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## CHAPTER 10

# Vital Signs and Laboratory Reference Intervals

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### Priority Concepts

#### Cellular Regulation; Perfusion

##### I. Vital Signs

A. Description: Vital signs include temperature, pulse, respirations, blood pressure (BP), oxygen saturation (pulse oximetry), and pain assessment.

##### B. Guidelines for measuring vital signs

1. Initial measurement of vital signs provides baseline data on a client's health status and is used to help identify changes in the client's health status.



2. Some vital sign measurements (temperature, pulse, respirations, BP, pulse oximetry) may be delegated to assistive personnel (AP), but the nurse is responsible for interpreting the findings.

3. The nurse collaborates with the primary health care provider (PHCP) in determining the frequency of vital sign assessment and also makes independent decisions regarding their frequency on the basis of the client's status.



*The nurse ensures that vital sign measurements are documented correctly and always reports abnormal findings to the PHCP.*

##### C. When vital signs are measured

1. On initial contact with a client (e.g., when a client is admitted to a health care facility)
2. During physical assessment of a client
3. Before and after an invasive diagnostic procedure or surgical procedure
4. During the administration of medication that affects the cardiac, respiratory, or temperature-controlling

functions (e.g., in a client who has a fever); may be required before, during, and after administration of the medication

5. Before, during, and after a blood transfusion
6. Whenever a client's condition changes or the client verbalizes unusual feelings such as nonspecific symptoms of physical distress (i.e., feeling funny or different)
7. Whenever an intervention (e.g., ambulation) may affect a client's condition
8. When a fever or known infection is present (check vital signs every 2 to 4 hours)

## II. Temperature

### A. Description

1. Normal body temperature ranges from 36.4° to 37.5° Celsius (C) (97.5° to 99.5° Fahrenheit [F]); the average in a healthy young adult is 37.0° C (98.6° F).
2. Common measurement sites are the mouth, rectum (unless contraindicated), axilla, ear, and across the forehead (temporal artery site); various types of electronic measuring devices are commonly used to measure temperature.
3. Rectal temperatures are usually 1° F (0.5° C) higher and tympanic and axillary temperatures about 1° F (0.5° C) lower than the normal oral temperature.
4. Know how to convert a temperature to a Fahrenheit or Celsius value (Box 10-1).

### B. Nursing considerations

1. Time of day
  - a. Temperature is generally in the low-normal range at the time of awakening as a result of muscle inactivity.
  - b. Afternoon body temperature may be high-normal as a result of the metabolic process, activity, and environmental temperature.
2. Environmental temperature: Body temperature is lower in cold weather and higher in warm weather.
3. Age: Temperature may fluctuate during the first year of life because the infant's heat-regulating mechanism is not fully developed.
4. Physical exercise: Use of the large muscles creates heat, causing an increase in body temperature.
5. Menstrual cycle: Temperature decreases slightly just before ovulation but may increase to 1° F above normal during ovulation.
6. Pregnancy: Body temperature may consistently stay at high-normal because of an increase in the woman's

metabolic rate.

7. Stress: Emotions increase hormonal secretion, leading to increased heat production and a higher temperature.



8. Illness: Infective agents and the inflammatory

response may cause an increase in temperature.

9. The inability to obtain a temperature should not be ignored, because it could represent a condition of hypothermia, a life-threatening condition in very young and older clients.

### C. Methods of measurement

#### 1. Oral

- a. If the client has recently consumed hot or cold foods or liquids or has smoked or chewed gum, the nurse must wait 15 to 30 minutes before taking the temperature orally.
- b. The thermometer is placed under the tongue in one of the posterior sublingual pockets; ask the client to keep the tongue down and the lips closed and to not bite down on the thermometer.

#### 2. Rectal

- a. Place the client in the Sims' position.
- b. The temperature is taken rectally when an accurate temperature cannot be obtained orally or via other methods including by an electronic method, or when the client has nasal congestion, has undergone nasal or oral surgery or had the jaws wired, has a nasogastric tube in place, is unable to keep the mouth closed, or is at risk for seizures.
- c. The thermometer is lubricated and inserted into the rectum, toward the umbilicus, about 1.5 inches (3.8 cm) (no more than 0.5 inch [1.25 cm] in an infant).



*The temperature is not taken rectally in*

*cardiac clients; the client who has undergone rectal surgery; or the client with diarrhea, fecal impaction, or rectal bleeding or who is at risk for bleeding.*

#### 3. Axillary

- a. This method of taking the temperature

is used when the oral or other methods of temperature measurement are contraindicated.

- b. Axillary measurement is not as accurate as the oral, rectal, tympanic, or temporal artery method but is used when other methods of measurement are not possible.
- c. The thermometer is placed in the client's dry axilla, and the client is asked to hold the arm tightly against the chest, resting the arm on the chest; follow the instructions accompanying the measurement device for the amount of time the thermometer should remain in the axillary area.

#### 4. Tympanic



- a. The auditory canal is checked for the presence of redness, swelling, discharge, or a foreign body before the probe is inserted; the probe should not be inserted if the client has an inflammatory condition of the auditory canal or if there is discharge from the ear.
- b. The reading may be affected by an ear infection or excessive wax blocking the ear canal.

#### 5. Temporal artery

- a. Ensure that the client's forehead is dry.
- b. The thermometer probe is placed flush against the skin and slid across the forehead or placed in the area of the temporal artery and held in place.
- c. If the client is diaphoretic, the temporal artery thermometer probe may be placed on the neck, just behind the earlobe.

### III. Pulse

#### A. Description

1. Pulse is a palpable bounding of blood flow in a peripheral artery; it is an indirect indicator of circulatory status.
2. The average adult pulse (heart) rate is 60 to 100 beats per minute.
3. Changes in pulse rate are used to evaluate the client's tolerance of interventions such as ambulation,

- bathing, dressing, and exercise.
4. Pedal pulses are checked to determine whether the circulation is blocked in the artery up to that pulse point.
  5. When the pedal pulse is difficult to locate, a Doppler ultrasound stethoscope (ultrasonic stethoscope) may be needed to amplify the sounds of pulse waves.



#### B. Nursing considerations

1. The heart rate slows with age.
2. Exercise increases the heart rate.
3. Emotions stimulate the sympathetic nervous system, increasing the heart rate.
4. Pain increases the heart rate.
5. Increased body temperature causes the heart rate to increase.
6. Stimulant medications increase the heart rate; depressants and medications affecting the cardiac system slow it.
7. When the BP is low, the heart rate is usually increased.
8. Hemorrhage increases the heart rate.

#### C. Assessing pulse qualities

1. When the pulse is being counted, note the rate, rhythm, strength (force or amplitude), and equality.
2. Once you have checked these parameters, use the grading scale for pulses to assess the information you have elicited ([Box 10-2](#)).

#### D. Pulse points and locations

1. The temporal artery can be palpated anterior to or in the front of the ear.
2. The carotid artery is located in the groove between the trachea and the sternocleidomastoid muscle, medial to and alongside the muscle.
3. The apical pulse may be detected at the left midclavicular, fifth intercostal space.
4. The brachial pulse is located above the elbow at the antecubital fossa, between the biceps and triceps muscles.
5. The radial pulse is located in the groove along the radial or thumb side of the client's inner wrist.
6. The ulnar pulse is located on the medial side of the wrist (little finger side of the forearm at the wrist).
7. The femoral pulse is located below the inguinal ligament, midway between the symphysis pubis and the anterosuperior iliac spine.
8. The popliteal pulse is located behind the knee.
9. The posterior tibial pulse is located on the inner side of the ankle, behind and below the medial malleolus

- (ankle bone).
10. The dorsalis pedis pulse is located on the top of the foot, in line with the groove between the extensor tendons of the great and first toes.



*The apical pulse is counted for 1 full minute and is assessed in clients with an irregular radial pulse or a heart condition, before the administration of cardiac medications such as digoxin and beta blockers, and in children younger than 2 years.*

#### E. Pulse deficit

1. In this condition, the peripheral pulse rate (radial pulse) is less than the ventricular contraction rate (apical pulse).
2. A pulse deficit indicates a lack of peripheral perfusion; it can be an indication of cardiac dysrhythmias.
3. One-examiner technique: Auscultate and count the apical pulse first and then immediately count the radial pulse.
4. Two-examiner technique: One person counts the apical pulse and the other counts the radial pulse simultaneously.
5. A pulse deficit indicates that cardiac contractions are ineffective, failing to send pulse waves to the periphery.
6. If a difference in pulse rate is noted, the PHCP is notified.

### IV. Respirations

#### A. Description

1. Respiration is a mechanism the body uses to exchange gases between the atmosphere and the blood and between the blood and the cells.
2. Respiratory rates vary with age.
3. The normal adult respiratory rate is 12 to 20 breaths per minute.



