OMSA Study Guide ~ updated July 10, 2020

Cardiovascular System

1. Know the anatomy of the heart and the blood flow through the heart.
The heart is composed of 4 chambers. The upper chambers are called atria (singular is atrium) and the lower chambers are called ventricles. So, there are right and left atria and right and left ventricles. In between these chambers are valves. The mitral valve is in between the left atrium and the left ventricle. The tricuspid valve is between the right atrium and the right ventricle. There are valves in the major blood vessels involved in blood flow through the heart: the aorta (aortic valve) and the pulmonary artery (pulmonic valve). Blood flows from the veins of the body through the superior and inferior vena cava into the right atrium. It goes through the tricuspid valve into the right ventricle. From there it gets pumped through the pulmonary artery to the lungs where it gets oxygenated. It now returns freshly oxygenated through the pulmonary vein into the left atrium. It then goes through the mitral valve into the left ventricle. From there, it goes through the aortic valve into the aorta to be pumped to the rest of the body. The heart sounds as you listen through the stethoscope sound like “lub-dub”. The first heart sound is “lub” and this is the mitral and tricuspid valves closing. The second heart sound is the “dub” and is caused by the aortic and pulmonic valves closing.

2. Understand the difference between angina pectoris and myocardial infarction.
Chest pain and heart attacks originate from lack of blood flow in the coronary arteries. These are arteries that arise from the aorta and supply and nourish the heart muscle itself**.** Angina pectoris is another name for chest pain of cardiac origin. It happens because of ischemia, or lack of oxygen, to the heart muscle. This, however, may be a reversible event, so if you restore the blood flow and oxygen to the heart muscle, the pain will go away. This is how nitroglycerin works. It dilates the coronary arteries and increases blood to the heart muscle. When the heart muscle is deprived of oxygen too long, that portion of the heart muscle dies. The event now becomes a myocardial infarction, which means that there is necrosis (death) of the heart muscle.

3. Know the risk factors for cardiovascular disease.
Patients that have the following medical issues are predisposed to an increased risk for cardiovascular disease. Smokers, hypercholesterolemia (high cholesterol), familial history of heart disease, diabetes, obesity, a sedentary lifestyle, hypertension (high blood pressure), advancing age, a history of a prior MI, congestive heart failure (CHF), heart valve dysfunctions and dysrhythmias.

4. Know signs and symptoms of a myocardial infarction.
Chest pain not relieved by nitroglycerin is a strong indicator that the patient is suffering from a myocardial infarction. This pain may radiate down the left arm or up to the left jaw. If it continues, the patient’s blood pressure will drop and they will have a very weak and thready pulse. They may also experience nausea and vomiting.

5. Know how to treat a patient who you suspect is having an MI.
Remember to call 911 and remember the mnemonic MONA: morphine, oxygen, nitrates (nitroglycerin) and aspirin. Put monitors on the patient. If possible, start an IV as soon as possible for administration of drugs.

6. Know signs and symptoms of congestive heart failure and how to treat it.
Congestive heart failure (commonly called CHF) is pump failure. The heart cannot pump blood in a forward direction, so things back up. Where? Depends on which side of the heart is failing. Right sided heart failure results in excess blood and fluid backing up systemically (to the rest of the body). So, the patient will demonstrate swelling to the ankles, ascities (swelling in the belly), distended neck veins. Left sided heart failure results in fluid backing up in the lungs, so the patient coughs pink frothy sputum, gets short of breath when they lie down (orthopnea) and often wakes up in the middle of the night gasping for air (paryoxysmal nocturnal dyspnea). Treatment of CHF usually involves diuretics (water pill) so the patient pees out the excess volume.

7. Know how we monitor the cardiovascular system.
We monitor the status of the cardiovascular system using the patient's pulse rate (how many times it beats in one minute), the patient's blood pressure and the EKG. The common areas to take a pulse are the radial, brachial and carotid pulses.

8. Know how to take a manual blood pressure
When we take a blood pressure reading manually, we wrap the cuff around the upper arm. There are different cuff sizes for different arm sizes. The cuff width should be greater than 1/3 the circumference of the arm. Taking the blood pressure with the incorrectly sized cuff may result in an erroneous reading. For example, taking the blood pressure reading with a cuff that is too small may lead to an artificially high reading. The cuff is pumped up, thus occluding the brachial artery. We listen for the pulse over the artery as we release the pressure from the cuff. The measurement at the first sound is labeled systolic pressure. It represents the force of ventricular contraction. These sounds are called the Korotkoff sounds. At the point where the Korotkoff sounds disappear, the artery is totally relaxed. This is the diastolic pressure.

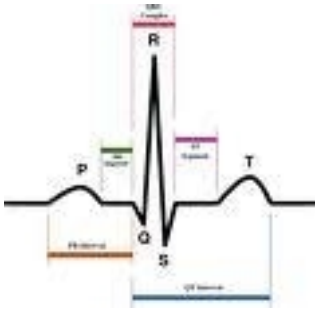
9. Know, in general terms, the autonomic nervous system and its components.
The components of the autonomic nervous system include the sympathetic nervous system which is the "fight or flight" response and the parasympathetic response (the couch potato vegetative state). Sympathetic stimulation increases heart rate and blood pressure and bronchodilates the airways. (Imagine what happens to you if you get scared). Parasympathetic innervation results in stimulation of salivary glands, and slows the heart rate.

