



Banner Staffing Services

Reviewing for Simulation Lab and Scenarios

Welcome to Banner Health. As a part of your new hire process we are asking that you attend simulation lab and complete scenarios related to your area of expertise. This information will be used to assist in your transition as a Banner Staffing Services employee.

Attached you will find a Study Guide for your review. This information is meant to be a tool for you to prepare for your simulation experience.

If you have any further questions regarding preparation for Simulation please call our educator, Amy Burlager, RN, MSN directly at 480-684-6427.

We look forward to working with you as you start your new career goals with Banner Health.

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General Assessment Study Guide

Diabetes

Diabetes is a chronic medical condition, meaning that although it can be controlled, it lasts a lifetime. Diabetes mellitus is a condition of a relative or absolute lack of insulin, affecting carbohydrate, protein, and fat metabolism.

What is diabetes?

Diabetes mellitus is a group of metabolic diseases characterized by high blood sugar (glucose) levels, which result from defects in insulin secretion, or action, or both. Elevated levels of blood glucose (hyperglycemia) lead to spillage of glucose into the urine. Normally, blood glucose levels are tightly controlled by insulin, a hormone produced by the pancreas. Insulin lowers the blood glucose level. When the blood glucose elevates (for example, after eating food), insulin is released from the pancreas to normalize the glucose level. In patients with diabetes, the absence or insufficient production of insulin causes hyperglycemia.

What are the different types of diabetes?

There are two major types of diabetes, called type 1 and type 2. Type 1 diabetes was also called insulin dependent diabetes mellitus (IDDM), or juvenile onset diabetes mellitus. In type 1 diabetes, the pancreas undergoes an autoimmune attack by the body itself, and is rendered incapable of making insulin. Abnormal antibodies have been found in the majority of patients with type 1 diabetes. The patient with type 1 diabetes must rely on insulin medication for survival.

In autoimmune diseases, such as type 1 diabetes, the immune system mistakenly manufactures antibodies and inflammatory cells that are directed against and cause damage to the patients' own body tissues. It is believed that the tendency to develop abnormal antibodies in type 1 diabetes is, in part, genetically inherited, though the details are not fully understood. These antibodies can be measured in the majority of patients, and may help determine which individuals are at risk for developing type 1 diabetes.

Type 1 diabetes tends to occur in young, lean individuals, usually before 30 years of age, however, older patients do present with this form of diabetes. This subgroup is referred to as latent autoimmune diabetes in adults (LADA). LADA is a slow, progressive form of type 1 diabetes. Of all the patients with diabetes, only approximately 10% of the patients have type 1 diabetes and the remaining 90% have type 2 diabetes.

Type 2 diabetes was also referred to as non-insulin dependent diabetes mellitus (NIDDM), or adult onset diabetes mellitus (AODM). In type 2 diabetes, patients can still produce insulin, but do so relatively inadequately for their body's needs, particularly in the face of insulin resistance as discussed above. In

many cases this actually means the pancreas produces larger than normal quantities of insulin. A major feature of type 2 diabetes is a lack of sensitivity to insulin by the cells of the body (particularly fat and muscle cells). In addition to the problems with an increase in insulin resistance, the release of insulin by the pancreas may also be defective and suboptimal. In fact, there is a known steady decline in beta cell production of insulin in type 2 diabetes that contributes to worsening glucose control. (This is a major factor for many patients with type 2 diabetes who ultimately require insulin therapy.) Finally, the liver in these patients continues to produce glucose through a process called gluconeogenesis despite elevated glucose levels. The control of gluconeogenesis becomes compromised.

While it is said that type 2 diabetes occurs mostly in individuals over 30 years old and the incidence increases with age, we are seeing an alarming number patients with type 2 diabetes who are barely in their teen years. In fact, for the first time in the history of humans, type 2 diabetes is now more common than type 1 diabetes in childhood. Most of these cases are a direct result of poor eating habits, higher body weight, and lack of exercise.

While there is a strong genetic component to developing this form of diabetes, there are other risk factors - the most significant of which is obesity. There is a direct relationship between the degree of obesity and the risk of developing type 2 diabetes, and this holds true in children as well as adults. It is estimated that the chance to develop diabetes doubles for every 20% increase over desirable body weight.

There are many forms of insulin. They are classified by how fast they start to work and how long their effects last.

The following chart lists the types of injectable insulin with details about **onset** (the length of time before insulin reaches the bloodstream and begins to lower blood glucose), **peak** (the time period when the insulin is the most effective in lowering blood glucose) and **duration** (how long insulin continues to lower blood glucose). These three factors may vary, depending on your body's response. The final column provides some insight into the "coverage" provided by the different insulin types in relation to mealtime.

Type of Insulin & Brand Names	Onset	Peak	Duration	Role in Blood Glucose Management
Rapid-Acting				
Humalog or lispro	15-30 min.	30-90 min	3-5 hours	Rapid-acting insulin covers insulin needs for meals eaten at the same time as the injection. This type of insulin is used with longer-acting insulin.
Novolog or aspart	10-20 min.	40-50 min.	3-5 hours	
Apidra or glulisine	20-30 min.	30-90 min.	1-2½ hours	
Short-Acting				
Regular (R) Humulin or novolin	30 min.-1 hour	2-5 hours	5-8 hours	Short-acting insulin covers insulin needs for meals eaten within 30-60 minutes
Velosulin (for use in the insulin pump)	30 min.-1 hour	2-3 hours	2-3 hours	
Intermediate-Acting				
NPH (N)	1-2	4-12 hours	18-24	Intermediate-acting insulin covers insulin

	hours		hours	needs for about half the day or overnight. This type of insulin is often combined with rapid- or short-acting insulin.
Lente (L)	1-2½ hours	3-10 hours	18-24 hours	
Long-Acting				
Ultralente (U)	30 min.-3 hours	10-20 hours	20-36 hours	Long-acting insulin covers insulin needs for about 1 full day. This type of insulin is often combined, when needed, with rapid- or short-acting insulin.
Lantus	1-1½ hour	No peak time; insulin is delivered at a steady level	20-24 hours	
Levemir or detemir (FDA approved June 2005)	1-2 hours	6-8 hours	Up to 24 hours	
Pre-Mixed*				
Humulin 70/30	30 min.	2-4 hours	14-24 hours	These products are generally taken twice a day before mealtime.
Novolin 70/30	30 min.	2-12 hours	Up to 24 hours	
Novolog 70/30	10-20 min.	1-4 hours	Up to 24 hours	
Humulin 50/50	30 min.	2-5 hours	18-24 hours	
Humalog mix 75/25	15 min.	30 min.-2½ hours	16-20 hours	
*Premixed insulins are a combination of specific proportions of intermediate-acting and short-acting insulin in one bottle or insulin pen (the numbers following the brand name indicate the percentage of each type of insulin).				

Hypoglycemia

Hypoglycemia, also called low blood sugar, occurs when the blood glucose (blood sugar) level drops too low to provide enough energy for the body's activities. In adults or children older than 10 years, hypoglycemia is uncommon except as a side effect of diabetes treatment, but it can result from other medications or diseases, hormone or enzyme deficiencies, or tumors.

Two types of hypoglycemia can occur in people who do not have diabetes: reactive (postprandial, or after meals) and fasting (post-absorptive). Reactive hypoglycemia is not usually related to any underlying disease; fasting hypoglycemia often is.

Symptoms

Symptoms of both types resemble the symptoms that people with diabetes and hypoglycemia experience: hunger, nervousness, perspiration, shakiness, dizziness, light-headedness, sleepiness, confusion, difficulty speaking, and feeling anxious or weak.

