

FUNDAMENTALS OF PATHOPHYSIOLOGY

OBJECTIVE/RATIONAL

Pathophysiology is the study of physiological and functional changes occurring because of disease processes. It includes the study of cell and tissue changes associated with disease. The student will know the classification of diseases, and terms associated with the disease process.

TEKS 121.4 1I

TAKS ELA 1, 3, 4, 6
Science 1, 2, 3

National Science Education Standards F9-12

National Health Care Skills Standards .01, .02, .03, .05, .06, .07, .08, .09

National Curriculum Standards for School Mathematics S1; S3

KEY POINTS

1. Pathophysiology is the study of the function of disease.
2. Pathology is the study of the disease process.
3. Disease - a change in normal structure or function that leads to an abnormal state.
 - a. A disruption in homeostasis may result in a disease.
 - b. Predisposing factors such as age, gender, lifestyle, stress or environment may contribute to development of a disease.
4. Etiology - the cause of a disease.
 - a. idiopathic
 - b. iatrogenic
5. Pathogenesis is the development of a disease and the course of tissue changes that occur.
 - a. Development – acute vs. chronic
 - b. Stages of disease progression
 - c. Manifestations are the signs and symptoms of a disease that may be pathognomotic.
 - d. Convalescence is the period of recovery
6. Diagnosis is the process of identifying a disease.
7. Prognosis is the most likely outcome of the disease.
8. Treatment is therapeutic interventions taken to treat or attempt to cure disease.
9. Complications are additional problems that may occur during the course of the disease.
10. Sequelae is a potential outcome of the primary disease.
11. Disease classification
 - a. Inflammatory
 - b. Ischemic
 - c. Immunologic
 - d. Infectious

- e. Neoplastic
- f. Metabolic
- g. Nutritional
- h. Genetic
- i. Congenital defects

ACTIVITIES

- I. Research a specific disease, disorder or syndrome using the **Pathophysiology Project Guidelines**.
- II. In small group, **Case Scenario Project**.

MATERIALS/RESOURCES

Gould, Barbara E, Pathophysiology for Health-Related Professions. 1997. WB Saunders Company. ISBN 0-7216-5954-3

Burns, Mary V. Pathophysiology: A Self-Instructional Program 1998. Simon & Schuster Company. ISBN 0-8385-8084-X

ASSESSMENT

Oral Presentation Rubric

ACCOMODATIONS

For reinforcement, the student will make a poster to represent examples of disease classifications.

For enrichment, the student will prepare a disease-related case study. Present findings to the class using a multimedia presentation.

REFLECTIONS

Pathophysiology Project Guidelines

1. Choose a disease, disorder, syndrome of interest in the field of Pathophysiology.
2. Use a tri-board (science fair board) for the presentation.
3. Include the following information in the presentation:
 - Classification
 - Etiology
 - Predisposing factors
 - Pathogenesis
 - Clinical manifestations
 - Diagnostic test used to identify the disease
 - Prognosis
 - Course of the disease
 - Treatment and complications or sequelae
4. Present your project to the class. Use pictures, graphs, etc. to enhance the presentation.

Case Scenario Project

After reading the content information, research and prepare a group presentation about the scenario. Presentations should be creative and given as a group. (Use visuals, guest speakers, videos, actual patients, and/or other resources for presentations.) They should include information in each of the following categories:

- Science/Pathophysiology involved with the scenario
- Medical Terminology within the context including definitions
- Care givers involved in the scenario and a description of their normal job duties.
- Historical view of the injury or condition (what kinds of treatments were given in this type of situation in the past or was it ever treated or recognized)
- Future direction of treatment possibilities (experimental treatments or new technology)
- Legal/ethical components
- Psychosocial Aspects of the injury or condition
- Prevention/Health Maintenance of the injury or condition

Alcohol Poisoning

Brad, a 16 year old junior on the varsity football team, is partying with his friends following the football game on Friday night. Brad and several of his friends get ID's from their older brothers and go to the liquor store and purchase four cases of beer and several bottles of whiskey, vodka, and gin. This is Brad's first time out with the older guys on the team, and he is very confident that he can hold his liquor. Brad believes that at 5 feet 11 ½ inches and 180 pounds he can drink quite a bit and not have any trouble. Brad and his friends agree to meet at the home of a friend whose parents are away for the weekend. After several beers, Brad is very talkative and feels great about the game and the opportunity to be with the star players. He really feels that he has made it to the "big Leagues." Several of the guys, including Brad, start wrestling in the living room. It is great fun when no one can get up off the floor. Following several hours of drinking and multiple drinking games, Brad is having trouble standing, balancing, and talking. His friends continue to pour and help him with his drinks. Sometime around 1:00 AM, Brad's friends find him on the floor in the kitchen. They carry him into a bedroom to sleep it off.