#### B. Nursing considerations

1. Many of the factors that affect the pulse rate also affect the respiratory rate.
2. An increased level of carbon dioxide or a lower level of oxygen in the blood results in an increase in respiratory rate.
3. Head injury or increased intracranial pressure will depress the respiratory center in the brain, resulting in shallow respirations or slowed breathing.
4. Medications such as opioid analgesics depress respirations.
5. Additional factors that can affect the respiratory rate

include exercise, pain, anxiety, smoking, and body position.

### C. Assessing respiratory rate

1. Count the client's respirations after measuring the radial pulse. (Continue holding the client's wrist while counting the respirations or position the hand on the client's chest.)
2. One respiration includes both inspiration and expiration.
3. The rate, depth, pattern, and sounds are assessed.



*The respiratory rate may be counted for 30 seconds and multiplied by 2, except in a client who is known to be very ill or is exhibiting irregular respirations, in which case respirations are counted for 1 full minute.*

## V. Blood Pressure

### A. Description

1. Blood pressure (BP) is the force on the walls of an artery exerted by the pulsating blood under pressure from the heart.
2. The heart's contraction forces blood under high pressure into the aorta; the peak of maximum pressure when ejection occurs is the systolic pressure; the blood remaining in the arteries when the ventricles relax exerts a force known as the *diastolic pressure*.
3. The difference between the systolic and diastolic pressures is called the *pulse pressure*.
4. For an adult (age 18 years and older), a normal BP is a systolic pressure below 120 mm Hg and a diastolic pressure below 80 mm Hg.
5. Categories of hypertension ([Box 10-3](#)).
6. In postural (orthostatic) hypotension, a normotensive client exhibits symptoms and low BP on rising to an upright position.



7. To obtain orthostatic vital sign measurements, check the BP and pulse with the client supine, sitting, and standing; readings are obtained 1 to 3 minutes after the client changes position.

### B. Nursing considerations



#### 1. Factors affecting BP

- a. BP tends to increase as the aging process progresses.
- b. Stress results in sympathetic

- stimulation that increases the BP.
- c. The incidence of high BP is higher among African Americans than among Americans of European descent.
  - d. Antihypertensive medications and opioid analgesics can decrease BP.
  - e. BP is typically lowest in the early morning, gradually increases during the day, and peaks in the late afternoon and evening.
  - f. After puberty, males tend to have higher BP than females; after menopause, women tend to have higher BP than men of the same age.
  - g. Additional factors affecting the BP include smoking, activity, and body weight.

## 2. Guidelines for measuring BP

- a. Determine the best site for assessment.
- b. Avoid applying a cuff to an extremity into which intravenous (IV) fluids are infusing, where an arteriovenous shunt or fistula is present, on the side on which breast or axillary surgery has been performed, or on an extremity that has been traumatized or is diseased.
- c. The leg may be used if the brachial artery is inaccessible; the cuff is wrapped around the thigh and the stethoscope is placed over the popliteal artery.
- d. Ensure that the client has not smoked or exercised in the 30 minutes before measurement, because both activities can yield falsely high readings.
- e. Have the client assume a sitting (with feet flat on floor) or lying position and then rest for 5 minutes before the measurement; ask the client not to speak during the measurement.
- f. Ensure that the cuff is fully deflated, then wrap it evenly and snugly around the extremity.
- g. Ensure that the stethoscope being used fits the examiner and does not impair hearing.
- h. Document the first Korotkoff sound at



phase 1 (heard as the blood pulsates through the vessel when air is released from the BP cuff and pressure on the artery is reduced) as the systolic pressure, and the beginning of the fifth Korotkoff sound at phase 5 as the diastolic pressure.

- i. BP readings obtained electronically with a vital sign monitoring machine should be checked with a manual cuff if there is any concern about the accuracy of the reading.



*When taking a BP, select the appropriate cuff size; a cuff that is too small will yield a falsely high reading, and a cuff that is too large will yield a falsely low one.*

## VI. Pulse Oximetry

### A. Description

1. Pulse oximetry is a noninvasive test that registers the oxygen saturation of the client's hemoglobin.
2. The capillary oxygen saturation ( $Sa_{O_2}$ ) is recorded as a percentage.
3. The normal value is 95% to 100%.
4. After a hypoxic client uses up the readily available oxygen (measured as the arterial oxygen pressure,  $Pa_{O_2}$ , on arterial blood gas [ABG] testing), the reserve oxygen—that is, oxygen attached to the hemoglobin ( $Sa_{O_2}$ )—is drawn on to provide oxygen to the tissues.
5. A pulse oximeter reading can alert the nurse to hypoxemia before clinical signs occur.
6. If pulse oximetry readings are below normal, instruct the client in deep breathing technique and recheck the pulse oximetry.

### B. Nursing Considerations

1. A vascular, pulsatile area, such as the fingertip or earlobe, is needed to detect the degree of change in the transmitted light that measures the oxygenated and deoxygenated hemoglobin.
2. Factors that affect light transmission also affect the measurement of  $SpO_2$ .
3. Some factors that affect light transmission can include sensor movement, fingernail polish, hypotension, anemia, or peripheral vascular disorders.



### C. Procedure

1. A sensor is placed on the client's finger, toe, nose, earlobe, or forehead to measure oxygen saturation, which then is displayed on a monitor.
2. Do not select an extremity with an impediment to blood flow.



*A usual pulse oximetry reading is between 95% and 100%. A*

*pulse oximetry reading lower than 90% necessitates PHCP notification; values below 90% are acceptable only in certain chronic conditions. Agency procedures and PHCP prescriptions are followed regarding actions to take for specific readings.*

## VII. Pain

### A. Types of pain

1. Acute/transient pain: Usually associated with an injury, medical condition, or surgical procedure; lasts hours to a few days
2. Chronic/persistent noncancer pain: Usually associated with long-term or chronic illnesses or disorders; may continue for months or even years
3. Chronic/episodic pain: Occurs sporadically over an extended period of time. Pain episodes last for hours, days, or weeks. Examples are migraine headaches and pain related to sickle cell crisis.
4. Cancer pain: Not all people with cancer have pain. Some have acute and/or chronic pain. Cancer pain is usually caused by tumor progression and related pathological processes, invasive procedures, treatment toxicities, infection, and physical limitations.
5. Idiopathic pain: This is a chronic pain in the absence of an identifiable physical or psychological cause or pain perceived as excessive for the extent of an organic pathological condition.



### B. Assessment

1. Pain is a highly individual experience.
2. Ask the client to describe pain in terms of timing, location, severity, quality, aggravating and precipitating factors, and relief measures.
3. Ask the client about the use of complementary and alternative therapies to alleviate pain.
4. Pain experienced by the older client may be manifested differently than pain experienced by members of other age groups (e.g., sleep disturbances, changes in gait and mobility, decreased socialization, depression).
5. Clients with cognitive disorders (e.g., a client with

- dementia, a comatose client) may not be able to describe their pain experiences.
6. The nurse should be alert to nonverbal indicators of pain (Box 10-4).
  7. Ask the client to use a number-based pain scale (a picture-based scale may be used in children or clients who cannot verbally describe their pain) to rate the degree of pain (Fig. 10-1).
  8. Evaluate client response to nonpharmacological interventions.



*Consider the client's culture and spiritual and religious beliefs*

*in assessing pain; some cultures frown on the outward expression of pain.*

### C. Conventional nonpharmacological interventions

1. Cutaneous stimulation
  - a. Techniques include heat, cold, and pressure and vibration. Therapeutic touch and massage are also cutaneous stimulation and may be considered complementary and alternative techniques.
  - b. Such treatments may require a PHCP's prescription.
2. Transcutaneous electrical nerve stimulation (TENS)
  - a. TENS is also referred to as *percutaneous electrical nerve stimulation (PENS)*.
  - b. This technique, which may require a PHCP's prescription, involves the application of a battery-operated device that delivers a low electrical current to the skin and underlying tissues to block pain (some similar units can be purchased without a prescription).
3. Binders, slings, and other supportive devices
  - a. Cloths or other materials or devices, wrapped around a limb or body part, can ease the pain of strains, sprains, and surgical incisions.
  - b. Some devices may require a PHCP's prescription.
  - c. Elevation of the affected body part is another intervention that can reduce swelling; supporting an extremity on a pillow may lessen discomfort.
4. Heat and cold

- a. The application of heat and cold or alternating application of the two can soothe pain resulting from muscle strain; cold reduces swelling.
- b. In some conditions, such treatment may require a PHCP's prescription.
- c. Heat applications may include warm-water compresses, warm blankets, thermal pads, and tub and whirlpool baths.



d. The temperature of the

application must be monitored carefully to help prevent burns; the skin of very young and older clients is extra sensitive to heat.



e. The client should be advised to

remove the source of heat or cold if changes in sensation or discomfort occur. If the change in sensation or discomfort is not relieved after removal of the application, the PHCP should be notified.



*Ice or heat should be applied with a towel*

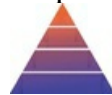
*or other barrier between the pack and the skin but should not be left in place for more than 15 to 30 minutes.*

#### D. Complementary and alternative therapies

1. Description: Therapies are used in addition to conventional treatment to provide healing resources and focus on the mind-body connection (Box 10-5).