10. Understand the mechanism, risk factors and treatment of stroke.
Cerebral Vascular Accident is another name for a stroke. As the name implies, a stroke occurs in the brain. There are 2 types of strokes: an embolic stroke, where a blood clot causes the blood vessel to become occluded or a hemorrhagic, where a blood vessel ruptures and bleeds. Either way, the brain tissue is deprived of oxygen. Symptoms

include weakness of the extremities, usually on one side (e.g. right arm and right leg are weak compared to the left side). Facial palsy or slurred speech can also be seen. Headache is also common. Treatment is to quickly determine what kind of stroke is occurring (either embolic or hemorrhagic). If it is embolic, thrombolytic agents can be administered (clot-busters). Long term therapy for these patients may be to put them on anticoagulants (like Coumadin). Risk factors for stroke are similar to those for heart attack: diabetes, hypertension, smoking, high cholesterol and atrial fibrillation.

CONDUCTION SYSTEM

11. Identify and be able to explain the parts of a normal EKG wave.
The P wave corresponds to depolarization of the atria. The QRS wave corresponds to ventricular depolarization. The T wave reflects ventricular repolarization. Atrial repolarization is not seen on the EKG tracing.

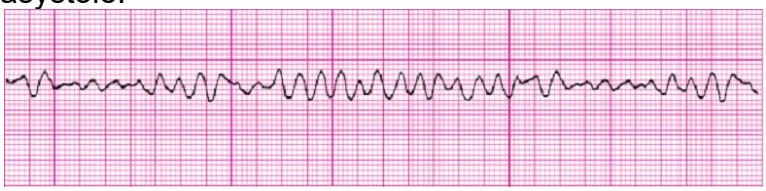


12. Know the pathway of the conduction system through the heart.
The electrical impulse starts in the Sinoatrial node (SA node) which is in the right atrium. It usually fires at a rate of 60-100 beats per minute. It then progresses through intermodal pathways through the atria to the Atrioventricular node (AV node), roughly at the junction of the atria and ventricles. The AV node has an inherent rate of 40-60 per minute. It then passes to the Bundle of His and then divides down the interventricular septum into right and left Purkinjie fibers. These fibers encircle the ventricles and produce the impulse that goes from the bottom up, producing a squeezing action of the ventricles. The ventricles themselves have an inherent rate of 20-40 beats per minute. Beats can originate from outside of this system and are called “ectopic” beats. The word “ectopic” means “not in the right place” and can occur either in the atria or the ventricles.

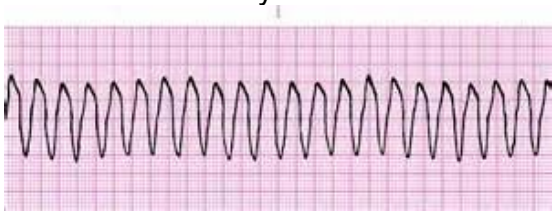
13. Know how to identify a bradycardia and a tachycardia.
The term bradycardia refers to a slow heart rate. Usually anything less than 60. The patient, however, may not be symptomatic at this heart rate. Athletes, for instance, often have slow heart rates. The term tachycardia usually refers to rates over 100. This is often seen during sympathetic stimulation.

14. Identify more common arrhythmias:

a. Ventricular fibrillation: the most common arrhythmia in cardiac arrest just prior to asystole.

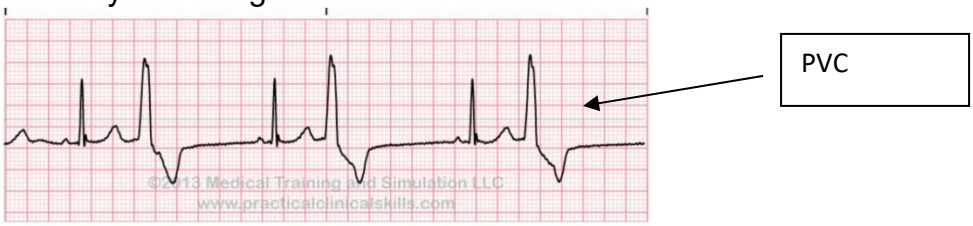


b. Ventricular tachycardia: looks like a big sine wave. A bunch of PVC's all run together



c. Asystole: flatline

d. Premature ventricular contractions: (PVC's) a wide bizarre wave QRS that occurs suddenly and merges with the T wave.



e. Atrial fibrillation: wavy baseline, with ventricular responses. It's called an "irregularly irregular rhythm." This is a common rhythm, especially in elderly patients. These patients are often on Coumadin, because this rhythm predisposes patients to blood clots.