Sometime around 2:00 AM, Shannon, Brad's girlfriend returning from another party, decides to say "hi" and shows up at the party. Brad's friends tell her he is sleeping it off in the next room. Shannon finds Brad in a pool of vomit, looking and sounding like something is wrong. Shannon is really scared. It takes several minutes for her to convince anyone that something is wrong, and many of his friends do not want to call anyone because they do not want to get into trouble. Brad's best friend finally calls Brad's brother at home and asks him to come over. When Brad's brother arrives, he tries to get Brad to his feet and then tries to shake him awake. Brad's brother calls 911 at around 3:30 AM.

When the ambulance arrives, they ask Bob what happened, and he tells them Brad as been drinking and he cannot get him to wake up. Brad is taken to the nearest hospital. Upon arrival in the emergency room, Brad arouses and is very agitated and appears crazy. Brad's behavior frightens both Bob and Shannon as they watch the health care team try to calm him down. A nurse takes Bob and Shannon into the waiting room and asks the following questions:

- What did he drink?
- How much did he drink?
- Does he regularly use alcohol?
- Does he use other drugs?

Shannon and Bob answer as many questions as they can.

The health care team working with Brad starts the following interventions:

- Phone Brad's parents.

- A physical examination of Brad, including vital signs, and an evaluation of his cardiac respiratory and neurological system.
- Obtain a blood specimen for determining the BAC and blood chemistry levels.
- Start an IV
- Apply oxygen
- Pad the bed and keep the rails up.
- Restrain Brad.

The team will start the detoxification process.

Brad's parents arrive at the emergency room. The admitting clerk pages the physician caring for Brad. The physician explains to Brad's parents what he knows about the circumstances leading up to Brad's arrival in the ER. He informs the parents of the care being given to Brad.

Hypothermia

Nathan and Paul are snowboarding in an “out of bounds” area. They find a fun jump and start daring each other to do trick jumping off it. They are having a great time until Paul tumbled end over end. He was clutching at his left leg screaming. With Nathan’s help, they remove the boot and push the pant leg over the knee. Paul’s lower leg is swelling, contused, with a small puncture type wound on the lateral side of his leg below the knee.

They try to walk out, but Paul cannot stand the pain. Nathan gives Paul his coat and goes for help.

One hour later, Nathan is back with help. Paul is cold, cyanotic lips and hands, and he is very confused. Hypothermia has set in on Paul. Swelling, confusion, pain, and a puncture wound are indicative of an open fracture, in this case a fractured tibia and fibula.

Search and Rescue arrive on the scene.

The paramedic does a head to toe assessment. He asks questions to ascertain the patient’s mental status, i.e., “Where are you?” “What day is this?” “Who is the president?” etc.

The paramedics note the pallor and coldness of Paul’s skin. Paul answers the questions slowly and is confused about what day it is. Paul complains of his leg hurting. Paul is wrapped in thermal blankets, his left leg is splinted with a cardboard splint to keep it immobile, a small dressing is taped over the puncture wound. Paul is then placed on a backboard with a cervical collar; then he is put in a wire basket for the trek out. Once in the ambulance, Paul’s wet clothes are removed, he is given warm fluids through an IV and he is put on the heart monitor every 15-20 minutes.

Paul will be examined for frostbite of his fingers, toes, ears, and nose.

At the emergency room, Paul is moved from the ambulance stretcher to the hospital stretcher. The paramedic gives a report to the nurse/doctor of the incident, patient condition, and injuries.

