



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

Unit 2 – Part 2

1

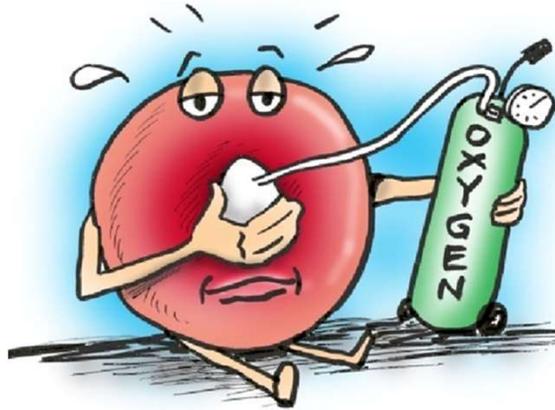


Moment-to-moment sustenance of human life depends on a single external substance

What is it?

2

OXYGEN



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

3

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%

4

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



5

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 (FiO₂) such as 0.24
 - Once desired dosage maintained, the patient's response is continually monitored



6

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 AN X-RAY, unless there is consent or supervision of a physician, respiratory care practitioner or attending nurse

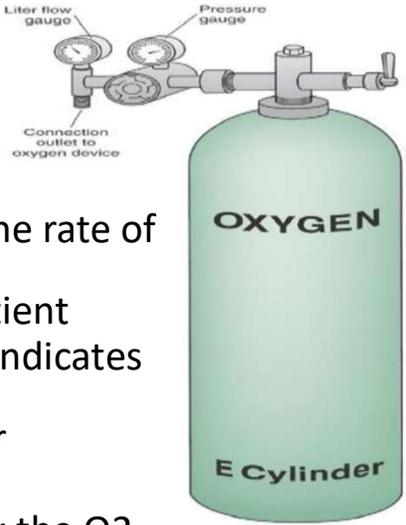
7



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

8



- 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

9

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.



10



Low Flow Devices

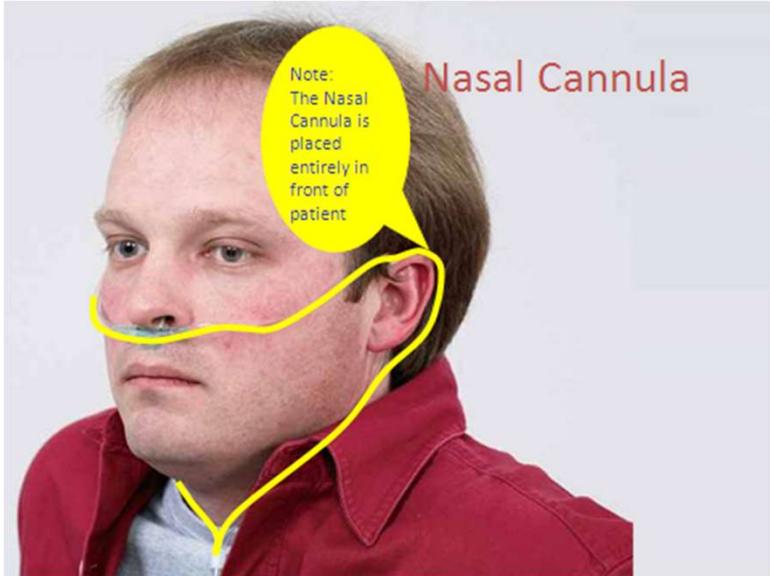
- Nasal Cannula
 - Short prongs inserted into the nares
 - Usual rates 1-4 LPM
 - Delivers 24%-36% O₂
 - Talking, eating and sleeping are not hindered
- Masks
 - Simple, nonrebreathing, partial rebreathing
 - Masks deliver more accurate concentrations of oxygen than cannula
 - Drawbacks
 - Hot
 - Stick 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

11



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

Nasal Cannula

12

- 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



13

High-Flow



- Nebulizer
 - Aerosol mist with precise O_2 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