##### 2. Nursing considerations

a. Some complementary and alternative therapies require a PHCP's prescription.



b. Herbal remedies are considered

pharmacological therapy by some PHCPs; because of the risk for interaction with prescription medications, it is important that the nurse ask the client about the use of such therapies.

c. If cultural or spiritual measures are to

be employed, the nurse must elicit from the client the preferred forms of spiritual expression and learn when they are practiced so that they may be integrated into the plan of care.

## VIII. Pharmacological Interventions

### A. Nonopioid analgesics

#### 1. Nonsteroidal antiinflammatory drugs (NSAIDs) and acetylsalicylic acid (aspirin) (Box 10-6)

- a. These medication types are contraindicated if the client has gastric irritation or ulcer disease or an allergy to the medication.
- b. Bleeding is a concern with the use of these medication types.
- c. Instruct the client to take oral doses with milk or a snack to reduce gastric irritation.
- d. NSAIDs can amplify the effects of anticoagulants.
- e. Hypoglycemia may result for the client taking ibuprofen if the client is concurrently taking an oral antidiabetic agent.
- f. A high risk of toxicity exists if the client is taking ibuprofen concurrently with a calcium channel blocker.

#### 2. Acetaminophen

- a. Acetaminophen, commonly known as Tylenol, is contraindicated in clients with hepatic or renal disease, alcoholism, or hypersensitivity.
- b. Assess the client for a history of liver dysfunction.
- c. Monitor the client for signs of hepatic damage (e.g., nausea and vomiting, diarrhea, abdominal pain).
- d. Monitor liver function parameters.
- e. Tell the client that self-medication should not continue longer than 10 days in an adult or 5 days in a child because of the risk of hepatotoxicity.
- f. The antidote to acetaminophen is acetylcysteine.



*The major concern with acetaminophen is*

*hepatotoxicity.*

## B. Opioid analgesics

### 1. Description

- a. These medications suppress pain impulses but can also suppress respiration and coughing by acting on the respiratory and cough center, located in the medulla of the brainstem.
- b. Review the client's history and note that clients with impaired renal or liver function may only be able to tolerate low doses of opioid analgesics; also assess for allergy.
- c. Intravenous route administration produces a faster effect than other routes, but the effect lasts shorter to relieve pain.
- d. Opioids, which produce euphoria and sedation, can cause physical dependence.
- e. Administer the medication 30 to 60 minutes before painful activities.



- f. Monitor the respiratory rate; if it is slower than 12 breaths per minute in an adult, withhold the medication and notify the PHCP.
- g. Monitor the pulse; if bradycardia develops, withhold the medication and notify the PHCP.
- h. Monitor the BP for hypotension and assess before administering pain medications to decrease the risk of adverse effects.
- i. Auscultate the lungs for normal breath sounds.
- j. Encourage activities such as turning, deep breathing, and incentive spirometry to help prevent atelectasis and pneumonia.
- k. Monitor the client's level of consciousness.
- l. Initiate safety precautions.
- m. Monitor intake and output and assess the client for urine retention; also constipation is common with opioid use.

- n. Instruct the client to take oral doses with milk or a snack to reduce gastric irritation.
- o. Instruct the client to avoid activities that require alertness.
- p. Assess the effectiveness of the medication 30 minutes after administration.



q. Have an opioid antagonist (e.g., naloxone), oxygen, and resuscitation equipment available.

- r. In many states, prescriptions for opioid analgesics can be given in only very specific circumstances, and a consent form needs to be obtained from the prescribing provider. Frequent collaboration between the nurse and the provider on continued need for this type of medication should be done.



*An electronic infusion device is always used for continuous or dose-demand IV infusion of opioid analgesics.*

## 2. Codeine sulfate

- a. This medication is also used in low doses as a cough suppressant.



b. It may cause constipation.

- c. Common medications in this class are hydrocodone and oxycodone (synthetic forms).

## 3. Hydromorphone



a. The primary concern is respiration depression.

- b. Other effects include drowsiness, dizziness, and orthostatic hypotension.
- c. Monitor vital signs, especially the respiratory rate and BP.

## 4. Morphine sulfate

- a. Used to ease acute pain resulting from myocardial infarction or cancer, for dyspnea resulting from pulmonary edema, and as a preoperative medication.



b. The major concern is respiratory

depression, but postural hypotension, urine retention, constipation, and pupillary constriction may also occur; monitor the client for adverse effects.



c. Morphine may cause nausea and

vomiting by increasing vestibular sensitivity.

d. It is contraindicated in severe respiratory disorders, head injuries, severe renal disease, or seizure activity and in the presence of increased intracranial pressure.

e. Monitor the client for urine retention.

f. Monitor bowel sounds for decreased peristalsis; constipation may occur.

g. Monitor the pupil for changes; pinpoint pupils may indicate overdose.

## IX. Laboratory Reference Intervals

For reference throughout the chapter, see [Fig. 10-2](#).

A. Methods for drawing blood ([Table 10-1](#))

### B. Serum sodium

1. A major cation of extracellular fluid
2. Maintains osmotic pressure and acid-base balance, and assists in the transmission of nerve impulses
3. Is absorbed from the small intestine and excreted in the urine in amounts dependent on dietary intake
4. Normal reference interval: 135 to 145 mEq/L (135 to 145 mmol/L)



5. Elevated values occur in the

following: dehydration, impaired renal function, increased dietary or IV intake of sodium, primary aldosteronism, use of corticosteroid therapy

6. Below normal values occur in the following: Addison's disease, decreased dietary of sodium, diabetic ketoacidosis, diuretic therapy, excessive loss from the gastrointestinal (GI) tract, excessive perspiration, water intoxication





*Drawing blood specimens from an extremity*

*in which an IV solution is infusing can produce an inaccurate result, depending on the test being performed and the type of solution infusing. Prolonged use of a tourniquet before venous sampling can increase the blood level of potassium, producing an inaccurate result.*



### C. Serum **potassium**

1. A major intracellular cation, potassium regulates cellular water balance, electrical conduction in muscle cells, and acid-base balance.
2. The body obtains potassium through dietary ingestion and the kidneys preserve or excrete potassium, depending on cellular need.



3. Potassium levels are used to evaluate cardiac function, renal function, gastrointestinal function, and the need for IV replacement therapy.
4. If the client is receiving a potassium supplementation, this needs to be noted on the laboratory form.
5. Normal reference interval: 3.5 to 5.0 mEq/L (3.5 to 5.0 mmol/L)
6. Elevated values occur in the following: acute kidney injury or chronic kidney disease, Addison's disease, dehydration, diabetic ketoacidosis, excessive dietary or IV intake of potassium, massive tissue destruction, metabolic acidosis
7. Below normal values occur in the following: Burns, Cushing's syndrome, deficient dietary intake of potassium, diarrhea (severe), diuretic therapy, GI fistula, insulin administration, pyloric obstruction, starvation, vomiting
8. Clients with elevated white **blood cell** (WBC) counts and platelet counts may have falsely elevated potassium levels.

### D. Activated partial thromboplastin time (aPTT)

1. The aPTT evaluates how well the coagulation sequence (intrinsic clotting system) is functioning by measuring the amount of time it takes in seconds for recalcified citrated **plasma** to clot after partial thromboplastin is added to it.
2. The test screens for deficiencies and inhibitors of all factors, except factors VII and XIII.



3. Usually, the aPTT is used to monitor the effectiveness of heparin therapy and screen for

- coagulation disorders.
4. Normal reference interval: 30 to 40 seconds (conventional and SI units [International System of Units]), depending on the type of activator used.
  5. If the client is receiving intermittent heparin therapy, draw the **blood** sample 1 hour before the next scheduled dose.
  6. Do not draw samples from an arm into which heparin is infusing.
  7. Transport specimen to the laboratory immediately.
  8. Provide direct pressure to the **venipuncture** site for 3 to 5 minutes.
  9. The aPTT should be between 1.5 and 2.5 times normal when the client is receiving heparin therapy.
  10. Elevated values occur in the following: Deficiency of one or more of the following: factor I, II, V, or VIII; factors IX and X; factor XI; and factor XII; hemophilia; heparin therapy; liver disease



*If the aPTT value is prolonged (longer than 100 seconds or per agency policy) in a client receiving IV heparin therapy or in any client at risk for thrombocytopenia, initiate bleeding precautions.*

- E. Prothrombin time (PT) and international normalized ratio (INR)
1. Prothrombin is a vitamin K–dependent glycoprotein produced by the liver that is necessary for fibrin clot formation.
  2. Each laboratory establishes a normal or control value based on the method used to perform the PT test.
  3. The PT measures the amount of time it takes in seconds for clot formation and is used to monitor response to warfarin sodium therapy or to screen for dysfunction of the extrinsic clotting system resulting from liver disease, vitamin K deficiency, or disseminated intravascular coagulation.
  4. A PT value within 2 seconds (plus or minus) of the control is considered normal.
  5. The INR is a frequently used test to measure the effects of some anticoagulants.
  6. The INR standardizes the PT ratio and is calculated in the laboratory setting by raising the observed PT ratio to the power of the international sensitivity index specific to the thromboplastin reagent used.
  7. If a PT is prescribed, baseline specimen should be drawn before anticoagulation therapy is started; note the time of collection on the laboratory form.
  8. Provide direct pressure to the venipuncture site for 3 to 5 minutes.