Endocrine System

15. Understand the mechanism of diabetes and how it impacts oral surgical procedures.

Diabetes is a disease of insufficient insulin secretion. Insulin is secreted by the pancreas. The function of insulin is to break down the sugar in the bloodstream and put

it into storage form. When you need more sugar, glucagon is the hormone that brings it out of storage. There are two different forms of diabetes: type I or juvenile diabetes is the form where patients are born without the ability to secrete insulin. They must take insulin, usually in injectable form. Type II is also known as adult onset diabetes. These patients just have decreased insulin secretion. They are usually controlled with oral medications. Symptoms of diabetes include the 3 P's: polyuria (peeing a lot), polydipsia (always thirsty) and polyphagia (always hungry). Also, some diabetics exhibit a fruity odor on the breath. Monitoring blood sugar levels is done either by finger stick (blood) or urine check. Oral surgical procedures affect diabetes in several ways. First, the patient cannot eat or drink for several hours prior to the procedure and consequently his/her blood sugar will go down. After the procedure, the patient usually will not eat a normal meal and therefore his/her insulin requirements will also be less than normal. For that reason, usually, the insulin dose is reduced the morning of surgery. If the patient is hypoglycemia (low blood sugar), he/she will exhibit symptoms of sweating, nervousness, irritability, tremor, confusion and hunger. We can determine the blood sugar level by using a glucometer. Normal readings will be around 80-130. Profoundly low blood sugar may lead to a crisis known as insulin shock. The patient will be anxious, mentally cloudy, tachycardic, coolness of the skin, diaphoretic (sweating), and may lose consciousness with seizures. Treatment would be administration of an intravenous glucose solution.

16. Explain the significance of chronic long term steroid use.

Corticosteroids are used to suppress inflammation. They are NOT the same as anabolic steroids such as testosterone. Your body produces its own kind of steroid called cortisol. It is produced in the adrenal gland: a pyramidal shaped gland that sits on top of the kidney. Some patients are on corticosteroids on a long term basis for diseases such as rheumatoid arthritis. These diseases are usually called auto-immune diseases, because the body makes antibodies to itself. The steroids are used to suppress this production. The problem is that if a patient takes corticosteroids for a long time, the body thinks that the adrenal gland doesn't need to produce any of its own cortisol (because there is enough concentration in the bloodstream). The adrenal gland then atrophies (shrivels up) and can't produce any cortisol. This is called adrenal suppression. In times of stress (such as in a surgical procedure), the body usually produces more of its own cortisol. Except that in this case, it can't. What would be the symptoms of this adrenal insufficiency? Hypoglycemia, dehydration, weight loss, disorientation. Severe symptoms include low blood pressure (shock) and cardiovascular collapse. In order to prevent this, we sometimes have to give these patients additional corticosteroids prior to the surgical procedure. This is called the Rule of 2's: If a patient has taken > 20 mg of Hydrocortisone for more than 2 weeks in the last 2 years then double the dose before any type of surgery!

17. Know what your thyroid does and symptoms of hyper and hypothyroidism.

Your thyroid gland is in your neck. It produces hormones that regulate metabolism and growth. Too little production of thyroid hormone leads to hypothyroidism. ("hypo" means "low"). Symptoms of hypothyroidism include: weight gain, dry skin and hair, depression,

lethargy, cold intolerance, low blood pressure. Too much thyroid hormone leads to hyperthyroidism. Patients will display hypertension, insomnia, weight loss, bulging eyes heat intolerance. A Thyroid Storm is a life threatening emergency due to too much thyroid hormone. Symptoms include: tachycardia or arrhythmia, hypertension, fever, nausea, vomiting, diarrhea, confusion and weakness.

Immune System

18. Know various products in your office that contain latex.
Things that you use every day contain latex. Of course you know that gloves have latex. But so do the following things: tourniquets, the rubber stopper in medication vials (including the local anesthetic) as well as the IV tubing, anesthesia masks and nasal hoods, ambu bags, some EKG straps and electrode pads, adhesive tape, blood pressure cuffs, nasal airways, elastic on surgical bonnets or shoe covers.

19. Know what medications are used in the treatment of anaphylactic shock.
The two biggest concerns about patients in anaphylactic shock are control of the airway and maintaining the blood pressure. The swelling can occlude the airway so that you would not be able to intubate the patient, so early intubation is key. Also, you want to maintain the blood pressure to the vital organs (like brain, heart & kidney). The first drug you want to give is epinephrine. This will keep the blood pressure and heart rate up. Second drug is a corticosteroid, like Decadron. This will combat the overwhelming immune response that is causing the symptoms. Finally, you want to give the patient an antihistamine, like Benadryl to prevent the chemical histamine from being released by the cells.

20. Know the significance of chemotherapy on patients.
Some patients undergoing cancer treatment are on chemotherapy. These drugs are given to kill the tumor cells. Except they often kill a lot more than just the tumor cells. They can lower the patient's blood count: including WBC's (the cells that fight infection) RBC's (that carry oxygen) and platelets (the cells that help you clot). So you should get a new CBC (complete blood count) before doing any surgery on these patients.

IV Therapy

21. Know the different types of IV fluid. What are their differences and which one(s) are preferred intraoperatively?
Because the intravenous route is the most predictable, most oral surgeons establish an IV line to administer medications. The equipment needed include an intravenous catheter, IV bag of fluid and an administration set. There are various choices for IV fluid including D5W, D5 ¼ NS, D5 ½ NS, D5 NS, D5 LR, LR and NS.