The nurse does another trauma assessment, takes vital signs including a core temperature. Paul’s temperature is 93 degrees Fahrenheit. Warmed blankets are piled on Paul to warm him, and the I.V. saline is exchanged for warmed saline. Paul’s foot is checked for a pulse (distal circulation). The open area (puncture) is cleaned with antiseptic (Betadine). Next the doctor comes in, he does another trauma assessment; he also asks many questions about mechanism of injury. Paul does not have any neck pain or back pain to palpation. The doctor orders x-rays of Paul’s leg and foot, a CBC for the patient’s crit and urine analysis, a culture swab is done of the open wound.

When the x-rays come back, a fractured tibia/fibula is discovered. An orthopedic specialist is called in. The leg is splinted with a fiber glass splint, and the patient is admitted and scheduled for the OR. The patient is also given I.V. antibiotics. The patient's hypothermia is closely monitored via vital signs and temperature.

Laceration

George, a 17 year old senior, was biking with two close friends. One half hour into the ride, George hit a rock and fell. Although stunned, he got up right away, laughing. His friend points to blood running down his leg from a gash. His hands, elbow, and thigh have surface abrasions, but are not bleeding.

George tries to pick up his bike and notices that his leg begins to bleed more as he moves around. So, George takes off his T-shirt and holds pressure on the gash. The wound continues to bleed. George ties the T-shirt over the gush and bikes about 5 minutes home.

At home, George washes the gash off in the bathtub and sees that the wound is still actively bleeding. George calls his mom at work who tells him to 1.) make sure the wound is rinsed clean, 2.) apply pressure with a clean towel, 3.) sit down and elevate his leg.

Mom calls back in 15 minutes, and George tells her that the bleeding has slowed down, but has soaked the towel. Mom comes home, looks at the gash, quickly wraps a new towel around the leg, yelling at George for not telling her how bad the gash really appeared. They get in the car and go to the Emergency Room.

George gets checked in at the Emergency Room, has his vital signs taken and is asked to take a seat. After 45 minutes, George and his mom are called in to an exam room. An Emergency Room Technician comes into the room to evaluate George's wound. George is asked to lie on the stretcher. Another set of vitals are taken.

The registered nurse comes into the room and instructs the technician in a 5 minute wash of the wound and the abrasions. He is asked about his relevant medical history. Washing the wound is rather uncomfortable and George is offered intramuscular pain medication. George decides to not take the pain shot. After the cleansing of the wound, the wound is covered with sterile cotton dressing and a pressure dressing is applied.

The physician comes into the room and examines the wound. The wound is actually quite deep but has managed to avoid severing any nerves or major blood vessels. A full exam of the extremities indicates the distal leg has good arterial supply, good capillary refill, and is warm. The injury is limited to the wound area.

The RN gives George an oral dose of antibiotics. George's mom is unsure when his last Tetanus shot was given. It is determined that the last shot may have been 8-10 years ago. A booster dose is given, intramuscularly, in George's arm.

The physician returns to the room after a 10 minute wait. Written instructions are explained to George's and his mom. The instructions inform them that the sutures are removed, the wound may be covered with a clean dressing, washed in the shower after 48

hours, and should be assessed every day for sign of infection. George is not allowed to swim, exercise heavily, or take tub baths.

The instructions include directions for taking the antibiotic and when to return to see the physician.

George and his mom leave the ER about three hours after their arrival. George is limping slightly but denies any discomfort other than the tape pulling on his skin. Later that evening, George tells his mom that his leg is sore and his arm aches where the shot was given.

Ten days later, George's mom takes him to the physician's office. After a very brief wait, the sutures are removed by the office nurse. The physician inspects the wound which has healed very well. George is released from their care without any restrictions on his activity. George does not experience any subsequent complications.

Seizure

Seventeen year old, Jeremy is walking to school with his friends. He is talking to his friends when suddenly he stops talking and walking. He stares straight ahead, and his lips begin to twitch. His friends stare at him. After 30 seconds, he shakes his head and continues walking.

Jeremy's friends begin telling him what happened and ask what his problem is. Jeremy states that he saw bright lights flashing. He remember nothing else. Jeremy's friends take him to see the school nurse. She asks Jeremy if he has missed any meals, is tired or stressed, or has missed taking any medication. Jeremy states that he has been feeling tired but thought it was because of his medicine, so he has not been taking it. The nurse recommends that he go see his physician to check his medication level.

