CHAPTER 22

MEASURING VITAL SIGNS

PAGE 359

OBJECTIVES

THEORY

1. List the anatomic structures involved in the regulation of the vital signs and describe their functions.
2. Identify the physiologic mechanisms that regulate temperature, heart rate, blood pressure, and respiration
3. List the factors that affect body temperature

OBJECTIVES

THEORY

4. Discuss normal and abnormal characteristic of the pulse

5. Describe the respiratory patterns considered to be normal and abnormal

6. Explain the relationship of Korotkoff sounds to systolic and diastolic blood pressure

7. State why pain is considered the fifth vital signs.

OBJECTIVES

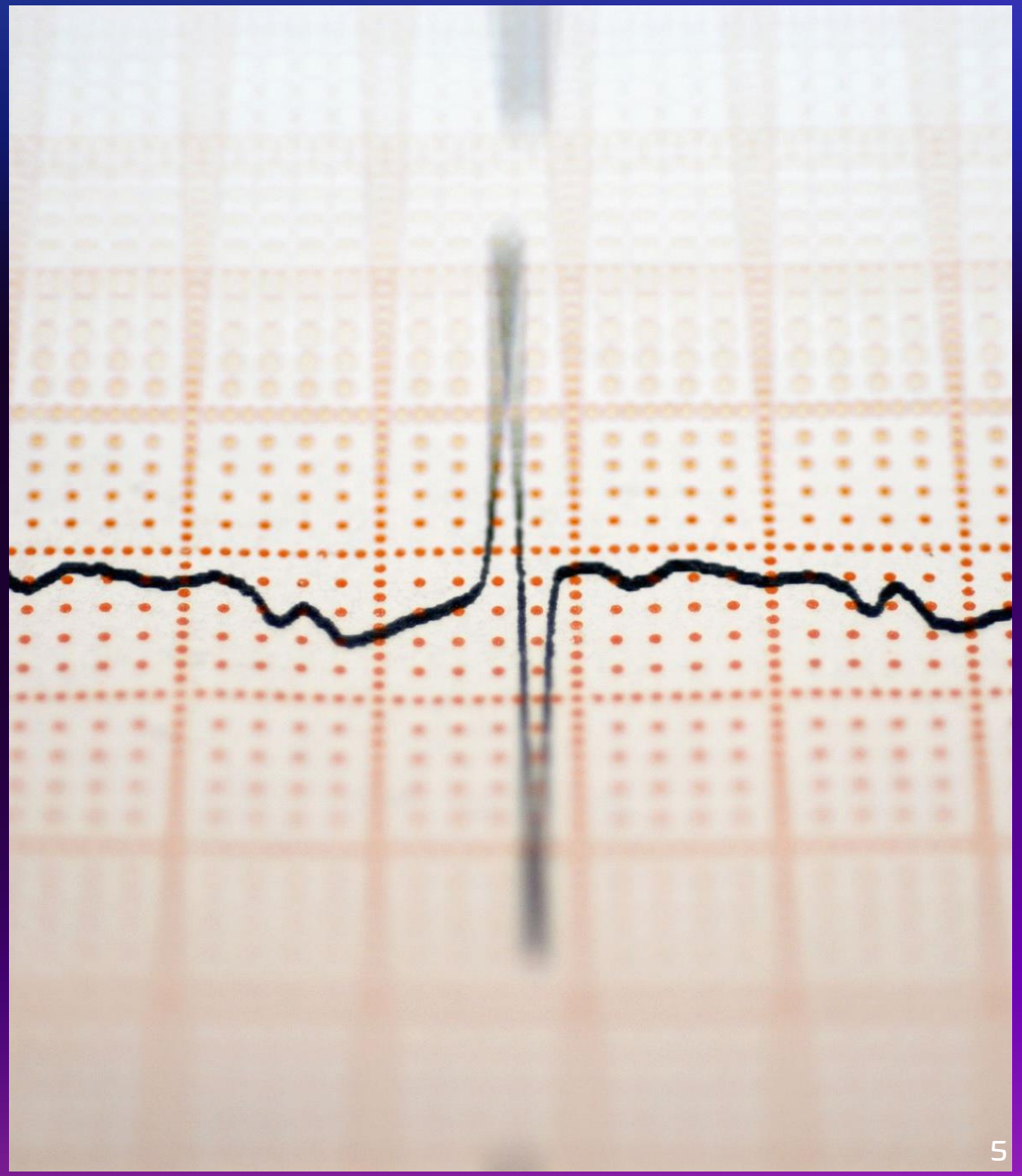
Skills

- 22-1:Measuring temperature with an electronic thermometer
- 22-2: Measuring temperature with a tympanic or temporal artery temperature
- 22-3: Measuring the Radial pulse
- 22-4: Measuring the Apical pulse
- 22-5: Measuring respirations
- 22-6: Measuring blood pressure