Reactive Hypoglycemia

In reactive hypoglycemia, symptoms appear within 4 hours after you eat a meal. A blood glucose level of less than 70 mg/dL at the time of symptoms and relief after eating will confirm the diagnosis.

To relieve reactive hypoglycemia, some health professionals recommend taking the following steps:

- eat small meals and snacks about every 3 hours
- exercise regularly
- eat a variety of foods, including meat, poultry, fish, or nonmeat sources of protein; starchy foods such as whole-grain bread, rice, and potatoes; fruits; vegetables; and dairy products.
- choose high-fiber foods
- avoid or limit foods high in sugar, especially on an empty stomach

Hyperglycemia

DKA is clinically defined by absolute insulin deficiency with hyperglycemia (glucose levels usually >200 mg/dl) with increased lipolysis, increased ketone production, hyperketonemia (ketone levels positive and acidosis). It is important to precisely define DKA in epidemiologic studies to accurately assess and compare morbidity and mortality.

DKA may be the initial manifestation of diabetes, particularly for IDDM,. Precipitating factors for DKA in those with established diabetes include infection, other acute illnesses, lack of diabetes education and training, noncompliance, poor self-care, inadequate glucose monitoring, and psychological problems. Infection is a common precipitating factor.

IV lines

Peripherally inserted central catheter

PICC lines are used when intravenous access is required over a prolonged period of time, as in the case of long chemotherapy regimens, extended antibiotic therapy, or total parenteral nutrition.

The PICC line is inserted into a peripheral vein usually in the arm, and then carefully advanced upward until the catheter is in the superior vena cava or the right atrium. This is usually done by feel and estimation; an X-ray then verifies that the tip is in the right place.

A PICC may have two parallel compartments, each with its own external connector (double-lumen), or a single tube and connector (single-lumen). From the outside, a single-lumen PICC resembles a peripheral IV, except that the tubing is slightly wider.

The chief advantage of a PICC over other types of central lines is that it is easy to insert, poses a relatively low risk of bleeding, is externally unobtrusive, and can be left in place for months to years for patients who require extended treatment. The chief disadvantage is that it must travel through a relatively

small peripheral vein and is therefore limited in diameter, and also somewhat vulnerable to occlusion or damage from movement or squeezing of the arm.

Central venous lines

There are several types of catheters that take a more direct route into central veins. These are collectively called *central venous lines*.

In the simplest type of central venous access, a catheter is inserted into a subclavian, internal jugular, or (less commonly) a femoral vein and advanced toward the heart until it reaches the superior vena cava, inferior vena cava or right atrium. Because all of these veins are larger than peripheral veins, central lines can deliver a higher volume of fluid and can have multiple lumens.

Another type of central line, called a Hickman line or Broviac catheter, is inserted into the target vein and then "tunneled" under the skin to emerge a short distance away. This reduces the risk of infection, since bacteria from the skin surface are not able to travel directly into the vein; these catheters are also made of materials that resist infection and clotting.

Risks of intravenous therapy

Infection--Any break in the skin carries a risk of infection. Infection of IV sites is usually local, causing easily visible swelling, redness, and fever. If bacteria do not remain in one area but spread through the bloodstream, the infection is called septicemia and can be rapid and life-threatening. An infected central IV poses a higher risk of septicemia, as it can deliver bacteria directly into the central circulation.

Phlebitis--is irritation of a vein that is not caused by infection, but from the mere presence of a foreign body (the IV catheter) or the fluids or medication being given. Symptoms are swelling, pain, and redness around the vein. The IV device must be removed and if necessary re-inserted into another extremity.

Fluid overload--This occurs when fluids are given at a higher rate or in a larger volume than the system can absorb or excrete. Possible consequences include hypertension, heart failure, and pulmonary edema.

Electrolyte imbalance--Administering a too-dilute or too-concentrated solution can disrupt the patient's balance of sodium, potassium, magnesium, and other electrolytes. Hospital patients usually receive blood tests to monitor these levels.

Embolism--A blood clot or other solid mass, or an air bubble, can be delivered into the circulation through an IV and end up blocking a vessel; this is called embolism. Peripheral IVs have a low risk of embolism, since large solid masses cannot travel through a narrow catheter. The risk is greater with a central IV.

Air bubbles of less than 30 milliliters generally dissolve into the circulation harmlessly. A larger amount of air, if delivered all at once, can cause life-threatening damage to pulmonary circulation, or, if extremely large (3-8 milliliters per kilogram of body weight), can stop the heart.

Extravasation--is the accidental administration of IV infused medicinal drugs into the surrounding tissue, either by leakage (e.g. because of brittle veins in very elderly patients), or directly (e.g. because the needle has punctured the vein and the infusion goes directly into the arm tissue).

Pneumothorax--Symptoms of a pneumothorax include chest pain that usually has a sudden onset. The pain is sharp and may lead to feelings of tightness in the chest. Shortness of breath, rapid heart rate, rapid breathing, cough, and fatigue are other symptoms of pneumothorax. The skin may develop a bluish color (termed cyanosis) due to decreases in blood oxygen levels. This complication can be a result of trauma to the lung during central line insertion.

Immediate treatment consists of assessing the patient immediately for diminished breath sounds on the side that the central line was placed; Level of consciousness and symptoms discussed above.

Blood Transfusions

Definition—the process of transferring whole blood or blood components from one person (donor) to another (recipient).

Purpose—Transfusions are given to restore lost blood, to improve clotting time, and to improve the ability of the blood to deliver oxygen to the body's tissues.

Description----Either whole blood or blood components can be used for transfusion. Whole blood is used exactly as it was received from the donor. Blood components are parts of whole blood, such as red blood cells (RBCs), plasma, platelets, clotting factors, immunoglobulin, and white blood cells. Whole blood is used only when needed or when components are not available. Most of the time whole blood is not used because the patient's medical condition can be treated with a blood component. Use of blood components is a more efficient way to use the blood supply, because blood that has been processed (fractionated) into components can be used to treat more than one person.

Whole blood is generally used when a person has lost a lot of blood. Such blood loss can be caused by injury or surgical procedures. Whole blood is given to help restore the blood volume, which is essential for maintaining blood pressure. Whole blood is also given to ensure that the body's tissues are receiving enough oxygen. Whole blood is occasionally given when a required blood component is unavailable in isolated form.

