interval - Normal (<5 small Squares. Anything above and this would be 1st degree block)
- Indicates that the electrical signal is generated by the sinus node and travelling in a normal fashion in the heart.



SINUS BRADYCARDIA

See page 191 for another example

- Rhythm - Regular
- Rate - less than 60 beats per minute
- QRS Duration - Normal
- P Wave - Visible before each QRS complex
- P-R Interval - Normal
- Usually benign and often caused by patients on beta blockers



SINUS TACHYCARDIA

See page 191 for another example

- Rhythm - Regular
- Rate - More than 100 beats per minute
- QRS Duration - Normal
- P Wave - Visible before each QRS complex
- P-R Interval - Normal
- The impulse generating the heart beats are normal, but they are occurring at a faster pace than normal. Seen during exercise



VENTRICULAR FIBRILLATION (VF OR V-FIB) ABNORMAL

See page 192 for another example

- Rhythm - Irregular
- Rate - 300+, disorganized
- QRS Duration - Not recognizable
- P Wave - Not seen
- This patient needs to be defibrillated!! QUICKLY



ASYSTOLE

ABNORMAL

See page 192 for another example

- Rhythm - Absent
- Rate - 0
- QRS Duration - Absent
- P Wave - Absent
- This patient needs to be defibrillated!! QUICKLY