The "D" stands for Dextrose, a kind of sugar. The "5" indicates that there is 5% concentration of the dextrose in the solution. "W" stands for water, NS stands for normal saline (salt water). LR stands for Lactated Ringers, which is like saline but has more electrolytes in it, like potassium.

The differences in these liquids is in their *tonicity*. This word refers to the particles dissolved in the fluid: (mostly salt and sugar: NaCl Glucose). If a fluid is isotonic, then the amount of particles in the fluid is just like the human body. There will be no net movement of water across cell membranes. Normal physiologic tonicity of human fluid is .9%. Therefore plain NS fluid is comparable to human physiologic salinity. ½ NS is equivalent to .45% and so on.

If a solution is more diluted than normal physiologic fluids, the water will naturally get drawn out of the vasculature and into the tissues. The more the tonicity approaches the physiologic tonicity, the more the solution will stay intravascularly.

During surgeries, the preferred solution is either NS or LR. The dextrose gets metabolized too rapidly, and then the solution is essentially too dilute.

22. Describe possible complications of venipuncture.
Complications of venipuncture include: phlebitis, extravasation, intra-arterial injection, air embolism and compartment syndrome.

Phlebitis is inflammation inside the vein due to chemical (drugs) or physical trauma. Treatment is elevation, moist heat and NSAIDS (non-steroidal anti-inflammatory) medications, like Advil or Motrin.

Extravasation is when the fluid goes outside the vein. Usually you will see swelling around the site and the IV bag drip rate slows way down. Obviously, you will need to stop the IV and remove the catheter.

Intra-arterial injection is very dangerous. It means instead of the medication going into a vein (which it is supposed to do), it goes into an artery. The danger is that some medications are really irritating to vessels and cause the artery to spasm. This blocks off blood supply to the artery and whatever it supplies (like the hand). This can compromise blood supply so much that the limb is in danger of dying. You can prevent intra-arterial injection by watching for bright red pulsating blood through the catheter. If you already have injected medications, leave the catheter in place and inject 10 cc of 1% procaine (to “numb” the arterial wall and reduce spasm). Pack ice around the arm and transport this patient to the hospital as soon as possible.

An air embolus is when air is introduced into the vascular circulation. It forms a bubble in the circulation. It will then go through the circulation (including the heart) and, dangerously, it goes through the vena cava, right atrium, right ventricle and out through the pulmonary artery where it can lodge. Now, instead of blood flow, there is this bubble that is stuck in the artery, preventing the blood from getting to the lung to pick up vital oxygen. This can be fatal. That’s why it is important to run the fluid through the lines before inserting and making sure that no air is introduced when introducing medications.

Compartment syndrome is a very rare complication and can occur anywhere. The muscles are surrounded by fascia (like that white gristle on raw meat that you see). The fascia does not expand. If there is swelling (like from trauma), this will compress blood vessels and nerves. Treatment is to do a surgical procedure called a fasciotomy which is an incision through the fascia to release the pressure.

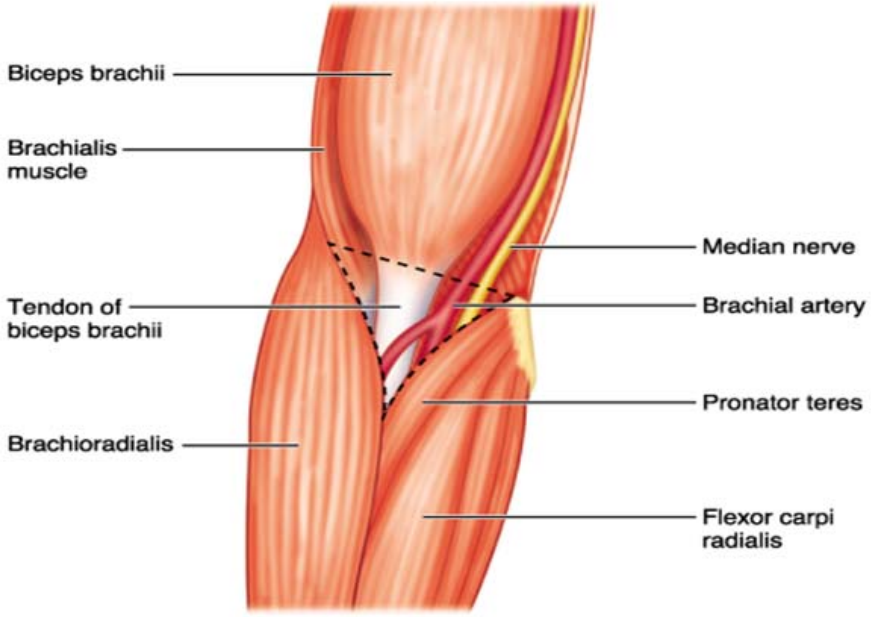
23. Understand the concentrations of medications. What does % concentration mean? What does 1:100,000 mean?