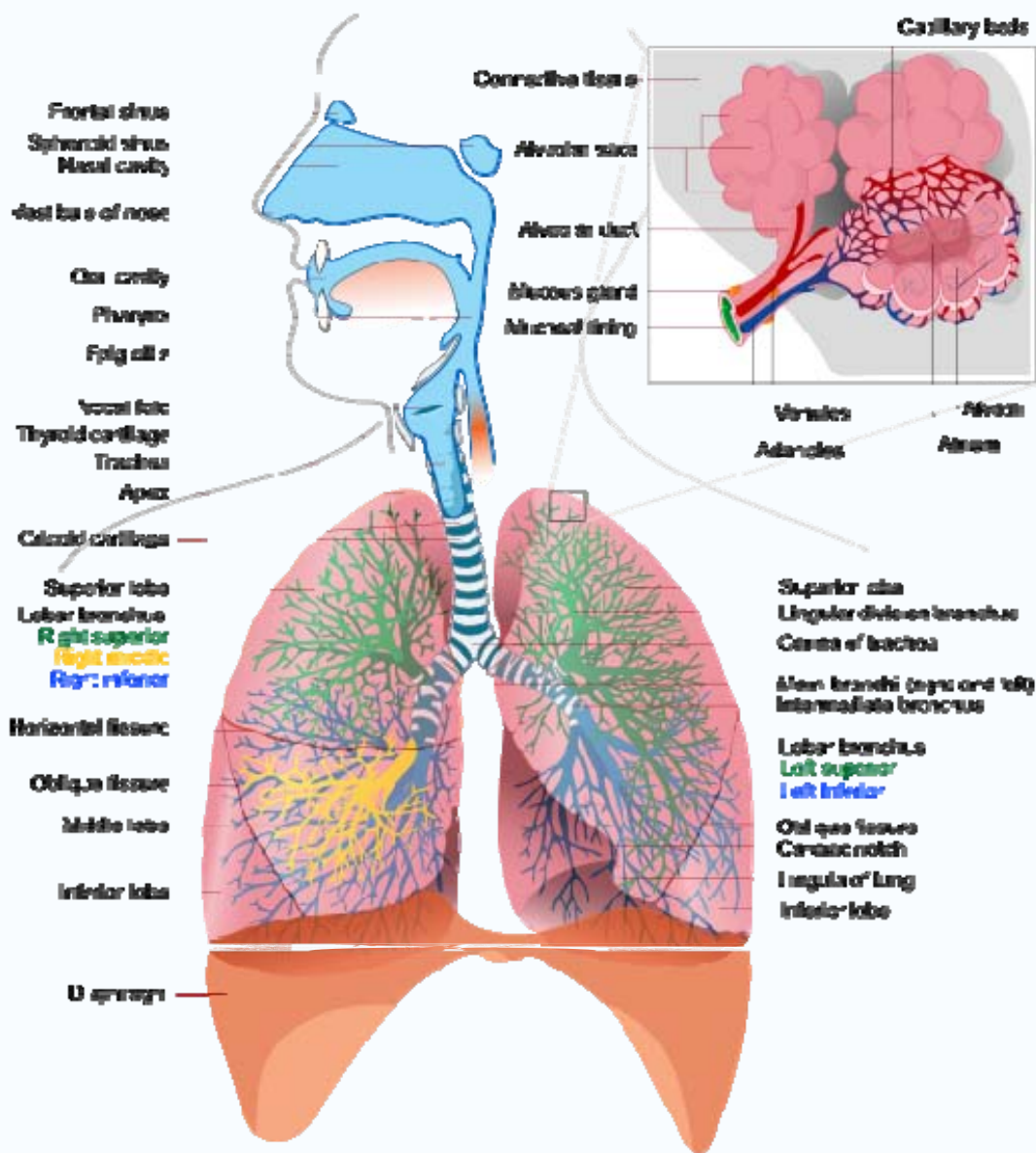
Red blood cells are the blood component most frequently used for transfusion. RBCs are the only cells in the body that transport oxygen. A transfusion of RBCs increases the amount of oxygen that can be carried to the tissues of the body. RBCs that have been separated from the liquid plasma (packed RBCs) are given to people who have anemia or who have lost a lot of blood. Platelets are another component frequently given by transfusion. Platelets are a key factor in blood clotting. The clear fluid that carries blood cells (plasma) also contains blood-clotting factors. The platelets and plasma clotting factors are extracted from donated blood and concentrated for use. In some cases, a patient may develop a reaction to the blood or blood components.

Signs and Symptoms of Blood Reaction

- Mild edema
- Fever, chills, headache, malaise, flushing
- Rash/hives
- Bronchial wheezing
- Anaphylaxis
- Circulatory overload

Respiratory

The **respiratory system** consists of the airways, the lungs, and the respiratory muscles that mediate the movement of air into and out of the body. The diaphragm helps pull air in and push air out. Within the alveolar system of the lungs, molecules of oxygen and carbon dioxide are passively exchanged, by diffusion, between the gaseous environment and the blood. Thus, the respiratory system facilitates oxygenation of the blood with a concomitant removal of carbon dioxide and other gaseous metabolic wastes from the circulation. The system also helps to maintain the acid-base balance of the body through the efficient removal of carbon dioxide from blood.



What Can Go Wrong With the Lungs and Respiratory System?

The respiratory system is susceptible to a number of diseases, and the lungs are prone to a wide range of disorders caused by pollutants in the air. The most common problems of the respiratory system are:

Asthma—More than 20 million people in the United States have asthma and it's the number-one reason for kids' chronically missing school. Asthma is a chronic inflammatory lung disease that causes airways to tighten and narrow. Often triggered by irritants in the air such as cigarette smoke, asthma flares involve contraction and swelling of the muscles lining the tiny airways. The resulting narrowing of the airways prevents air from flowing properly, causing wheezing and difficulty breathing, sometimes to the point of being life-threatening. Management of asthma starts with an asthma management plan, which usually involves avoiding asthma triggers and sometimes taking medications.

Bronchiolitis—Not to be confused with bronchitis, bronchiolitis is an inflammation of the bronchioles, the smallest branches of the bronchial tree. Bronchiolitis affects mostly infants and young children, and can cause wheezing and serious difficulty breathing. It's usually caused by specific viruses in the wintertime, including respiratory syncytial virus (RSV).

Chronic obstructive pulmonary disease (COPD). COPD is a term that describes two lung diseases - emphysema and chronic bronchitis.

- Long-term smoking often causes **emphysema** and although it seldom affects children and teens, it's a condition that can have its roots in the teen and childhood years. In emphysema, the lungs produce an excessive amount of mucus, and the alveoli become damaged. It becomes difficult to breathe and get enough oxygen into the blood.
- In **bronchitis**, a common disease of adults and adolescents, the membranes lining the larger bronchial tubes become inflamed, and an excessive amount of mucus is produced. The person develops a bad cough to get rid of the mucus. Cigarette smoking is a major cause of chronic bronchitis in teens.

Pneumonia is an inflammation of the lungs that usually occurs because of bacterial or viral infection. Pneumonia causes fever and inflammation of lung tissue, and makes breathing difficult because the lungs have to work harder to transfer oxygen into the bloodstream and remove carbon dioxide from the blood. Common causes of pneumonia are influenza and infection with the bacterium *Streptococcus pneumoniae*.

What are the symptoms?

Symptoms of pneumonia caused by bacteria usually come on quickly. They may include:

- ✓ Cough. Patient will cough up mucus (sputum) from the lungs. Mucus may be rusty or green or tinged with blood.
- ✓ Fever.
- ✓ Fast breathing and feeling short of breath.
- ✓ Shaking and "teeth-chattering" chills.
- ✓ Chest pain that often feels worse when you cough or breathe in.
- ✓ Fast heartbeat.
- ✓ Feeling very tired or feeling very weak.
- ✓ Nausea and vomiting.
- ✓ Diarrhea.

Mild symptoms, may be called "walking pneumonia."

Older adults may have different, fewer, or milder symptoms. They may not have a fever. Or they may have a cough but not bring up mucus. The main sign of pneumonia in older adults may be a change in how well they think. Confusion or delirium is common. Or, if they already have a lung disease, that disease may get worse. Symptoms caused by viruses are the same as those caused by bacteria. But they may come on slowly and often are not as obvious or as bad. Chest X-ray and a blood test is usually enough for the physician to diagnose pneumonia.