9. Concurrent warfarin therapy with heparin therapy can lengthen the PT for up to 5 hours after dosing.



10. Diets high in green leafy vegetables can

increase the absorption of vitamin K, which shortens the PT.



11. Orally administered anticoagulation therapy

usually maintains the PT at 1.5 to 2 times the laboratory control value.

12. Normal reference intervals

a. PT: 11 to 12.5 seconds (conventional and SI units)

b. INR: 0.81 to 1.20 (conventional and SI units)

13. For both the PT and INR, elevated values occur in the following: deficiency of one or more of the following: factor I, II, V, VII, or X; liver disease; vitamin K deficiency; warfarin therapy



*If the PT value is longer than 25 seconds and the INR is*

*greater than 3.0 in a client receiving standard warfarin therapy (or per agency policy), initiate bleeding precautions.*

#### F. Platelet count

1. Platelets function in hemostatic plug formation, clot retraction, and coagulation factor activation.
2. Platelets are produced by the bone marrow to function in hemostasis.
3. Normal reference interval: 150,000 to 400,000 mm<sup>3</sup> (150 to 400 × 10<sup>9</sup>/L)
4. Elevated values occur in the following: acute infections, chronic granulocytic leukemia, chronic pancreatitis, cirrhosis, collagen disorders, polycythemia, postsplenectomy; high altitudes and chronic cold weather can increase values.
5. Below normal values occur in the following: acute leukemia, chemotherapy, disseminated intravascular coagulation, hemorrhage, infection, systemic lupus erythematosus, thrombocytopenic purpura.
6. Monitor the venipuncture site for bleeding in clients with known thrombocytopenia.
7. Bleeding precautions should be instituted in clients when the platelet count falls sufficiently below the normal level; the specific value for implementing bleeding precautions usually is determined by agency policy.



*Monitor the platelet count closely in clients receiving*

*chemotherapy because of the risk for thrombocytopenia. In addition, any client who will be having an invasive procedure (such as a liver biopsy or thoracentesis) should have coagulation studies and platelet counts done before the procedure.*

## G. Hemoglobin and hematocrit



1. Hemoglobin is the main component of erythrocytes and serves as the vehicle for transporting oxygen and carbon dioxide.
2. Hematocrit represents red blood cell (RBC) mass and is an important measurement in the presence of anemia or polycythemia ([Table 10-2](#)).
3. Fasting is not required for this test.
4. Elevated values occur in the following:
  - a. Hemoglobin: chronic obstructive pulmonary disease, high altitudes, polycythemia
  - b. Hematocrit: dehydration, high altitudes, polycythemia
5. Below normal values occur in the following:
  - a. Hemoglobin: anemia, hemorrhage
  - b. Hematocrit: anemia, bone marrow failure, hemorrhage, leukemia, overhydration

## H. Lipids

1. Blood lipids consist primarily of cholesterol, triglycerides, and phospholipids.
2. Lipid assessment includes total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides.
3. Cholesterol is present in all body tissues and is a major component of LDLs, brain and nerve cells, cell membranes, and some gallbladder stones.
4. Low-density lipoprotein (LDL) transports cholesterol from the liver to the tissues of the body.
5. Triglycerides are synthesized in the liver from fatty acids, protein, and glucose and are obtained from the diet.
6. Increased cholesterol levels, LDL levels, and triglyceride levels place the client at risk for coronary artery disease.
7. HDL helps protect against the risk of coronary artery disease.
8. Instruct the client to abstain from food and fluid, except for water, for 12 to 14 hours and from alcohol for 24 hours before the test.

9. Instruct the client to avoid consuming high-cholesterol foods with the evening meal before the test.
10. Normal reference intervals ([Table 10-3](#)).
11. Elevated values occur in the following:
  - a. Cholesterol, LDL: biliary obstruction, cirrhosis hyperlipidemia, hypothyroidism, idiopathic hypercholesterolemia, renal disease, uncontrolled diabetes, oral contraceptive use
  - b. Triglycerides: diabetes mellitus, hyperlipidemia, hypothyroidism, liver disease
12. Below normal values occur in the following:
  - a. Cholesterol, LDL: extensive liver disease, hyperthyroidism, malnutrition, use of corticosteroid therapy
  - b. Triglycerides: hyperthyroidism, malabsorption syndrome, malnutrition

#### I. Fasting **blood** glucose

1. Glucose is a monosaccharide found in fruits and is formed from the digestion of carbohydrates and the conversion of glycogen by the liver.
2. Glucose is the main source of cellular energy for the body and is essential for brain and erythrocyte function.
3. Fasting blood glucose levels are used to help diagnose diabetes mellitus and hypoglycemia.
4. Instruct the client to fast for 8 to 12 hours before the test.
5. Instruct a client with diabetes mellitus to withhold morning insulin or oral hypoglycemic medication until after the blood is drawn.
6. Normal reference interval: glucose (fasting) 70-99 mg/dL (3.9-5.5 mmol/L).
7. Elevated values occur in the following: acute stress, cerebral lesions, Cushing's syndrome, diabetes mellitus, hyperthyroidism, pancreatic insufficiency
8. Below normal values occur in the following: Addison's disease, hepatic disease, hypothyroidism, insulin overdose, pancreatic tumor, pituitary hypofunction, postdumping syndrome



#### J. Glycosylated hemoglobin (HgbA1C)

1. HgbA1C is blood glucose bound to hemoglobin.
2. Hemoglobin A<sub>1c</sub> (glycosylated hemoglobin A; HbA<sub>1c</sub>)

is a reflection of how well blood glucose levels have been controlled for the past 3 to 4 months.

3. Fasting is not required before the test.
4. Normal reference interval: <6% (adult without diabetes).
5. Elevated values occur in the following: nondiabetic hyperglycemia, poorly controlled diabetes mellitus
6. Below normal values occur in the following: chronic blood loss, chronic kidney disease, pregnancy, sickle cell anemia
7. HgbA1C and estimated average glucose (eAG) reference intervals ([Table 10-4](#))

#### K. Renal function studies



##### 1. Serum creatinine

- a. Creatinine is a specific indicator of renal function.
- b. Increased levels of creatinine indicate a slowing of the glomerular filtration rate.
- c. Instruct the client to avoid excessive exercise for 8 hours and excessive red meat intake for 24 hours before the test.
- d. Normal reference interval: Male: 0.6 to 1.2 mg/dL (53 to 106  $\mu\text{mol/L}$ ); female: 0.5 to 1.1 mg/dL (44 to 97  $\mu\text{mol/L}$ )
- e. Elevated values occur in severe renal disease.
- f. Below normal values occur in diseases with decreased muscle mass such as muscular dystrophy and myasthenia gravis.



##### 2. Blood urea nitrogen (BUN)

- a. Urea nitrogen is the nitrogen portion of urea, a substance formed in the liver through an enzymatic protein breakdown process.
- b. Urea is normally freely filtered through the renal glomeruli, with a small amount reabsorbed in the tubules and the remainder excreted in the urine.
- c. BUN and creatinine ratios should be analyzed when renal function is evaluated.
- d. Normal reference interval: 10 to

20 mg/dL (3.6 to 7.1 mmol/L)

- e. Elevated levels indicate a slowing of the glomerular filtration rate.
- f. Elevated values occur in the following: burns, dehydration, GI bleeding, increase in protein catabolism (fever, stress), renal disease, shock, urinary tract infection
- g. Below normal values occur in the following: fluid overload, malnutrition, severe liver damage, syndrome of inappropriate antidiuretic hormone

#### L. White blood cell (WBC) count

1. WBCs function in the immune defense system of the body.
2. The WBC differential provides specific information on WBC types.
3. A “shift to the left” (in the differential) means that an increased number of immature neutrophils is present in the blood.
4. A low total WBC count with a left shift indicates a recovery from bone marrow depression or an infection of such intensity that the demand for neutrophils in the tissue is higher than the capacity of the bone marrow to release them into the circulation.
5. A high total WBC count with a left shift indicates an increased release of neutrophils by the bone marrow in response to an overwhelming infection or inflammation.
6. An increased neutrophil count with a left shift is usually associated with bacterial infection.
7. A “shift to the right” means that cells have more than the usual number of nuclear segments; found in liver disease, Down’s syndrome, and megaloblastic and pernicious anemia.
8. Normal reference interval: 5000 to 10,000 mm<sup>3</sup> (5.0 to 10.0 × 10<sup>9</sup>/L)
9. Elevated values occur in the following: inflammatory and infectious processes, leukemia
10. Below normal values occur in the following: aplastic anemia, autoimmune diseases, overwhelming infection, side effects of chemotherapy and irradiation



*Monitor the WBC count and differential closely in clients receiving chemotherapy because of the risk for neutropenia;*

neutropenia places the client at risk for infection.