Each medication vial is label with the name of the medication and its concentration. This is very important, since some medications come in different concentrations. When you are charting these medications, always be sure you chart the concentration used. Most often the concentrations are in mg/cc (milligrams per cc). Sometimes they are in a percent concentration. The best way to understand the concept of concentration is to think of the medication in powder form first. It is weighed in grams (unit of dry weight), or smaller, in milligrams (one thousandth of a gram). The liquid it is dissolved in is measured in cc's (cubic centimeters). Look at your syringes: they are all measured in cc's: 1 cc, 3 cc, 5, cc, 10 cc and 20 cc. Another unit of liquid is a liter (think of a liter of Coke). A smaller unit is a milliliter (one thousandth of a liter). How does a cc compare to a milliliter (ml)? 1 cc = 1 ml. (!)

The notation "5%" means 5 grams in 100 cc. [2% solution means 2 grams in 100 cc and so on].

1:100,000 means 1 gram in 100,000 cc's of solution.

24. Know the anatomy of the antecubital fossa:



(b)

Office Anesthesia Emergencies

25. Know how to treat a patient who you suspect is having an MI.
Remember to call 911 and remember the mnemonic MONA: morphine, oxygen, nitrates (nitroglycerin) and aspirin. Put monitors on the patient. If possible, start an IV as soon as possible for administration of drugs.

26. Know reversal agents.
Romazicon (brand name) or Flumazinil (generic name) reverses benzodiazepines (like Versed). Narcan (brand name) or naloxone (generic name) reverses opioids, like Demerol, Fentanyl or Morphine. Be careful if you use naloxone. It might wear off before the effects of the opioid wear off, causing re-sedation and recurrence of respiratory depression.

27. Know signs and symptoms and treatment for a laryngospasm.
A laryngospasm is characterized by attempts at inspiration, suprasternal notch retraction, chest-abdominal rocking in an attempt to expand the rib cage and a high pitched crowing called stridor. Treatment is to pack off the surgical site, clear the pharynx of secretions, delivery of 100% oxygen, opening up the airway by repositioning. If the laryngospasm continues, 10-20 mg of Anectine IV should be administered. It is possible that ventilation may have to be supported after administration of the Anectine, as it is a muscle relaxant (paralyzing agent).

28. Know the signs and symptoms and how to treat hypoglycemia.
A patient that is severely hypoglycemic will look pale, confused, have tremors and tachycardia. They may lose consciousness and progress to seizures. Treatment is to give them sugar. If they are awake, you can give them a bit of juice. If they are unconscious, you need to start an IV and give them 50% dextrose IV and possibly glucagon IM.

29. Know the signs and symptoms and treatment for vasovagal syncope (fainting).
Symptoms of vasovagal syncope include: light headedness, dizziness, sweating, low blood pressure, slow pulse. Treatment includes placing the patient in Trendelenburg position (head lower than the heart, feet up), O2 and a cool moist towel to their forehead.

Outpatient Anesthesia

30. Know the American Society of Anesthesiologists (ASA) Classifications.
ASA Class I: a healthy patient. A 17 year old otherwise healthy patient undergoing third molar surgery is an example.

ASA Class II: mild systemic disease, non-debilitating. An example would be a 30 year old asthmatic whose asthma is well controlled with just an inhaler, or a 40 year old patient with hypertension (high blood pressure) which is well controlled with medication.

ASA Class III: Modest systemic disease, limits activity but not incapacitating. Often these are patients with two or more diseases: examples are a 65 year old patient with hypertension that requires 2 different medications and a diabetic which requires insulin injections.

ASA Class IV: Incapacitating systemic disease, constant threat to life: this patient is seriously ill, for example a 72 year old patient that has leukemia, and is now profoundly anemic and required hospitalization last week.