Evaluating abnormalities in Respiratory System:

Arterial Blood Gases

An arterial blood gas (ABG) test measures the acidity (pH) and the levels of oxygen and carbon dioxide in the blood. This test is used to check how well the lungs are able to move oxygen into the blood and remove carbon dioxide from the blood. An ABG test uses blood drawn from an artery, where the oxygen and carbon dioxide levels can be measured before they enter body tissues. An ABG measures:

- **Partial pressure of oxygen (PaO₂).** This measures the pressure of oxygen dissolved in the blood and how well oxygen is able to move from the airspace of the lungs into the blood.
- **Partial pressure of carbon dioxide (PaCO₂).** This measures how much carbon dioxide is dissolved in the blood and how well carbon dioxide is able to move out of the body.
- **pH.** The pH measures hydrogen ions (H⁺) in blood. The pH of blood is usually between 7.35 and 7.45. A pH of less than 7.35 is called acid and a pH greater than 7.45 is called basic (alkaline).
- **Bicarbonate (HCO₃).** Bicarbonate is a chemical that keeps the pH of blood from becoming too acid. If the pH level drops, HCO₃ is absorbed by the kidneys and returned to the blood instead of passing out of the body in the urine.
- **Oxygen content (O₂CT) and oxygen saturation (O₂Sat) values.** O₂ content measures the amount of oxygen in the blood. Oxygen saturation measures how much of the hemoglobin in the red blood cells is carrying oxygen (O₂).

Normal

Normal values may vary from lab to lab and depend upon the elevation above sea level. Results are usually available right away.

Arterial blood gases (at sea level and breathing room air)	
Partial pressure of oxygen (PaO₂):	75–100 <u>mm Hg</u>
Partial pressure of carbon dioxide (PaCO₂):	35–45 mm Hg
pH:	7.35–7.45
Bicarbonate (HCO₃):	20–29 <u>mEq/L</u> or 20–29 <u>mmol/L</u>
Oxygen content (O₂CT):	15%–22% (15–22 <u>mL</u> per 100 mL of blood)
Oxygen saturation (O₂Sat):	95%–100% (95–100 mL per 100 mL of blood)

The concentration of oxygen being breathed, called the fraction of inhaled oxygen (FiO₂), is also usually reported. This is only useful if you are receiving oxygen therapy from a tank or are on a ventilator.

Abnormal results may be caused by:

- ✓ Diabetes.
- ✓ Drug or alcohol overdose.
- ✓ Kidney failure.
- ✓ Lung diseases, such as chronic lung disease, a blood clot in the lungs, or pneumonia.
- ✓ Severe dehydration from severe burns, vomiting, diarrhea, or taking water pills (diuretics).
- ✓ Severe infection (sepsis)

Cardiovascular System

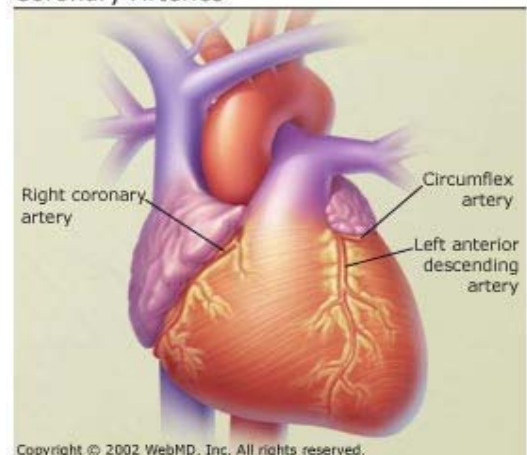
Cardiovascular disease is the leading cause of death for both men and women in the U.S.

Coronary artery disease (CAD) is atherosclerosis, or hardening, of the arteries that provide vital oxygen and nutrients to the heart. Blockage of the coronary arteries causes heart attack (By plaque build up or blood clot).

Atherosclerosis

- Build up of fatty deposits (plaque)
- As the plaque builds up, the artery opening gradually narrows
- Decrease blood supply means decreased oxygen to the muscles
- Has no obvious symptoms in the early stages
- Damaged or partially blocked arteries can cause intermittent pain (Angina)

Coronary Arteries



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Heart Attack

- A heart attack (sometimes called Myocardial Infarction) occurs when there is a sudden and complete block of an artery that supplies the heart muscle with blood.
- The lack of oxygenate-rich blood to the affected heart muscle causes chest pain that is typically more severe than angina and lasts longer.
- The pain of a heart attack does not go away with rest or with medicine that was previously effective.
- A heart attack may be accompanied by shortness of breath, indigestion, irregular heartbeat, nausea, weakness, and sweating.
- A heart attack may also cause sudden cardiac death.
- Related to genetic and lifestyle
- Risk Factors that cannot be changed: Heredity, Family history of early heart disease, and increasing age

Signs/Symptoms of a Heart Attack

- Chest discomfort/Chest pain
- Uncomfortable pressure, squeezing, fullness or pain in the center of the chest.
- Pain that spreads to the shoulders, neck, back, jaw or arms
- Pale or ashen skin.
- Elevated Blood Pressure
- Anxiety
- Elevated Cardiac Enzymes
- EKG changes (ST elevation, Cardiac Dysrhythmias)

Signs/Symptoms are often more subtle for a woman, these may include:

- Fatigue
- Anxiety
- Sleep disturbances
- Stomach complaints
- Often there is no chest pain

Treatment of Symptoms

Damage to the heart can be greatly reduced or even eliminated if treatment is given early. The key to survival and recovery is the prompt recognition of heart attack signals and quick activation of EMS.

- If breathing and pulse stop, CPR must be administered to sustain blood flow to vital organs until EMS arrives and takes over.
- Evaluation in Emergency department within one hour of onset of pain.
- O2 4L/min.
- Cardiac monitoring
- Determine history of symptoms
- Treat pain with Nitro SL 1/150gr every 5 minutes time 3. Reassess symptoms
- Treat unresolved pain with Morphine 1-3 mg slow IV push.
- **Meds:**

- *Vasodilators*—Used to dilates arterioles and veins, thereby improving cardiac function (workload of the heart).
- *Nitrates* (Nitro Sublingual)—Decreases preload of the heart and reduces the risk of congestive heart failure. 1/150 SL x 3 for c/o chest pain.
- *Beta Blockers*—Inderal 10-20 mg p.o TID
- *Diuretics*—prevent fluid overload
- *Morphine*—venous dilation rapidly decreases preload, sedative affect decreases anxiety, decreasing hyperventilation. Dose 2-10 mg slow IV push.
- *Digoxin*—Increases contractility state of the ventricles. Usual dose-0.25mg/day.

Complications of Heart Attack

- Cardiac Arrest—usually caused by cardiac dysrhythmia (Ventricular tachycardia or Ventricular Fibrillation).
- Heart Failure—the heart is unable to provide enough cardiac output to meet the body’s demands.
- DVT—Venous stasis occurs in persons who are inactive for a time because of bed rest or immobilization of the low extremities. Calf pain and tenderness “Homan’s sign”, dilated superficial veins; edema of the involved extremity; pain and tenderness over involved vein; increased size compared with unaffected side.

- ✓ Treatment--Anticoagulants—Heparin Sodium
- ✓ Warfarin—Given later to maintain prothrombin time.