### Box 10-1

## Body Temperature Conversion

**To convert Fahrenheit to Celsius:** Degrees Fahrenheit  $- 32 \times 5/9 =$  Degrees Celsius

**Example:**  $98.2^{\circ} \text{ F} - 32 \times 5/9 = 36.7^{\circ} \text{ C}$

**To convert Celsius to Fahrenheit:** Degrees Celsius  $\times 9/5 + 32 =$  Degrees Fahrenheit

**Example:**  $38.6^{\circ} \text{ C} \times 9/5 + 32 = 101.5^{\circ} \text{ F}$

### Box 10-2

## Grading Scale for Pulses

- 4 + = Strong and bounding
- 3 + = Full pulse, increased
- 2 + = Normal, easily palpable
- 1 + = Weak, barely palpable
- 0 = Absent, not palpable

### Box 10-3

## Hypertension Categories and Guidelines

### Categories

**Normal:** Less than 120/80 mm Hg

**Elevated:** Systolic between 120-129 mm Hg *and* diastolic less than 80 mm Hg

**Stage 1:** Systolic between 130-139 mm Hg *or* diastolic between 80-89 mm Hg

**Stage 2:** Systolic at least 140 mm Hg *or* diastolic at least 90 mm Hg

**Hypertensive crisis:** Systolic over 180 mm Hg *and/or* diastolic over 120 mm Hg, with clients needing prompt changes in medication if there are no other indications of problems, or immediate hospitalization if there are signs of organ damage.

### Guidelines

- Using proper technique to measure blood pressure.
- Use of home blood pressure monitoring using validated devices.
- Appropriate training of health care providers to reveal *white-coat hypertension*.
- Only prescribing medication for stage I hypertension if a client has already had a cardiovascular event such as a heart attack or stroke or is at high risk for heart attack or stroke based on age, the presence of diabetes mellitus, chronic kidney



disease, or calculation of atherosclerotic risk (using the same risk calculator used in evaluating high cholesterol).

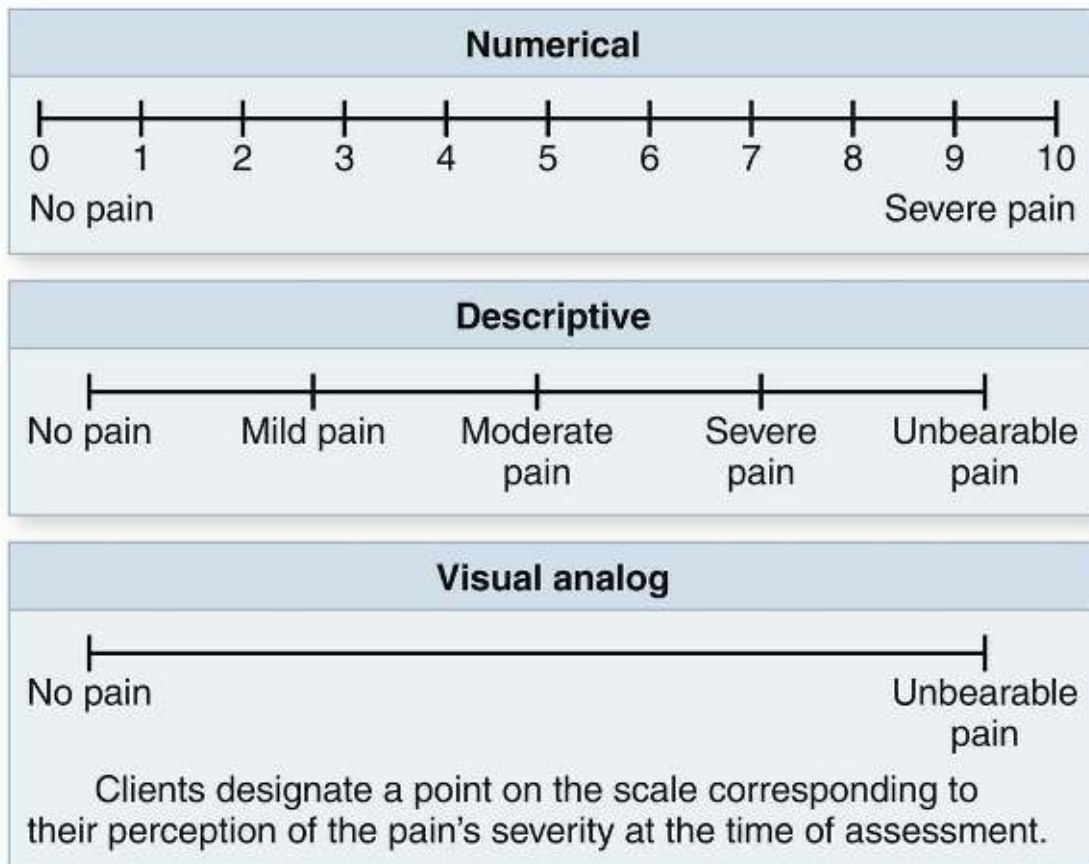
- Recognizing that many people will need two or more types of medications to control their blood pressure, and that people may take their pills more consistently if multiple medications are combined into a single pill.
- Identifying socioeconomic status and psychosocial stress as risk factors for high blood pressure that should be considered in a client's plan of care.

From American College of Cardiology, 2017, New ACC/AHA High Blood Pressure Guidelines Lower Definition of Hypertension. <http://www.acc.org/latest-in-cardiology/articles/2017/11/08/11/47/mon-5pm-bp-guideline-aha-2017>

#### **Box 10-4**

### **Nonverbal Indicators of Pain**

- Moaning
- Crying
- Irritability
- Restlessness
- Grimacing or frowning
- Inability to sleep
- Rigid posture
- Increased blood pressure, heart rate, or respiratory rate
- Nausea
- Diaphoresis
- Use of the FLACC® (face, legs, activity, cry, consolability) scale or FACES® pain scale are appropriate in clients who cannot communicate their pain verbally.



A



B

**FIG. 10-1** Pain assessment scales. **A**, Numerical, descriptive, and visual analog scales. **B**, Wong-Baker FACES® Pain Rating Scale. (B, Copyright 1983, Wong-Baker FACES® Foundation, [www.WongBakerFACES.org](http://www.WongBakerFACES.org). Used with permission. Originally published in *Whaley & Wong's Nursing Care of Infants and Children*. ©Elsevier Inc.)

### Box 10-5

## Complementary and Alternative Therapies

Acupuncture and acupressure  
Biofeedback  
Chiropractic manipulation

Distraction techniques  
Guided imagery and meditation techniques  
Herbal therapies  
Hypnosis  
Laughter and humor  
Massage  
Relaxation and repositioning techniques  
Spiritual measures (e.g., prayer, use of a rosary or prayer beads, reading of scripture)  
Therapeutic touch

### **Box 10-6**

## **Side and Adverse Effects of NSAIDs and Acetylsalicylic Acid**

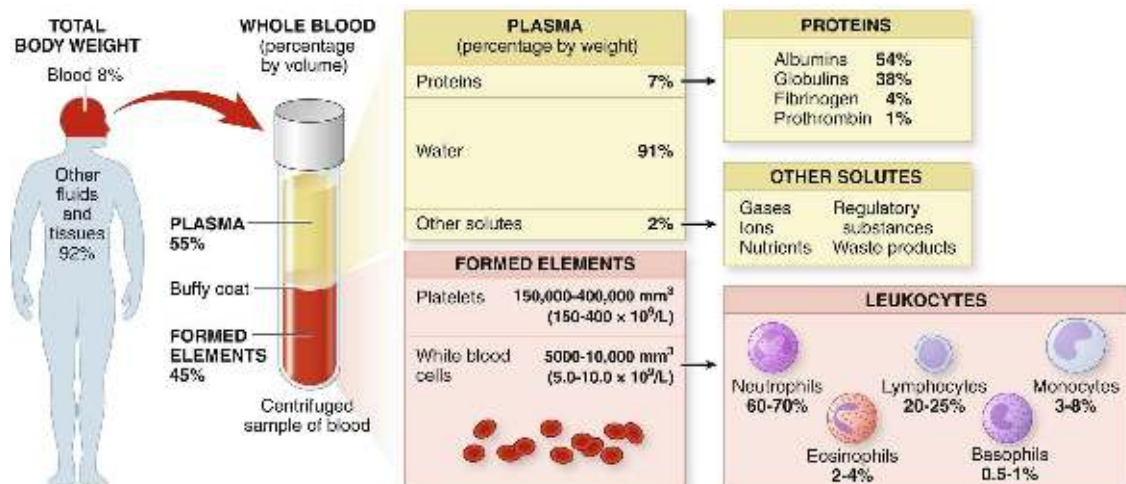
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### **NSAIDs**