31. Know the Mallampati classification.

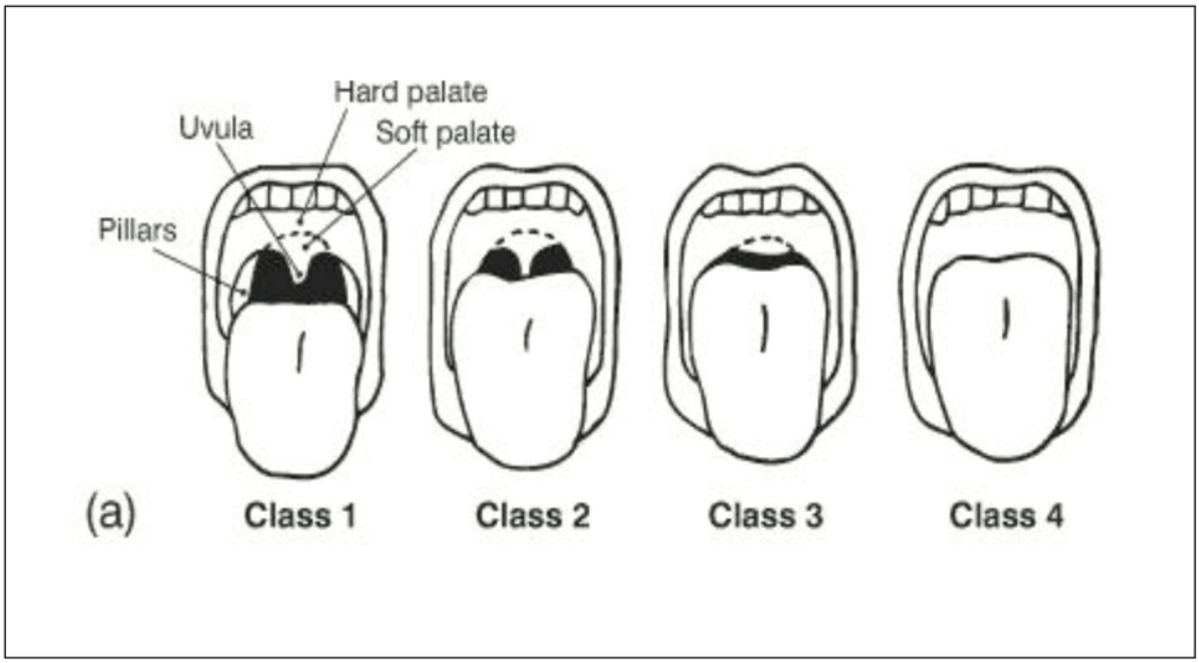


Figure 1. The Mallampati score:
Class 1. Complete visualization of the soft palate
Class 2. Complete visualization of the uvula
Class 3. Visualization of only the base of the uvula
Class 4. Soft palate is not visible at all

From an airway standpoint: Class 1 is the best, Class 4 is the worst.

32. Know the properties of Narcotics.
Narcotics are a classification of drugs derived from the poppy. They include Morphine, Codeine, Demerol and Fentanyl. They are primarily used as analgesics (pain killers). All are respiratory depressants. They have minimal cardiovascular effects at normal doses. They produce drowsiness, euphoria (happy feeling) and the pupils constrict. The side effect is that they may produce nausea, vomiting and constipation. Sometimes patients get a skin rash caused by histamine release. They can also cause chest wall rigidity.

Fentanyl is very potent (about 100 times as potent as morphine). The reversal agent is naloxone (Narcan).

33. Know the properties of Ketamine.
Ketamine causes blockade of an excitatory neurotransmitter. It produces potent analgesia and amnesia. This type of anesthetic is called a “dissociative anesthetic”. It is associated with emergence delirium, primarily in adults which can be largely prevented with benzodiazepines. It causes increase in cerebral blood flow and intracranial pressure. It also causes increase in blood pressure and heart rate by stimulating the sympathetic nervous system. It peaks in 2-4 minutes and decreases over 10-20 minutes. It has minimal effect on the respiratory system, and actually is a potent bronchodilator. It can also cause an increase in secretions.

34. Know how to monitor ventilation and oxygenation.
We can assess the adequacy of ventilation and oxygenation by observing the patient: their skin color (blue = cyanosis), chest rise and fall, listen to breath sounds with a pretracheal stethoscope, watch the reservoir bag. The pulse oximeter measures the level of oxygenated hemoglobin compared to the total hemoglobin. Normal O2 saturation will be > 96%. The capnograph measures the amount of CO2 in expired air. IT is used to assess the adequacy of ventilation. The normal values are 5-6% or 35-45 mm Hg.

35. Know the guidelines for NPO instructions as recommended by the ASA.
The ASA generally recommends no solid foods 6 hours prior the procedure and clear liquids up to 2 hours before the procedure. This allows for gastric emptying and minimizes the potential for vomiting and its potential complications.

36. Know the airway adjuncts (accessories) that help maintain the airway.
Nasal airway, oral airway, laryngeal-mask-airway (LMA) endotracheal intubation, full face mask, items for tongue manipulation, suction equipment.

37. Know the differences in pediatric airways versus adults.
1. Tongue relatively large compared to remainder of airway, along with relatively small jaw. 2. Oblique angle of vocal cords, slanting downward anteriorly. 3. Epiglottis shape is larger, longer and curved. (“omega-shaped”), creating floppy characteristics. 4. Narrowest segment at the cricoid, creating an inverse cone-shape of the airway.

38. Know the stages of anesthesia.
Stage 1: The period between administration of an anesthetic and loss of consciousness. Stage 2: The period after loss of consciousness which may include actions such as uncontrolled movement, delirium, and vocalization. Stage 3: The level at which surgery can be performed. Stage 3 anesthesia is divided into 4 planes: Plan 1: “Light” still has blink and swallowing reflexes and regular respiration. Plane 2: “surgical anesthesia”:

lost blink reflexes, pupils become fixed and respiration is regular. Plane 3: starts to lose ability to use the respiratory muscles and breathing becomes shallow; may require assisted ventilation. Plane 4: loss of all respiratory effort, breathing may stop entirely.

Pharmacology

39. Describe the different routes of administration of drugs and their advantages disadvantages.

Topical medications are applied to the surface of the skin or mucosa. Their absorption is limited. Oral medications are swallowed: either in pill or liquid form. Absorption varies with digestion, and if patients are nauseated and/or vomiting, this route is ineffective. Subcutaneous injections are just below the skin and have only limited use. Intramuscular injections are into the muscle: usually the deltoid (shoulder), gluteus (buttocks) or quadriceps (thigh). There is no need to start an IV and a higher level of drug dose is achieved more quickly than with orally administered medications. Intravenous administration is via a vein. The medication is directly injected to the bloodstream. This route is clearly preferred over the others due to greater bioavailability and the ability to titrate drugs. An IV line also permits administration of fluids. IV administered drugs have the most rapid onset of action. Most oral surgery offices utilize the IV technique of drug administration.