- Shock—Hypovolemic, Cardiogenic, Vasogenic, Septic
 - **Hypovolemic**—Decrease in total volume of circulating blood volume. Caused by bleeding, trauma, dehydration, or fluid loss.
 - **Cardiogenic**—Breakdown in ventricular performance and myocardial metabolism. This is characterized by marked hypotension and marked reduction in left ventricular function; along with over all signs and symptoms of shock (hypoxemia secondary to poor ventilation and perfusion, hypovolemia and metabolic acidosis).
 - **Vasogenic**—Leads to results in massive vasodilatation from an increase in total vascular capacity (Venous Pooling).
 - **Sepsis** Is the most common form of Vasogenic shock. Septic shock is commonly related to the release of bacterial endotoxins after a gram-negative bacterial infection. Patients particularly susceptible to septic shock are the elderly, immunosuppressed patients, patients with indwelling catheters (Foley, intravenous, intracranial).
 - Restlessness is the most common early sign of septic shock.
 - Other causes: Pulmonary emboli, cardiac surgery, tamponade

- Treatment:
 - Fluid replacement—3-5 Liter of saline or other volume expanders over 30-60 minutes.
 - Monitoring of Hemodynamic parameters
 - Blood plasma expanders are given after the initial fluid volume deficit is replaced.
 - Support cardiac function with Adrenergic drugs
 - Vasodilator agents improve left ventricular function by decreasing myocardial oxygen demand through the reduction of preload and afterload.
 - Antihypertensive agents—cause both arterial and venous dilation, improving cardiac output.
 - Support Respiratory function—O₂, Ventilation

Angina Pectoris

The most common symptom of coronary artery disease is angina or "angina pectoris," also known as chest pain. Angina can be described as a discomfort, heaviness, pressure, aching, burning, fullness, squeezing or painful feeling. Often, it can be mistaken for indigestion. Angina is usually felt in the chest, but may also be felt in the shoulders, arms, neck, throat, jaw or back.

When blood flow to an area of the heart is decreased, it impairs the delivery of oxygen and vital nutrients to the heart muscle cells. When this happens, the heart muscle must use alternative, less efficient forms of fuel so that it can perform its function of pumping blood to the body. The byproduct of using this less efficient fuel is a compound called lactic acid that builds up in the muscle and causes pain.

Stable angina—the pain is predictable and present only during exertion or extreme emotional distress, disappearing with rest.

Unstable angina—this may signal an impending heart attack. Unstable angina is angina pain that is different from your regular angina pain or pain that occurs while at rest. The angina may occur more frequently, more easily at rest, feel more severe, last longer, or come on with minimal activity. Although this type of angina can often be relieved with oral medications (medicine taken by mouth), it is unstable and may progress to a heart attack. Usually more intense medical treatment or a procedure is required.

Treatment for Angina

The treatment you receive depends on the severity of the underlying problem, namely the amount of damage to the heart. For most people with mild angina, a combination of medications and lifestyle changes can control the symptoms. Lifestyle changes include: eating a heart-healthy diet, lowering cholesterol, getting regular exercise, quitting smoking and controlling diabetes and high blood pressure.

Some medications used to treat angina work by either increasing the amount of oxygen delivered to the heart muscle or reducing the heart's need for oxygen. These medicines include:

- **Beta-blockers**-- Sectral (acebutolol), Zebeta (bisoprolol), Brevibloc (esmolol), Inderal (propranolol), Tenormin (atenolol),
- **Nitrates**—nitroglycerin, isosorbide dinitrate, Isordil Sorbitrate isosorbide, Nitro-Dur Nitrolingual, Nitrostat, Transderm-Nitro. Nitrates may be given in a pill or spray form that is placed under the tongue (sublingual). Skin patches or paste are also available.
- **Calcium channel blockers**-- (amlodipine), Plendil (felodipine), Cardizem, Cardizem CD, Cardizem SR, Procardia, Procardia XL (nifedipine),.
- **Angiotensin-converting enzyme inhibitors** (ACE inhibitors). Benazepril hydrochloride Lotensin, captopril Capoten, enalapril maleate, Prinivil, Zestril, Quinapril hydrochloride, Accupril

Hypertension

What is high blood pressure?

High blood pressure, or hypertension, comes from blood pushing too hard against your blood vessels. A healthy blood pressure is 120/80 mm Hg.



High blood pressure is blood pressure that is 140/90 mm Hg or above.

High Blood Pressure Symptoms

High blood pressure usually has no symptoms, but it can cause serious problems such as stroke, heart failure, heart attack and kidney failure. You can control high blood pressure through healthy lifestyle habits and taking medicines, if needed. High blood pressure is often called a "silent killer" because many people have it but don't know it. Over time, people who do not get treated for high blood pressure can get very sick or even die.

Mild to moderate hypertension symptoms may include headaches, dizziness, fatigue, vertigo, palpitations.

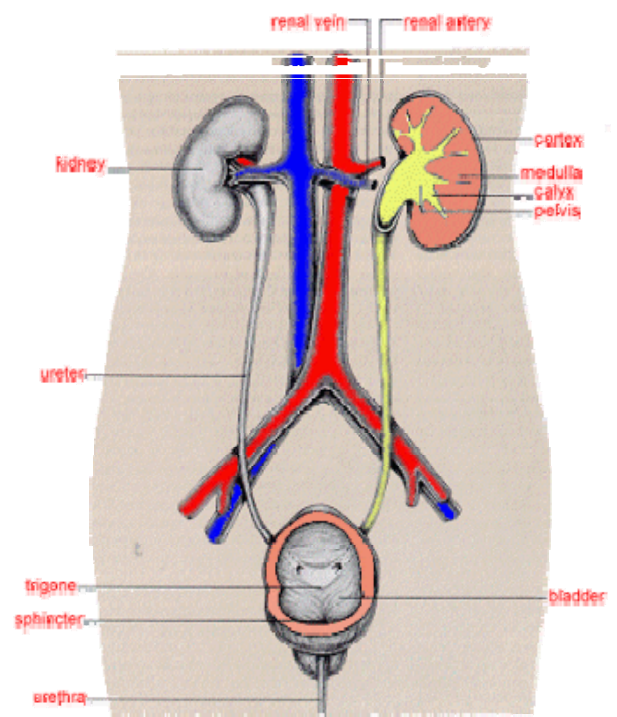
Medications

- ✓ Diuretics—Thiazides,
- ✓ Chlorothiazide—Diuril
- ✓ Hydrochlorothiazide—HydroDiuril, Novo-Hydrazine
- ✓ Loop Diuretics—Lasix, Bumex,
- ✓ B adrenergic blocking agents—Inderal, Tenormin, Blocadren, Corgard
- ✓ Antihypertensive agents—Aldomet, Capoten, Apresoline, Nipride

Urinary Tract System

The kidneys are essentially regulatory organs which maintain the volume and composition of body fluid by filtration of the blood and selective reabsorption or secretion of filtered solutes.

The kidneys take their blood supply directly from the aorta via the renal arteries; blood is returned to the inferior vena cava via the renal veins. Urine excreted from the kidneys passes down the fibromuscular **ureters** and collects in the **bladder**. The bladder muscle (the **detrusor muscle**) is capable of distending to accept urine without increasing the pressure inside; this means that large volumes can be collected (700-1000ml) without high-pressure damage to the renal system



occurring. When urine is passed, the **urethral sphincter** at the base of the bladder relaxes, the detrusor contracts, and urine is voided via the **urethra**.

Acute Renal Failure

Acute kidney failure is the sudden loss of your kidneys' ability to perform their main function — eliminate excess fluid and waste material from your blood. When your kidneys lose their filtering ability, dangerous levels of fluid and waste accumulate in your body.

Acute kidney failure is most common in people who are already hospitalized, particularly people who need intensive care. Acute kidney failure tends to occur after complicated surgery, after a severe injury or when blood flow to your kidneys is disrupted.