- Gastric irritation
- Hypotension
- Sodium and water retention
- Blood dyscrasias
- Dizziness
- Tinnitus
- Pruritus

### **Acetylsalicylic Acid**

- Gastric irritation
- Flushing
- Tinnitus
- Drowsiness
- Headaches
- Vision changes



**FIG. 10-2** Approximate values for the components of blood in a normal adult.

**Table 10-1**

**Obtaining a Blood Sample**

Peripheral Intravenous Line	Central Intravenous Line
Check PHCP's prescription. A blood sample may be drawn from a peripheral line on insertion, but typically not thereafter. Check the agency's policy on this practice.	Check PHCP's prescription.
Identify foods, medications, or other factors such as the type of solution infusing that may affect the procedure or results.	Identify foods, medications, or other factors such as the type of solution infusing that may affect the procedure or results.
Gather needed supplies, including gloves, tourniquet, transparent dressing or other type of dressing, tape, 2- by 2-inch gauze, antiseptic agent, extension set (optional), two 5- or 10-mL normal saline flushes, one empty 5- or 10-mL syringe (depending on the amount of blood needed), transfer/collection device per agency policy, specimen containers per agency policy, alcohol-impregnated intravenous (IV) line end caps, tube labels, biohazard bag, requisition form or bar code per agency policy.	Gather needed supplies, including gloves, transfer/collection device per agency policy, specimen containers per agency policy, two 5- or 10-mL normal saline flushes, one empty 5- or 10-mL syringe (depending on the amount of blood needed), antiseptic swabs, alcohol-impregnated IV line end caps, 2 masks, biohazard bag, requisition form or bar code per agency policy.
Perform hand hygiene. Identify the client with at least 2 accepted identifiers.	Perform hand hygiene. Identify the client with at least 2 accepted identifiers.
Explain the purpose of the test and procedure to the client.	Explain the purpose of the test and procedure to the client.
Prepare extension set if being used by priming with normal saline. Attach syringe to extension set. Place extension set within reach while maintaining aseptic technique and keeping it in the package.	Place mask on self and client or ask client to turn the head away. Stop any running infusions for at least 1 minute.
Apply tourniquet 10 to 15 cm above intravenous site.	Clamp all ports. Scrub port to be used with antiseptic swab.
Apply gloves. Scrub tubing insertion port with antiseptic solution or per agency policy.	Attach 5- or 10-mL normal saline flush and unclamp line. Flush line with appropriate amount per agency policy and withdraw 5-10 mL of blood to discard (per agency policy). Clamp line and detach flush syringe.
Attach 5- or 10-mL normal saline flush and unclamp line. Flush line with appropriate amount per agency policy and withdraw 5-10 mL of blood to discard (per agency policy). Clamp line and detach flush syringe.	Scrub port with antiseptic swab. Attach 5- or 10-mL syringe or transfer/collection device to port (depending on available equipment), unclamp line, and withdraw needed sample or attach specimen container to withdraw using vacuum system. Clamp line and detach syringe or transfer/collection device.
Scrub tubing insertion port. Attach 5- or 10-mL syringe, extension set, or transfer/collection device to port (depending on available equipment), unclamp line, and withdraw needed sample or attach specimen container to withdraw using vacuum system. Clamp line and detach syringe or transfer/collection device.	Scrub port with antiseptic swab. Attach a 5- or 10-mL normal saline flush. Unclamp line and flush with amount per agency policy. Clamp line, remove flush syringe, and place end cap on IV line. Remove masks.
Remove tourniquet and flush with normal saline to ensure patency.	Transfer specimen to collection device per agency policy and procedure.

Send specimen to the laboratory in biohazard bag with associated requisition forms or bar codes per agency policy.

Send specimen to the laboratory in biohazard bag with associated requisition forms or bar codes per agency policy.

**Table 10-2**

**Hemoglobin and Hematocrit: Reference Intervals**

Blood Component	Reference Interval
Hemoglobin (altitude dependent)	
Male adult	14-18 g/dL (140-180 mmol/L)
Female adult	12-16 g/dL (120-160 mmol/L)
Hematocrit (altitude dependent)	
Male adult	42%-52% (0.42-0.52)
Female adult	37%-47% (0.37-0.47)

**Table 10-3**

**Lipids: Reference Intervals**

Blood Component	Reference Interval
Cholesterol	< 200 mg/dL (< 5.0 mmol/L)
High-density lipoproteins (HDLs)	> 60 mg/dL (> 1.55 mmol/L)
Low-density lipoproteins (LDLs)	< 100 mg/dL (< 2.59 mmol/L)
Triglycerides	Male: 40-160 mg/dL (0.45-1.81 mmol/L) Female: 35-135 mg/dL (0.40-1.52 mmol/L)

**Table 10-4**

**Glycosylated Hemoglobin (HgbA1C) and Estimated Average Glucose (eAG)**

HgbA1C %	eAG mg/dL	eAG mmol/L
4	65	3.62
5	100	5.57
6	135	7.52
7	170	9.47
8	205	11.42

Pagana KD, Pagana TJ, Pagana TN. *Mosby's Diagnostic and Laboratory Test Reference*, ed 13, Grafton, IL: Mosby; 450.

**Practice Questions**

64. A client with atrial fibrillation who is receiving maintenance therapy of warfarin sodium has a prothrombin time (PT) of 35 seconds. On the basis of these laboratory values, the nurse anticipates which prescription?
  1. Adding a dose of heparin sodium
  2. Holding the next dose of warfarin
  3. Increasing the next dose of warfarin
  4. Administering the next dose of warfarin
65. A staff nurse is precepting a new graduate nurse and the new graduate is assigned to care for a client with chronic pain. Which statement, if made by

the new graduate nurse, indicates the **need for further teaching** regarding pain management?

1. "I will be sure to ask my client what his pain level is on a scale of 0 to 10."
  2. "I know that I should follow up after giving medication to make sure it is effective."
  3. "I will be sure to cue in to any indicators that the client may be exaggerating their pain."
  4. "I know that pain in the older client might manifest as sleep disturbances or depression."
66. A client has been admitted to the hospital for gastroenteritis and dehydration. The nurse determines that the client has received adequate volume replacement if the blood urea nitrogen (BUN) level drops to which value?
1. 3 mg/dL (1.08 mmol/L)
  2. 15 mg/dL (5.4 mmol/L)
  3. 29 mg/dL (10.44 mmol/L)
  4. 35 mg/dL (12.6 mmol/L)
67. The nurse is explaining the appropriate methods for measuring an accurate temperature to an assistive personnel (AP). Which method, if noted by the UAP as being an appropriate method, indicates the **need for further teaching**?
1. Taking a rectal temperature for a client who has undergone nasal surgery
  2. Taking an oral temperature for a client with a cough and nasal congestion
  3. Taking an axillary temperature for a client who has just consumed hot coffee
  4. Taking a temperature on the neck behind the ear using an electronic device for a client who is diaphoretic
68. A client is receiving a continuous intravenous infusion of heparin sodium to treat deep vein thrombosis. The client's activated partial thromboplastin time (aPTT) is 65 seconds. The nurse anticipates that which action is needed?
1. Discontinuing the heparin infusion
  2. Increasing the rate of the heparin infusion
  3. Decreasing the rate of the heparin infusion
  4. Leaving the rate of the heparin infusion as is
69. 69. A client with a history of heart failure is due for a morning dose of furosemide. Which serum potassium level, if noted in the client's laboratory report, should be reported before administering the dose of furosemide?
1. 3.2 mEq/L (3.2 mmol/L)
  2. 3.8 mEq/L (3.8 mmol/L)
  3. 2 mEq/L (4.2 mmol/L)
  4. 8 mEq/L (4.8 mmol/L)
70. Several laboratory tests are prescribed for a client, and the nurse reviews the results of the tests. Which laboratory test results should the nurse report?  
**Select all that apply.**

- 1. Platelets 35,000 mm<sup>3</sup> (35 × 10<sup>9</sup>/L)
- 2. Sodium 150 mEq/L (150 mmol/L)
- 3. Potassium 5.0 mEq/L (5.0 mmol/L)
- 4. Segmented neutrophils 40% (0.40)
- 5. Serum creatinine, 1 mg/dL (88.3 μmol/L)
- 6. White blood cells, 3000 mm<sup>3</sup> (3.0 × 10<sup>9</sup>/L)

71. The nurse is caring for a client who takes ibuprofen for pain. The nurse is gathering information on the client's medication history and determines it is necessary to contact the primary health care provider (PHCP) if the client is also taking which medications? **Select all that apply.**

- 1. Warfarin
- 2. Glimepiride
- 3. Amlodipine
- 4. Simvastatin
- 5. Atorvastatin

72. A client with diabetes mellitus has a glycosylated hemoglobin A<sub>1c</sub> level of 8%. On the basis of this test result, the nurse plans to teach the client about the need for which measure?