40. Know the fate of the drugs once administered in your body.

Drugs are absorbed from the gut (if given orally), the muscle or the blood stream, depending on the route of administration. Anesthetic agents are distributed to the brain, but also to muscle mass and fat stores. They are usually metabolized in the liver and excreted by the kidneys.

41. Know how to treat a patient on dialysis for kidney disease and what effect kidney disease has on prescribed medications.

When the kidneys are no longer able to perform their filtering functions, patients are put on dialysis which artificially performs the same function. Dialysis may require the patients to be on short acting blood thinners, like heparin. Therefore, it is not advised to do a surgical procedure on the day of dialysis. Surgery on the “off day” of dialysis is recommended. Remember that a lot of medications are cleared by the kidney. Patients with kidney disease cannot clear the medications as fast and will require a lower dose than normal.

42. Understand the clinical significance of liver disease.

Liver diseases encompass a wide spectrum of disorders. Hepatitis is a liver disease. Hepatitis B, C, D and E are transmitted by viruses and therefore are transmissible. It is important to determine 1. How impacted the patient’s liver is from the disease and 2. If the patient still carries the virus which can be transmitted to a health care worker (namely you). If the liver is diseased, it affects the liver, primarily in 2 ways. First the liver cannot break down the drugs as quickly as it should. Therefore the effects of the drugs that are given to the patient last longer. Secondly, the liver is responsible for

producing clotting factors. Patients with compromised liver function may not be able to form a clot.

43. Know the properties of Brevital.
Brevital is classified as an ultra short acting barbiturate, meaning it puts patients to sleep. It primarily acts on the wakefulness center. It wears off very quickly due to its redistribution. The blood pressure will usually drop and there will be an increase in the heart rate (because of the lower blood pressure). It will cause respiratory depression and the major drawback is that it may predispose the patient to a laryngospasm.

44. Know the properties of Propofol.
Propofol is classified as a sedative-hypnotic. Although it looks like milk, the carrier contains soybean oil, glycerol and egg lecithin (which comes from the YOLK, not the egg white).It also acts primarily on the wakefulness center. It is known for giving the patients a sense of euphoria or well being on emergence and also has an antiemetic ("anti-nausea") effect. It is redistributed rapidly to the muscle, fat and skin. The elderly needs smaller doses, females need higher doses and so do children. It is metabolized in the liver.

45. Know the options for anti-emetic agents (anti-nausea).
For motion sickness and or dizziness, Benadryl or Phenergan is recommended. But for the nausea associated with anesthetic agents or medications, Zofran or Compazine is recommended.

46. Know how to recognize the signs of overdose of local anesthetics.
Early signs: patient may become more talkative, anxious or disoriented. At higher doses, the patient may develop seizures

Respiratory System

47. Trace the anatomic passage of a molecule of oxygen from the air into the bloodstream.
The molecule of oxygen is inspired through the nose, goes through the nasal passages into the back of the nose which is called the nasopharynx. It then descends down into the oropharynx (the back of the throat) into the laryngopharynx (which has the larynx or vocal cords). It then goes through the vocal cords into the trachea (or windpipe). From here it goes either to the right or left main stem bronchus. These bronchi then divide into bronchioles. They continue to branch off until it gets to the alveoli or air sacs. These alveoli are surrounded by capillaries. Both the walls of the alveoli and the capillaries are so thin that the oxygen will just diffuse into the capillaries and similarly the carbon dioxide will diffuse from the bloodstream into the alveoli for exhalation.

48. Understand the concept of respiratory depression.
Certain drugs cause respiratory depression. What this means is that normal control mechanisms are impaired. Breathing becomes slower and shallower.

49. Understand the terminology to describe breathing.
Dyspnea means difficulty breathing. Tachypnea means fast breathing. Apnea means no breathing

50. Know what to do if your patient is under sedation and vomits.
The main idea is to prevent the vomitus from reaching the lungs. Position the patient with the head down (Trendelenburg) and turn the patient on the right side. The idea is that the right main stem bronchus branches off at a gentle angle, while the left main stem bronchus branches off at an acute angle. Since we anticipate that the patient will aspirate the vomit, we want to "save" the left lung, and therefore keep the patient's left side up.

51. Know how to recognize a bronchospasm.
Bronchospasm is often associated with asthma. It is a constriction of the smooth muscle in the airways and is classified as an obstructive disorder. It is characterized by difficulty with expiration and wheezing especially during expiration. Asthma attacks are precipitated by a recent upper respiratory tract infection, chemical irritants or an allergic reaction.

52. Understand the mechanism of acute bronchitis.
Bronchitis is an acute inflammation of the mucous membranes of the bronchial tubes. There are excess secretions, making the patient at risk for laryngospasm or bronchospasm. When one listens with a stethoscope, the lungs sound "wet". Treatment often is with nebulizers, inhalers and antibiotics. Elective surgery is usually contraindicated in the presence of bronchitis.