Jeremy then calls his mother who picks him up from school and takes him to the doctor's office. There, they are greeted by a receptionist who asks them to fill out their insurance form and have a seat. The doctor will see them between appointments.

While waiting, a nurse comes out and takes Jeremy back to an examining room. A phlebotomist draws blood from a vein while the nurse checks his vital signs, does "neuron checks" and asks about the seizure (what happened before and after, how long it lasted, how often the seizures happen, and how long it takes him to return to normal afterward). Half an hour later, the physician comes in and tells Jeremy that his medication level is low and that is why he is having seizures again. She decides to increase Jeremy's medication. He will need to come in and be rechecked in one week.

The RN then comes in and explains to Jeremy how to take his new dose. She also explains the side effects and what symptoms to report. She goes over several pages of pre-printed educational material on seizures. She encourages Jeremy to wear a medical bracelet or carry an identification card. She discusses the complications of seizures.

Jeremy goes home, feels better, and has no seizures for two weeks. He then develops a cold. He wants to go camping over the weekend, and he knows that he cannot go if he is sick. His mother keeps some antibiotics in the refrigerator so he takes a few. He also takes some aspirin.

The next day, Jeremy has another seizure. He does not understand this because his medication was increased. He tells his mother, and she calls the doctor's office. The physician is off. A nurse practitioner is working this day. She gets a medical history of Jeremy's case and asks him about the cold. Jeremy remembers that he took some of his mother's antibiotic and some aspirin. The nurse explains how some drugs interact with each other and can cause increased or decreased levels in the blood. She gives Jeremy a list of drugs that interact with the medication he is on.

After one year, Jeremy has had no more seizure activity. He is taking his medication regularly, using coping techniques to avoid stress, practicing good health habits, and has

told a few good friends about his seizures and what they could do to help him if he has a seizure.

Snake Bite

Morgan, a 20 year old college student at Colorado University was mountain biking in the foothills near Morrison, Colorado. While stopped at the side of the trail to allow another rider to pass, he felt a sudden “electric shock” in his right ankle. He looked down and saw a 3-foot long rattle snake slither into the bush.

He felt a stinging, burning sensation radiating up his right leg. Just above his sock, he saw 2 small bleeding puncture wounds. Morgan realized that he had been bitten by a rattle snake.

By now, Morgan’s friends had realized something was wrong. His friend, Trent, who had taken first aid and wilderness courses rushed to his side. Knowing that time was of the essence, he instructed Morgan to remain calm and avoid excessive movement.

Trent told Morgan to sit on his bike but not to pedal. Another of Morgan’s friends pushed his bike back to the trailhead. A person in the parking lot with a cellular phone called 911.

Trent instructed Morgan to lie on the ground and remain calm. About 5 minutes later, an ambulance arrived. Morgan was placed on a stretcher and lifted into the ambulance.

In the ambulance, paramedics started an I.V. line and took Morgan’s vital signs. The ambulance arrived at the emergency room. Because he was very sick, Morgan was brought into the ER immediately.

The triage nurse noted that Morgan’s leg was very swollen. She took his vital signs and placed him in a room where he was hooked up to a heart monitor and a pulse oximeter which measures his oxygen level. She also made sure that his I.V. line was working.

The doctor came into the room and took a medical history and gave Morgan a physical. He confirmed that Morgan was bitten by a rattle snake and could tell by the puncture wounds and swelling that his condition was very serious. He orders blood tests to help further determine the severity of the snake bite.

Because the doctor determined that Morgan’s wound is severe, he ordered antivenin. The nurse carefully administered this through the I.V. line. Morgan began to feel relief shortly after the antivenin was given. The pain was less and the swelling in his leg began to go down.

His condition was stabilized, and he was admitted to the hospital. His condition was monitored to make sure that the snake bite would continue to resolve and that there was no reaction to the antivenin.

After one day in the hospital Morgan was discharged. After several days, his wound is almost completely healed.

Morgan follows up with his family doctor in one week to have his leg checked. This is to insure that the wound has healed properly and that there is no sign of infection.

Two weeks after the incident, Morgan was fully recovered, but it could be a long time before he goes to snake infested Morrison for a bike ride.