- 1. Avoiding infection
- 2. Taking in adequate fluids
- 3. Preventing and recognizing hypoglycemia
- 4. Preventing and recognizing hyperglycemia

73. The nurse is caring for a client with a diagnosis of breast cancer who is immunosuppressed. The nurse would consider implementing neutropenic precautions if the client's white blood cell count was which value?

- 1. 2000 mm<sup>3</sup> (2.0 × 10<sup>9</sup>/L)
- 2. 5800 mm<sup>3</sup> (5.8 × 10<sup>9</sup>/L)
- 3. 8400 mm<sup>3</sup> (8.4 × 10<sup>9</sup>/L)
- 4. 11,500 mm<sup>3</sup> (11.5 × 10<sup>9</sup>/L)

74. A client brought to the emergency department states that he has accidentally been taking 2 times his prescribed dose of warfarin for the past week. After noting that the client has no evidence of obvious bleeding, the nurse plans to take which action?

- 1. Prepare to administer an antidote.
- 2. Draw a sample for type and crossmatch and transfuse the client.
- 3. Draw a sample for an activated partial thromboplastin time (aPTT) level.
- 4. Draw a sample for prothrombin time (PT) and international normalized ratio (INR).

75. The nurse is caring for a postoperative client who is receiving demand-dose hydromorphone via a patient-controlled analgesia (PCA) pump for pain

control. The nurse enters the client's room and finds the client drowsy and records the following vital signs: temperature 97.2° F (36.2° C) orally, pulse 52 beats per minute, blood pressure 101/58 mm Hg, respiratory rate 11 breaths per minute, and SpO<sub>2</sub> of 93% on 3 liters of oxygen via nasal cannula.

Which action should the nurse take **next**?

1. Document the findings.
  2. Attempt to arouse the client.
  3. Contact the primary health care provider (PHCP) immediately.
  4. Check the medication administration history on the PCA pump.
76. An adult female client has a hemoglobin level of 10.8 g/dL (108 mmol/L). The nurse interprets that this result is **most likely** caused by which condition noted in the client's history?
1. Dehydration
  2. Heart failure
  3. Iron deficiency anemia
  4. Chronic obstructive pulmonary disease
77. A client with a history of upper gastrointestinal bleeding has a platelet count of 300,000 mm<sup>3</sup> (300 × 10<sup>9</sup>/L). The nurse should take which action after seeing the laboratory results?
1. Report the abnormally low count.
  2. Report the abnormally high count.
  3. Place the client on bleeding precautions.
  4. Place the normal report in the client's medical record.

## Answers

64. *Answer:* 2

**Rationale:** The normal PT is 11 to 12.5 seconds (conventional therapy and SI units). A therapeutic PT level is 1.5 to 2 times higher than the normal level. Because the value of 35 seconds is high, the nurse should anticipate that the client would not receive further doses at this time. Therefore, the prescriptions noted in the remaining options are incorrect.

**Test-Taking Strategy:** Focus on the **subject**, a PT of 35 seconds. Recall the normal range for this value and remember that a PT greater than 25 seconds places the client at risk for bleeding; this will direct you to the correct option.

**Level of Cognitive Ability:** Analyzing

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Analysis

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** Adult Health: Cardiovascular: Dysrhythmias

**Priority Concepts:** Clinical Judgment; Clotting

**Reference:** Lewis et al. (2017), p. 601.

65. *Answer:* 3



**Rationale:** Pain is a highly individual experience, and the new graduate nurse should not assume that the client is exaggerating his pain. Rather, the nurse should frequently assess the pain and intervene accordingly through the use of both nonpharmacological and pharmacological interventions. The nurse should assess pain using a number-based scale or a picture-based scale for clients who cannot verbally describe their pain to rate the degree of pain. The nurse should follow up with the client after giving medication to ensure that the medication is effective in managing the pain. Pain experienced by the older client may be manifested differently than pain experienced by clients in other age groups, and they may have sleep disturbances, changes in gait and mobility, decreased socialization, and depression; the nurse should be aware of this attribute in this population.

**Test-Taking Strategy:** Note the **strategic words**, *need for further teaching*. These words indicate a **negative event query** and the need to select the incorrect statement as the answer. Recall that pain is a highly individual experience, and the nurse should not assume that the client is exaggerating pain.

**Level of Cognitive Ability:** Evaluating

**Client Needs:** Physiological Integrity

**Integrated Process:** Teaching and Learning

**Content Area:** Skills: Vital Signs

**Health Problem:** Adult Health: Neurological: Pain

**Priority Concepts:** Clinical Judgment; Pain

**Reference:** Lewis et al. (2017), pp. 110-111, 123.

66. *Answer:* 2

**Rationale:** The normal BUN level is 10 to 20 mg/dL (3.6 to 7.1 mmol/L). Values of 29 mg/dL (10.44 mmol/L) and 35 mg/dL (12.6 mmol/L) reflect continued dehydration. A value of 3 mg/dL (1.08 mmol/L) reflects a lower than normal value, which may occur with fluid volume overload, among other conditions.

**Test-Taking Strategy:** Focus on the **subject**, adequate fluid replacement and the normal BUN level. The correct option is the only option that identifies a normal value.

**Level of Cognitive Ability:** Evaluating

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Evaluation

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** Adult Health: Gastrointestinal: Dehydration

**Priority Concepts:** Fluids and Electrolytes; Leadership

**Reference:** Lewis et al. (2017), p. 1026.

67. *Answer:* 2

**Rationale:** An oral temperature should be avoided if the client has nasal congestion. One of the other methods of measuring the temperature should be used according to the equipment available. Taking a rectal temperature for a client who has undergone nasal surgery is appropriate. Other, less invasive measures should be used if available; if not available, a rectal temperature is acceptable. Taking an

axillary temperature on a client who just consumed coffee is also acceptable; however, the axillary method of measurement is the least reliable, and other methods should be used if available. If electronic equipment is available and the client is diaphoretic, it is acceptable to measure the temperature on the neck behind the ear, avoiding the forehead.

**Test-Taking Strategy:** Note the **strategic words**, *need for further teaching*. These words indicate a **negative event query** and the need to select the incorrect action as the answer. Recall that nasal congestion is a reason to avoid taking an oral temperature, as the nasal congestion will cause problems with breathing while the temperature is being taken.

**Level of Cognitive Ability:** Evaluating

**Client Needs:** Safe and Effective Care Environment

**Integrated Process:** Teaching and Learning

**Content Area:** Skills: Vital Signs

**Health Problem:** N/A

**Priority Concepts:** Teaching and Learning; Thermoregulation

**Reference:** Perry et al. (2018), pp. 68-69.

68. *Answer:* 4

**Rationale:** The normal aPTT varies between 30 and 40 seconds (30 and 40 seconds), depending on the type of activator used in testing. The therapeutic dose of heparin for treatment of deep vein thrombosis is to keep the aPTT between 1.5 (45 to 60) and 2.5 (75 to 100) times normal. This means that the client's value should not be less than 45 seconds or greater than 100 seconds. Thus, the client's aPTT is within the therapeutic range and the dose should remain unchanged.

**Test-Taking Strategy:** Focus on the **subject**, the expected aPTT for a client receiving a heparin sodium infusion. Remember that the normal range is 30 to 40 seconds and that the aPTT should be between 1.5 and 2.5 times normal when the client is receiving heparin therapy. Simple multiplication of 1.5 and 2.5 by 30 and 40 will yield a range of 45 to 100 seconds. This client's value is 65 seconds.

**Level of Cognitive Ability:** Analyzing

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Analysis

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** Adult Health: Cardiovascular: Vascular Disorders

**Priority Concepts:** Clinical Judgment; Clotting

**Reference:** Lewis et al. (2017), p. 601.

69. *Answer:* 1

**Rationale:** The normal serum potassium level in the adult is 3.5 to 5.0 mEq/L (3.5 to 5.0 mmol/L). The correct option is the only value that falls below the therapeutic range. Administering furosemide to a client with a low potassium level and a history of cardiac problems could precipitate ventricular dysrhythmias. The remaining options are within the normal range.

**Test-Taking Strategy:** Note the **subject** of the question, the level that should be

reported. This indicates that you are looking for an abnormal level. Remember, the normal serum potassium level in the adult is 3.5 to 5.0 mEq/L (3.5 to 5.0 mmol/L). This will direct you to the correct option.

**Level of Cognitive Ability:** Applying

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Implementation

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** Adult Health: Cardiovascular: Heart Failure

**Priority Concepts:** Clinical Judgment; Fluids and Electrolytes

**Reference:** Lewis et al. (2017), p. 280.

70. **Answer:** 1, 2, 4, 6

**Rationale:** The normal values include the following: platelets 150,000 to 400,000  $\text{mm}^3$  (150 to 400  $\times 10^9/\text{L}$ ); sodium 135 to 145 mEq/L (135 to 145 mmol/L); potassium 3.5 to 5.0 mEq/L (3.5 to 5.0 mmol/L); segmented neutrophils 62% to 68% (0.62 to 0.68); serum creatinine male: 0.6 to 1.2 mg/dL (53 to 106  $\mu\text{mol/L}$ ); female: 0.5 to 1.1 mg/dL (44 to 97  $\mu\text{mol/L}$ ); and white blood cells 5000 to 10,000  $\text{mm}^3$  (5.0 to 10.0  $\times 10^9/\text{L}$ ). The platelet level noted is low; the sodium level noted is high; the potassium level noted is normal; the segmented neutrophil level noted is low; the serum creatinine level noted is normal; and the white blood cell level is low.