Loss of kidney function may also develop gradually over time, with few signs or symptoms in the early stages. In this case, it's referred to as chronic kidney failure. High blood pressure and diabetes are the most common causes of chronic kidney failure.

Acute kidney failure can be serious and generally requires intensive treatment. Unlike the chronic form, however, acute kidney failure is reversible and if you're otherwise in good health you should recover normal kidney function within a few weeks. If acute kidney failure occurs in the context of severe chronic illness — a heart attack, stroke, overwhelming infection or multi-organ failure — the outcome is often worse.

Signs and symptoms

Signs and symptoms of acute kidney failure may include:

- Decreased urine output, although occasionally urine output remains normal
- Fluid retention, causing swelling in your legs, ankles or feet
- Drowsiness
- Shortness of breath
- Fatigue
- Confusion
- Seizures or coma in severe cases
- Chest pain related to pericarditis, an inflammation of the sac-like membrane that envelops your heart
- Some people don't notice any early signs or symptoms, or are more bothered by the underlying problem causing the sudden kidney failure.

Treatment

Determine cause--The first goal is to treat the illness or injury that originally damaged your kidneys. Once that's under control, the focus will be on preventing the accumulation of excess fluids and wastes in your blood while your kidneys heal.

Dialysis--to help remove toxins and excess fluids from the body; dialysis is a mechanical way of filtering waste from the blood. It can replace the function of the kidney, albeit imperfectly, while the kidneys are healing.

Fluid Restriction—Daily weight, Limit fluid intake

Nutritional support—Low sodium diet, high-carbohydrate, low-protein, low-potassium diet.

Monitor Labs—Serum pH, sodium, calcium, BUN, and Creatinine

Note: Diabetics in hypoglycemia that are also in renal failure should NOT receive orange juice due to the high potassium content.

Neurological System

Head injury is a general term used to describe any trauma to the head, and most specifically to the brain itself.

Skull fracture: A skull fracture is a break in the bone surrounding the brain and other structures within the skull.

Linear skull fracture: A common injury, especially in children. A linear skull fracture is a simple break in the skull that follows a relatively straight line. It can occur after seemingly minor head injuries (falls, blows such as being struck by a rock, stick, or other object; or from motor vehicle accidents). A linear skull fracture is not a serious injury unless there is an additional injury to the brain itself.

Depressed skull fractures: These are common after forceful impact by blunt objects—most commonly, hammers, rocks, or other heavy but fairly small objects. These injuries cause "dents" in the skull bone. If the depth of a depressed fracture is at least equal to the thickness of the surrounding skull bone (about 1/4-1/2 inch), surgery is often required to elevate the bony pieces and to inspect the brain for evidence of injury. Minimally depressed fractures are less than the thickness of the bone. Other fractures are not depressed at all. They usually do not require surgical treatment unless other injuries are noted.

Basilar skull fracture: A fracture of the bones that form the base (floor) of the skull and results from severe blunt head trauma of significant force. A basilar skull fracture commonly connects to the sinus cavities. This connection may allow fluid or air entry into the inside of the skull and may cause infection. Surgery is usually not necessary unless other injuries are also involved.

Intracranial (inside the skull) hemorrhage (bleeding)

- **Subdural hematoma:** Bleeding between the brain tissue and the Dura mater (a tough fibrous layer of tissue between the brain and skull) is called a subdural hematoma. The stretching and tearing of "bridging veins" between the brain and Dura mater causes this type of bleeding. A subdural hematoma may be acute, developing suddenly after the injury, or chronic, slowly accumulating after injury. Chronic subdural hematoma is more common in the elderly whose bridging veins are often brittle and stretched and can more easily begin to slowly bleed after minor injuries. They are potentially serious and often require surgery.
- **Epidural hematoma:** Bleeding between the Dura mater and the skull bone is an epidural hematoma. These occur when arteries are cut. Injury in the temple area is a common cause. Epidural hematoma is potentially serious and often requires surgery.
- **Intraparenchymal hemorrhage/cerebral contusion:** These terms describe bleeding into the brain tissue itself. A contusion is like a bruise to the brain tissue and usually requires no special intervention, much like a concussion. An intraparenchymal hemorrhage is a pool of blood within

the brain tissue. Minor bleeding may stop without any treatment and cause no serious problems. More serious or large bleeds usually require surgery.

- **Closed head injuries:** This broad term describes any injury to the brain or structures within the skull that are not caused by a penetrating injury (such as a gunshot wound or stab wound). They range from very minor to potentially fatal injuries.

Head Injury Symptoms

Signs and symptoms of head injuries vary with the type and severity of the injury. Minor blunt head injuries may involve only symptoms of being "dazed" or brief loss of consciousness. They may result in headaches or blurring of vision or nausea and vomiting.

Severe blunt head trauma involves a loss of consciousness lasting from several minutes to many days or longer. Seizures may result. The person may suffer from severe and sometimes permanent neurological deficits or may die. Neurological deficits from head trauma resemble those seen in stroke and include paralysis, seizures, difficulty speaking, seeing, hearing, walking, or understanding.

Penetrating trauma may cause immediate, severe symptoms or only minor symptoms despite a potentially life-threatening injury. Death may follow from the initial injury. Any of the signs of serious blunt head trauma may result.

- ✓ Head injury without loss of consciousness
- ✓ Vomiting more than once
- ✓ Confusion
- ✓ Weakness or inability to walk
- ✓ Severe headache

Seizure Disorders

Seizures, or convulsions, are paroxysmal episodes in which there are sudden and violent involuntary contractions of a group of skeletal muscles and disturbances in consciousness, behavior, sensation, and autonomic functioning.

Generalized epileptic seizures occur when electrical abnormalities exist throughout the brain. A partial seizure does not involve the entire brain. A partial seizure begins in an area called an epileptic focus, but may spread to other parts of the brain and cause a generalized seizure. Some people who have epilepsy have more than one type of seizure.

Motor attacks cause parts of the body to jerk repeatedly. A motor attack usually lasts less than an hour and may last only a few minutes. Sensory seizures begin with numbness or tingling in one area. The sensation may move along one side of the body or the back before subsiding.

Visual seizures, which affect the area of the brain that controls sight, cause people to see things that are not there. Auditory seizures affect the part of the brain that controls hearing and cause the patient to imagine voices, music, and other sounds. Other types of seizures can cause confusion, upset stomach, or emotional distress.

Generalized Seizures

A generalized tonic-clonic (grand-mal) seizure begins with a loud cry before the person having the seizure loses consciousness and falls to the ground. The muscles become rigid for about 30 seconds during the tonic phase of the seizure and alternately contract and relax during the clonic phase, which lasts 30-60 seconds. The skin sometimes acquires a bluish tint and the person may bite his tongue, lose bowel or bladder control, or have trouble breathing.

A grand mal seizure lasts between two and five minutes, and the person may be confused or have trouble talking when he regains consciousness (post-ictal state). He may complain of head or muscle aches, or weakness in his arms or legs before falling into a deep sleep.

Signs and symptoms

The origin of 50-70% of all cases of epilepsy is unknown. Epilepsy sometimes is the result of trauma at birth. Such causes include insufficient oxygen to the brain; head injury; heavy bleeding or incompatibility between a woman's blood and the blood of her newborn baby; and infection immediately before, after, or at the time of birth.