14

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%

15



Other Oxygen Delivering Devices

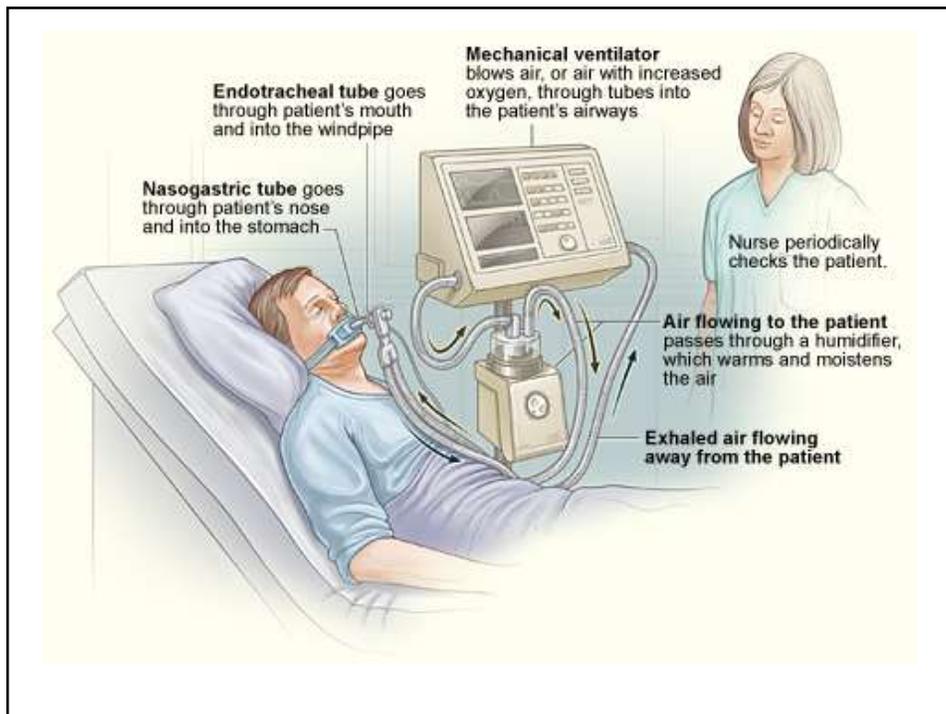
- Tent and Oxyhood
 - Used for pediatrics for O₂ therapy or additional humidity
 - Tent – difficult controlling O₂ concentrations (opening and closing)
 - O₂ supports combustion, make sure our x-ray equipment is functioning properly
 - Oxyhood – used on infants, box that fits over infant's head
 - O₂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

16



- 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

17



18



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)

19



- 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

20

Some information obtained from Medline Plus, Mayo Clinic

NORMAL RANGES OF LAB DATA

21



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

22

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

23

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

24

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

25



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

26

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).

27

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

28

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

29

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.

30

Contrast-Induced Nephropathy

Why are we concerned with these lab values?

- 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.

31

- 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

32



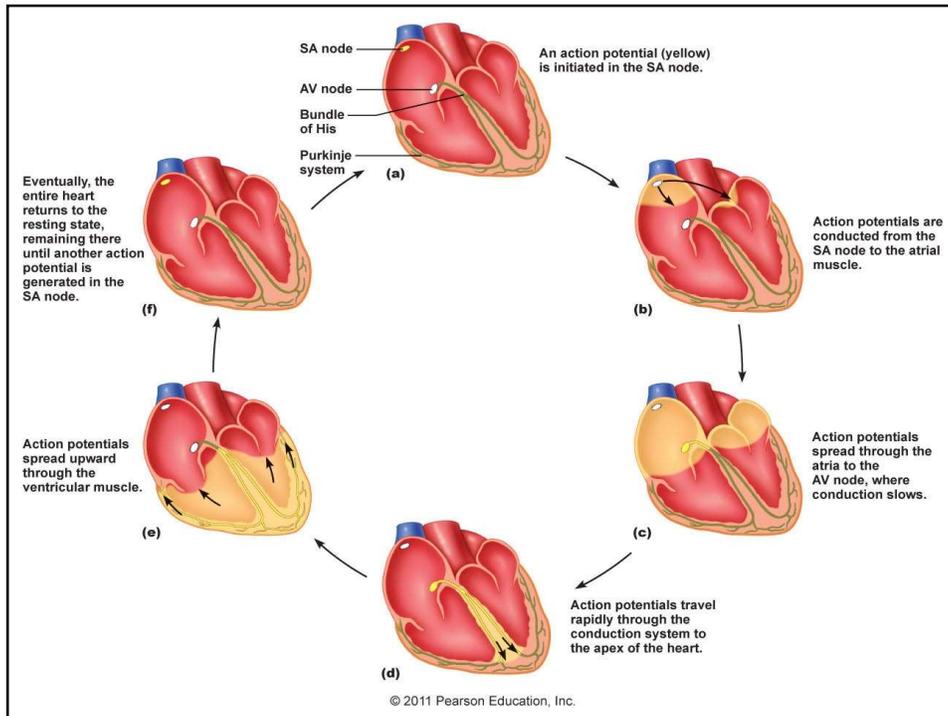
BASIC CARDIAC MONITORING

33

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)

34



35

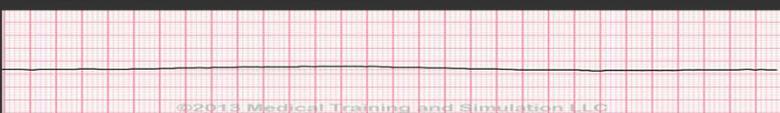
WHICH ONES OF DOES NOT LOOK NORMAL?

A.


B.


C.


D.


E.


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36