**Test-Taking Strategy:** Focus on the **subject**, the abnormal laboratory values that need to be reported. Recalling the normal laboratory values for the blood studies identified in the options will assist in answering this question.

**Level of Cognitive Ability:** Analyzing

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Implementation

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** N/A

**Priority Concepts:** Clinical Judgment; Collaboration

**Reference:** Lewis et al. (2017), pp. 599-601, 1026.

71. **Answer:** 1, 2, 3

**Rationale:** Nonsteroidal antiinflammatory drugs (NSAIDs) can amplify the effects of anticoagulants; therefore, these medications should not be taken together. Hypoglycemia may result for the client taking ibuprofen if the client is concurrently taking an oral antidiabetic agent such as glimepiride; these medications should not be combined. A high risk of toxicity exists if the client is taking ibuprofen concurrently with a calcium channel blocker such as amlodipine; therefore, this combination should be avoided. There is no known interaction between ibuprofen and simvastatin or atorvastatin.

**Test-Taking Strategy:** Note the **subject** of the question, data provided by the client necessitating contacting the PHCP. Determining that ibuprofen is classified as an NSAID will help you determine that it should not be combined with anticoagulants. Also recalling that hypoglycemia can occur as an adverse effect if taken with antidiabetic agents will help you recall that these medications should not be

combined. From the remaining options, it is necessary to remember that toxicity can result if NSAIDs are combined with calcium channel blockers. Also note that options 4 and 5 are **comparable or alike** and are antilipemic medications. This will assist in eliminating these options.

**Level of Cognitive Ability:** Analyzing

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Implementation

**Content Area:** Skills: Vital Signs

**Health Problem:** Adult Health: Neurological: Pain

**Priority Concepts:** Clinical Judgment; Safety

**Reference:** Lewis et al. (2017), p. 111.

72. **Answer:** 4

**Rationale:** The normal reference range for the glycosylated hemoglobin A<sub>1c</sub> is less than 6.0%. This test measures the amount of glucose that has become permanently bound to the red blood cells from circulating glucose. Erythrocytes live for about 120 days, giving feedback about blood glucose for the past 120 days. Elevations in the blood glucose level will cause elevations in the amount of glycosylation. Thus, the test is useful in identifying clients who have periods of hyperglycemia that are undetected in other ways. The estimated average glucose for a glycosylated hemoglobin A<sub>1c</sub> of 8% is 205 mg/dL (11.42 mmol/L). Elevations indicate continued need for teaching related to the prevention of hyperglycemic episodes.

**Test-Taking Strategy:** Focus on the **subject**, a glycosylated hemoglobin A<sub>1c</sub> level of 8%. Recalling the normal value and that an elevated value indicates hyperglycemia will assist in directing you to the correct option.

**Level of Cognitive Ability:** Applying

**Client Needs:** Health Promotion and Maintenance

**Integrated Process:** Teaching and Learning

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** Adult Health: Endocrine: Diabetes Mellitus

**Priority Concepts:** Client Education; Glucose Regulation

**Reference:** Lewis et al. (2017), p. 1118.

73. **Answer:** 1

**Rationale:** The normal WBC count ranges from 5000 to 10,000 mm<sup>3</sup> (5 to 10 × 10<sup>9</sup>/L). The client who has a decrease in the number of circulating WBCs is immunosuppressed. The nurse implements neutropenic precautions when the client's values fall sufficiently below the normal level. The specific value for implementing neutropenic precautions usually is determined by agency policy. The remaining options are normal values.

**Test-Taking Strategy:** Focus on the **subject**, the need to implement neutropenic precautions. Recalling that the normal WBC count is 5000 to 10,000 mm<sup>3</sup> (5 to 10 × 10<sup>9</sup>/L) will direct you to the correct option.

**Level of Cognitive Ability:** Applying

**Client Needs:** Physiological Integrity  
**Integrated Process:** Nursing Process—Planning  
**Content Area:** Foundations of Care: Laboratory Tests  
**Health Problem:** Adult Health: Cancer: Breast  
**Priority Concepts:** Clinical Judgment; Infection  
**Reference:** Potter et al. (2017), p. 451.

74. **Answer:** 4

**Rationale:** The action that the nurse should take is to draw a sample for PT and INR level to determine the client's anticoagulation status and risk for bleeding. These results will provide information as to how to best treat this client (e.g., if an antidote such as vitamin K or a blood transfusion is needed). The aPTT monitors the effects of heparin therapy.

**Test-Taking Strategy:** Focus on the **subject**, a client who has taken an excessive dose of warfarin. Eliminate the option with aPTT first because it is unrelated to warfarin therapy and relates to heparin therapy. Next, eliminate the options indicating to administer an antidote and to transfuse the client because these therapies would not be implemented unless the PT and INR levels were known.

**Level of Cognitive Ability:** Applying  
**Client Needs:** Physiological Integrity  
**Integrated Process:** Nursing Process—Planning  
**Content Area:** Foundations of Care: Laboratory Tests  
**Health Problem:** N/A  
**Priority Concepts:** Clinical Judgment; Clotting  
**Reference:** Ignatavicius, Workman, Rebar (2018), pp. 744-745.

75. **Answer:** 2

**Rationale:** The primary concern with opioid analgesics is respiratory depression and hypotension. Based on the assessment findings, the nurse should suspect opioid overdose. The nurse should first attempt to arouse the client and then reassess the vital signs. The vital signs may begin to normalize once the client is aroused, because sleep can also cause decreased heart rate, blood pressure, respiratory rate, and oxygen saturation. The nurse should also check to see how much medication has been taken via the PCA pump and should continue to monitor the client closely to determine whether further action is needed. The nurse should contact the PHCP and document the findings after all data are collected, after the client is stabilized, and if an abnormality still exists after arousing the client.

**Test-Taking Strategy:** First, note the **strategic word**, *next*. **Focus on the data in the question and determine if an abnormality exists.** It is clear that an abnormality exists because the client is drowsy and the vital signs are outside of the normal range. Recall that attempting to arouse the client should come before further assessment of the pump. The client should always be assessed before the equipment, before contacting the PHCP, and before documentation.

**Level of Cognitive Ability:** Synthesizing  
**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Implementation

**Content Area:** Skills: Vital Signs

**Health Problem:** Adult Health: Neurological: Pain

**Priority Concepts:** Clinical Judgment; Pain

**Reference:** Lewis et al. (2017), pp. 114-115, 152.

76. **Answer:** 3

**Rationale:** The normal hemoglobin level for an adult female client is 12 to 16 g/dL (120 to 160 mmol/L). Iron deficiency anemia can result in lower hemoglobin levels. Dehydration may increase the hemoglobin level by hemoconcentration. Heart failure and chronic obstructive pulmonary disease may increase the hemoglobin level as a result of the body's need for more oxygen-carrying capacity.

**Test-Taking Strategy:** Note the **strategic words**, *most likely*. Evaluate each of the conditions in the options in terms of their pathophysiology and whether each is likely to raise or lower the hemoglobin level. Also, note the relationship between hemoglobin level in the question and the correct option.

**Level of Cognitive Ability:** Analyzing

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Assessment

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** Adult Health: Hematological: Anemias

**Priority Concepts:** Clinical Judgment; Gas Exchange

**Reference:** Lewis et al. (2017), p. 600.

77. **Answer:** 4

**Rationale:** A normal platelet count ranges from 150,000 to 400,000 mm<sup>3</sup> (150 to 400 × 10<sup>9</sup>/L). The nurse should place the report containing the normal laboratory value in the client's medical record. A platelet count of 300,000 mm<sup>3</sup> (300 × 10<sup>9</sup>/L) is not an elevated count. The count also is not low; therefore, bleeding precautions are not needed.

**Test-Taking Strategy:** Focus on the **subject**, a platelet count of 300,000 mm<sup>3</sup> (300 × 10<sup>9</sup>/L). Remember that options that are **comparable or alike** are not likely to be correct. With this in mind, eliminate options indicating to report the abnormally low count and placing the client on bleeding precautions first. From the remaining options, recalling the normal range for this laboratory test will direct you to the correct option.

**Level of Cognitive Ability:** Applying

**Client Needs:** Physiological Integrity

**Integrated Process:** Nursing Process—Implementation

**Content Area:** Foundations of Care: Laboratory Tests

**Health Problem:** Adult Health: Gastrointestinal: Upper GI Disorders

**Priority Concepts:** Clinical Judgment; Clotting

**Reference:** Lewis et al. (2017), p. 601.