Status epilepticus, a condition in which a person suffers from continuous seizures and may have trouble breathing, can be caused by:

- suddenly discontinuing anti-seizure medication
- hypoxic or metabolic encephalopathy (brain disease resulting from lack of oxygen or malfunctioning of other physical or chemical processes)
- acute head injury
- Blood infection caused by inflammation of the brain or the membranes that cover it

Medication

A combination of drugs may be needed to control some symptoms, but most patients who have epilepsy take one of the following medications:

- Dilantin (phenytoin)
- Tegretol (carbamazepine)
- Barbita (Phenobarbital)
- Mysoline (primidone)
- Depakene (valproic acid, sodium valproate)
- Klonopin (clonazepam)
- Zarontin (ethosuximide).

Dilantin, Tegretol, Barbita, and Mysoline are used to manage or control generalized tonic-clonic and complex partial seizures. Depakene, Klonopin, and Zarontin are prescribed for patients who have absence seizures. The less complicated the treatment, the more likely the patient will comply and better manage the seizure disorder.

First aid for seizures

A person having a seizure should not be restrained, but sharp or dangerous objects should be moved out of reach. Anyone having a complex partial seizure can be warned away from danger by someone calling his/her name in a clear, calm voice.

A person having a grand mal seizure should be helped to lie down. Tight clothing should be loosened. A soft, flat object like a towel or the palm of a hand should be placed under the person's head. Forcing a hard object into the mouth of someone having a grand mal seizure could cause injuries or breathing problems. Turning his head to the side will help him breathe. After a grand mal seizure has ended, the person who had the seizure should be told what has happened and reminded of where he is.

Dosage Calculations

Morphine: Use: Relief of moderate to severe acute and chronic pain; relief of pain of myocardial infarction; relief of dyspnea of acute left ventricular failure and pulmonary edema; pre-anesthetic medication. DepoDur™: Epidural (lumbar) single-dose management of surgical pain .

Dosage

Note: These are guidelines and do not represent the maximum doses that may be required in all patients. Doses should be titrated to pain relief/prevention.

Adults: Acute pain (moderate-to-severe):

I.V.— Initial: Opiate-naive: 2.5-5 mg every 3-4 hours; patients with prior opiate exposure may require higher initial doses. **Note:** Repeated doses (up to every 5 minutes if needed) in small increments (eg, 1-4 mg) may be preferred to larger and less frequent doses.

Administration—I.V: When giving morphine I.V. push, it is best to first dilute in 4-5 ml of sterile water, and then to administer slowly (e.g., 2-10 mg over 3-5 minutes)

Digoxin/LANOXIN is indicated for the treatment of mild to moderate heart failure. Lanoxin increases left ventricular ejection fraction and improves heart failure symptoms. Where possible, Lanoxin should be used with a diuretic and an angiotensin-converting enzyme inhibitor. Lanoxin is indicated for the control of ventricular response rate in patients with chronic atrial fibrillation and for patients with heart failure.

Dosage and Administration--Recommended dosages of Digoxin may require considerable modification because of individual sensitivity of the patient to the drug, the presence of associated conditions, or the use of concurrent medications.

Parenteral administration of Digoxin should be used only when the need for rapid digitalization is urgent or when the drug cannot be taken orally. Intramuscular injection can lead to severe pain at the injection site, thus intravenous administration is preferred. LANOXIN Injection can be administered undiluted or diluted with a 4-fold or greater volume of Sterile Water for Injection, 0.9% Sodium Chloride Injection, or 5% Dextrose Injection.

Dig toxicity—excessive slowing of the heart rate (less than 60 beats per minute) may be a sign of dig toxicity. Toxic effects on the heart may be life threatening. Other s/s of toxicity include fatigue, generalized muscle weakness, agitation, hallucinations, stupor, paresthesia, nausea, vomiting and cardiac arrhythmias. Monitor Digoxin level; therapeutic levels range from 0.8-2.0 ng/ml. Withhold this drug and contact physician.

Dilantin: NAME: phenytoin

BRAND NAME: Dilantin—Phenytoin is an oral and injectable anti-seizure medication first synthesized in 1908. Although it has been used in many conditions, Phenytoin's only approved use is as an anti-seizure medication (anticonvulsant), especially to prevent tonic-clonic (grand mal) seizures and complex partial seizures (psychomotor seizures). It may be used alone or with Phenobarbital or other anticonvulsants.

DOSING: The dosing of phenytoin is very patient- specific. It may be given once, twice, or three times daily. Doses are often adjusted to find the optimal dose, based on measurement of blood levels. Taking phenytoin with food may reduce some of the side effects. Elderly patients, debilitated persons, and patients with certain kidney or liver diseases may need lower doses. The suspension should not be given at the same time as tube feedings. Always flush the IV line with Normal Saline before and after administration as it will precipitate if the pH is altered.

DRUG INTERACTIONS: There are many potential drug interactions with phenytoin. Phenytoin can increase the metabolism (elimination) of many drugs, reducing their concentrations in the body. Drugs that may be affected include: Digoxin, carbamazepine, clonazepam, corticosteroids (e.g. prednisone), cyclosporine, disopyramide, doxycycline, estrogens, levodopa, lidocaine, methadone, oral contraceptives, quinidine, theophylline, and Warfarin. Phenytoin can interact with these drugs not only when it is added to therapy but also when it is discontinued. In the latter case, the concentration of the other drugs may increase.

SIDE EFFECTS: Many varied adverse effects can occur during phenytoin therapy including dizziness, drowsiness, difficulty focusing (vision), unsteady gait, tiredness, abnormal involuntary movements, nausea, vomiting, constipation, abdominal pain, and loss of appetite. If given IV, infiltration can cause tissue necrosis and sloughing. Stop immediately and administer antidote.

KCL--Generic Name: potassium chloride—Brand Names: , *K-Dur, K-Lor, K-Norm, K-Tab, Kaochlor, Kaon-Cl, Kato, Kay Ciel, Klor-Con,, Klotrix, Micro-K, Slow-K*

This product is a potassium supplement. KCL is used to prevent or treat low levels of potassium in the blood in patients who cannot take potassium by mouth. Low blood levels of potassium may be caused by "water pills" (diuretics), poor diet, or various medical conditions (e.g., severe diarrhea/vomiting, dialysis). It is important to have a normal level of potassium in the blood so that your cells, nerves, heart, muscles, and kidneys work properly. Low levels of potassium in the blood can result in serious side effects (e.g., irregular heartbeat, muscle cramps/weakness).

Indications and Dosage—normal range 3.5-5.0 mEq/l

- To prevent hypokalemia—Initially 20 mEq
- To treat hypokalemia—40-100 mEq daily.
- IV dose—40meq/L at 10meq/hour. Use only when oral replacement isn't feasible or when hypokalemia is life threatening.
- *Give by infusion only, never I.V. push or IM.* Give slowly as dilute solutions; if burning occurs during infusion decrease rate or dilute according to physician orders.
- **Adverse Reactions**
 - Paresthesia of limbs, listlessness, confusion, flaccid paralysis.
 - Arrhythmias, heart block, cardiac arrest.
 - Nausea, vomiting, abdominal pain, diarrhea

Antibiotics

Ancef--Cefazolin is an antibiotic used to treat a wide variety of bacterial infections. It may also be used before and during certain surgeries to help prevent infection. This medication is known as a cephalosporin antibiotic. It works by stopping the growth of bacteria. This antibiotic treats only bacterial infections. It will not work for viral infections (e.g., common cold, flu). Unnecessary use or misuse of any antibiotic can lead to its decreased effectiveness.