53. Understand how pulse oximetry works and its limitations.
The pulse oximeter sensor emits a red light which passes through thin capillaries in the body: either fingertips, ear lobes or even toes. Depending on the degree of oxygenation, the blood will absorb the light and transmit a certain spectrum. This spectrum is recorded at the opposite end of the sensor and gives a reading which corresponds to percentage oxygenation of the blood. This can be correlated directly to the partial pressure of oxygen present in the blood (the direct pressure exerted by oxygen). The relationship is represented by the oxyhemoglobin dissociation curve. As we can see on the curve, the partial pressure of oxygen drops sharply as the percentage of oxygenation reaches 90%. At 90% oxygenation, the partial pressure is only between 60 and 70 mm Hg. This is significantly low and the doctor should be informed immediately. The pulse oximeter sensor can be affected by anything that could affect an accurate reading through the sensor, including dark fingernail polish, cold extremities, or venous congestion.

Autonomic Nervous System

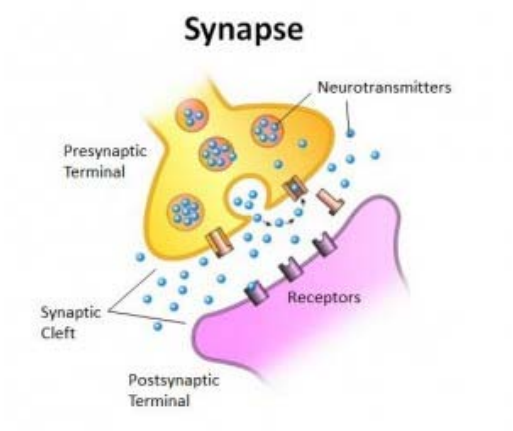
The autonomic nervous system controls the body processes that we don't usually think about: blood pressure, heart and breathing rate, temperature, digestion, metabolism, electrolyte control, urination, and defecation. We don't think about our heart rate or breathing rate, they kind of regulate themselves, right? Think of the word "autonomic" to be the same as "automatic".

There are two main divisions of the autonomic nervous system:

- Sympathetic
- Parasympathetic

Let's talk about the parasympathetic system first. Stimulation of the parasympathetic system results in conserving and restoring processes. It slows the heart rate and lowers the blood pressure. It stimulates the digestive tract to process food and eliminate waste. Energy from processed food is used to restore and build tissues. Think of the parasympathetic system like a "couch potato". What happens when you plop on the couch to watch TV (and eat snacks?). Your salivation and digestion systems increase while your heart rate and BP decrease, right?

Now let's drill down closer into a nerve cell. Actually, nerve cells don't touch each other. They are separated by a small space called a synapse. At one end of the nerve there are little vesicles "pouches" filled with chemicals called neurotransmitters. When the nerve is stimulated, the nerve ending releases these chemicals and they float across the synapse to the other nerve cell which have receptors for these chemicals.



For the parasympathetic system, the chemical is Acetylcholine. Therefore, these nerves are considered *cholinergic.*

Now let's talk about the Sympathetic system. Stimulation of the sympathetic system occurs during what they call a "flight or fright" situation. Let's pretend you are in a really scary situation. You are getting ready to run for your life. What happens to your body? Your heart rate goes up, (and therefore your blood pressure goes up), your bronchi

dilate (because you are getting ready to run, your pupils will dilate (because you have to see where you are running), you begin to sweat, muscular strength is increased, the body releases store energy, and other body processes that are not as important get slowed, like digestion. You get the idea, right?

Now the chemical transmitter for the sympathetic system is called Norepinephrine. (remember, it sounds like epinephrine—and you know that epinephrine will increase heart rate and blood pressure. What is another word for epinephrine? Adrenaline!) Therefore, these nerves are considered *adrenergic.*

There are two different kinds of receptors for the sympathetic system.

- Alpha α
- Beta β

Alpha (α) receptors are located on blood vessels. Stimulation of these receptors will constrict the blood vessels (and this will raise BP).

There are two different kinds of Beta receptors: β1 and β2.

- Beta 1 (β1) is located in the heart
- Beta 2 (β2) is located in your lungs.

[Just remember you have 1 heart and 2 lungs].

Stimulation of Beta 1 will increase heart rate and increase the strength of the heartbeat or contractility.

Stimulation of Beta 2 will dilate the bronchioles and airways as well as increase blood flow to the skeletal muscles.

Why are we telling you all this? Because a lot of medications (like the ones in your crash cart) are based on either stimulating or blocking these receptors. If they block the receptor, they are considered an *antagonist.* (Just think of an antagonist is someone who is really against you). If they stimulate the receptor, they are an *agonist.*

So, let's look at some examples:
In asthma, we want to dilate the airways, because asthma restricts the airways, right? So, we can use a *Beta 2 agonist* like an albuterol inhaler to do that. What is the emergency drug for an acute asthma attack? Epinephrine, right? Epi has both alpha and beta properties, so in addition to dilating the airways, it will raise the heart rate and BP (and constrict the arteries).

What kind of medications are our cardiac patients on? Beta Blockers. They are beta antagonists, deliberately slowing the heart rate down and thereby also lowering blood pressure. Some examples of beta blockers include: atenolol, nadolol, metoprolol and propranolol.