Gentamicin—Gentamicin sulfate is effective against *E. coli*. It often is used with ampicillin to treat people who have bacterial meningitis caused by group B streptococci.

Ampicillin and penicillin G are effective against many bacteria that cause meningitis, including *Listeria monocytogenes*, certain strains of *Streptococcus pneumoniae*, *Neisseria meningitidis*, and group B streptococcus.

Ceftriaxone and cefotaxime also are effective against many bacteria that cause meningitis, including most *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, and *Escherichia (E.) coli*.

Vancomycin is effective against many bacteria that are not killed by other antibiotics.

Side Effects-This medication may also infrequently cause loss of appetite, nausea, vomiting, diarrhea, or headache. If any of these effects persist or worsen, tell your doctor or physician promptly. Allergic reactions including skin rash, fever, and sometimes difficulty breathing.

Antibiotics used to treat bacterial meningitis usually are given into a vein (intravenous, or IV), 1 to 4 times a day. The number of days the medicine is given (between 7 and 21) depends on the bacteria causing the infection, the severity of the illness, the person's age, and whether the person is likely to develop severe meningitis or complications.

Penicillin and cefotaxime are two of the antibiotics most frequently used to treat meningitis. However, some bacteria (particularly *Streptococcus pneumoniae*) are becoming increasingly resistant to penicillin. As a result, doctors often combine different types of antibiotics to try to kill all bacteria. For infants older than 1 month, treatment may include vancomycin and cefotaxime or ceftriaxone. For infants younger than 1 month, vancomycin may be added to the usual treatment of ampicillin and cefotaxime or ceftriaxone.

Ciprofloxacin and Rifampin are often effective at preventing infection when they are given to people who have been exposed to certain bacteria that cause meningitis. Rifampin is the preferred medicine for children.

People who receive gentamicin sulfate or vancomycin need to be checked for hearing problems, low back pain, or less-than-expected amounts of urine. These medicines can cause hearing loss and kidney damage. Kidney damage usually clears up after the medicines are stopped.

People should take antibiotics only when they have a bacterial infection. Antibiotics do not kill viruses and other organisms. Because of the problem of resistance, people who take antibiotics when they do not have a bacterial infection may require stronger antibiotics for future bacterial infections.

Heparin

Anticoagulant therapy in prophylaxis and treatment of venous thrombosis and its extension;

Use a low-dose regimen for prevention of postoperative deep venous thrombosis and pulmonary embolism in patients undergoing major abdominothoracic surgery or who, for other reasons, are at risk of developing thromboembolic disease. Other uses are for prophylaxis and treatment of pulmonary embolism; atrial fibrillation with embolization; diagnosis and treatment of acute and chronic consumptive

coagulopathies (disseminated intravascular coagulation); prevention of clotting in arterial and cardiac surgery; prophylaxis and treatment of peripheral arterial embolism. Heparin may also be employed as an anticoagulant in blood transfusions, extracorporeal circulation, and dialysis procedures and in blood samples for laboratory purposes.

Dose and Administration

Parenteral drug products should be inspected visually for particulate matter and discoloration prior to administration, whenever solution and container permit. Slight discoloration does not alter potency.

Heparin should be given by intermittent intravenous injection, intravenous infusion, or deep subcutaneous. The intramuscular route of administration should be avoided because of the frequent occurrence of hematoma at the injection site.

The dosage of heparin sodium should be adjusted according to the patient's coagulation test results. When heparin is given by continuous intravenous infusion, the APTT should be determined approximately every 6 hours in the early stages of treatment. Dosage is considered adequate when the activated partial thromboplastin time (APTT) is 1.5 to 2 times normal or when the whole blood clotting time is elevated approximately 2.5 to 3 times the control value. After deep subcutaneous (intrafat) injections, tests for adequacy of dosage are best performed on samples drawn 4 to 6 hours after the injection.

Periodic platelet counts, hematocrits and tests for occult blood in stool are recommended during the entire course of heparin therapy, regardless of the route of administration.

Converting to Oral Anticoagulant

When an oral anticoagulant of the Coumadin or similar type is to be begun in patients already receiving heparin sodium, baseline and subsequent tests of prothrombin activity must be determined at a time when heparin activity is too low to affect the prothrombin time. This is about 5 hours after the last intravenous bolus and 24 hours after the last subcutaneous dose. If continuous IV heparin infusion is used, prothrombin time can usually be measured at any time.

In converting from heparin to an oral anticoagulant, the dose of the oral anticoagulant should be the usual initial amount and thereafter prothrombin time should be determined at the usual intervals. To ensure continuous anticoagulation, it is advisable to continue full heparin therapy for several days after the prothrombin time has reached the therapeutic range. Heparin therapy may then be discontinued without tapering.

Conversions and Calculations

Solids

1 milligram (mg) = 1000 micrograms (mcg)

1 gram (g) = 1000mg

1 kilogram (kg) = 1,000 g

Liquids

1 milliliter (ml) = 1 cubic centimeter (cc)
1ml = 1,000 microliter (mcl)
1 Liter =1,000 ml
1L =1,000 cc
1 grain (gr) = 60 mg

Temperature conversions

To convert (C) degrees to (F) degrees

Use the following equation

$$(C \times 1.8) + 32 = F$$

Example: 38 degree C times 1.8 is 68.4 plus 32 equals 100.4 degrees F.

To convert (F) to (C)

(F degrees – 32) divided by 1.8 = (C) degrees

Example: 98.6 F minus 32 is 66.8 divided by 1.8 equals C degrees.

Household to metric equivalents

1 teaspoon (tsp) =5 ml
1 tablespoon (tbs) =15 ml
1 ounce (oz) =30 ml
2 tbs =30 ml
1 oz.= 30g
1 pound (lb)=454 g
2.2 lb = 1 kg
1 inch = 2.54 centimeters (cm)

Basic Drug Calculations

$\frac{D \text{ (desired dose)}}{H \text{ (on-hand dose)}} \times \text{(Vehicle--- tablet, liquid)} = \text{amount to give}$

Example:

Drug dose ordered by the physician divided by the drug dose on the container; times the vehicle is equal to the amount to give (Keflex 1gm. P.O. bid; Drug available is 250 mg/capsule = amount to give is 4 capsules twice a day.

Calculating dosages and administration rates:

Concentration of solution in mg/ml = $\frac{\text{mg of drug}}{\text{ml of solution}}$

Example: $\frac{500\text{mg Ampicillin}}{100\text{ml of 0.9\% N}} = 5\text{mg/cc}$

Infusion rate in ml/hr= $\frac{\text{ml of solution}}{\text{hours to infuse}}$

Example: $\frac{1000 \text{ ml NS}}{6 \text{ hours}}$

$\text{Infuse over 6 hours} = 166.67 \text{ ml/Hr}$

Infusion rate in mg/min= $\frac{\text{mg of drug (times) ml/hr}}{\text{ml of solution}} \div 60$

Concentration of solution in mcg/ml= $\frac{\text{mg of drug divided by 1000}}{\text{ml of solution}}$

Infusion rate in mcg/kg/min= $\frac{\text{mcg of drug times kg times 60}}{\text{mcg/cc}}$

Infusion rate in gtts/minute= $\frac{\text{ml of solution times drip factor}}{\text{time in minutes}}$

Example: $\frac{1000 \times 10}{60} = 166.67 \text{ gtts/minute}$

*The drip factor = the number of drops per milliliter, is usually printed on the package.

*Macro drips range from 10-20 gts/ml

*Micro drips = 60 gts/ml

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