VITAL SIGNS

PAGE 360

- TEMPERATURE, PULSE, RESPIRATION, BLOOD PRESSURE, PLUS OXYGEN SATURATION
- LEARNING TO MEASURE VITAL SIGNS IS THE BEGINNING STEP IN GATHERING ASSESSMENT DATA FOR PATIENTS
- IT IS IMPORTANT TO UNDERSTAND THE PHYSIOLOGIC MECHANISMS THAT REGULATE VITAL SIGNS AND THE FACTORS THAT CAN AFFECT EACH ONE.



HOW IS BODY HEAT PRODUCED?

PAGE 360

- **Heat production is a by-product of metabolism** (cellular chemical reactions in the body)
- **When metabolism increases, more heat is produced. This is what causes fever!**
- What is fever? (elevated temperature) when pathogens invade the body and the body attempts to destroy them, the increased activity causes fever.
- Pyrogens(agents that cause fever) produced by some pathogens act on the body's thermostat and raise the body temperature.
- Basal metabolic rate(BMR) is the rate at which heat is produced when the body is at rest.

WHAT FACTORS AFFECT BODY HEAT PRODUCTION?

PAGE 360

- BMR is affected by thyroid hormone. Excessive amounts of thyroid hormone cause an increase in the metabolic rate. Insufficient thyroid hormone results in a decreased metabolic rate, and the person's body temperature falls.
- **Voluntary muscle movement of exercise increases the BMR and heat production (running, jogging, exercising)**
- **Involuntary muscle action of shivering can increase heat production up to five times normal. (this is why you shiver when you are cold)**

HOW IS BODY TEMPERATURE REGULATED?

PAGE 360

- The hypothalamus, located between the cerebral hemisphere, acts as a thermostat and controls body temperature by a feedback mechanism
- When the body heat **rises** above normal, the hypothalamus sends out a signal through the nervous system that causes vasodilation, sweating, and inhibition of heat production.
- Heat loss occurs through the skins exposure to the environment. It occurs through **radiation, conduction, convection, and evaporation.**
- How Your Body Maintains Its Temperature

HOW IS BODY TEMPERATURE REGULATED?

PAGE 360

- When objects in the surroundings are warmer than the body, heat is ***radiated*** to the body and absorbed. (campfire)
- When warm skin touches a cool object, heat is lost to the object by ***conduction***. (holding a cold water bottle transfers heat from your hand to the bottle)
- Air movement causes heat to be transferred from skin to the air molecules by ***convection. (heater warms the air near it)***
- Sweat glands contribute to ***evaporation*** loss by secreting sweat in response to a message from the hypothalamus when the body temperature rises too high. (like sweating when running)

HOW DOES FEVER OCCUR, AND WHAT ARE ITS PHYSIOLOGICAL EFFECTS? PAGE 361

Pyrexia (fever) occurs when normal mechanisms of the body cannot keep up with excessive heat production and body temperatures rises. This is when the body temperature rise above ***100.2 F***.

When Pyrogens such as bacteria cause an immune response in the body the hypothalamus is stimulated to raise the body's temperature set point

If the temperature rises above the new set point, the skin becomes flushed and moist.

Diaphoresis is excessive sweat production, which attempts to cool the body by evaporation.

Heart and **respiratory rate** rises to help the body meet the increased metabolic demand. If the oxygen demand cannot be met, cellular hypoxia(insufficient oxygen) occurs.

Cerebral hypoxia (insufficient oxygen to the brain) may cause ***confusion*** in the individual

WHAT IS RESPIRATION?

PAGE 361-362

1. ***Respiration*** is the exchange of oxygen and carbon dioxide in the lungs and tissues and is initiated by the act of breathing.
2. Respiration is a combination of two processes: **external respirations** and **internal respiration.**

External respiration- occurs in four ways:

1. **Ventilation** which is mechanical movement of air in and out of the lungs

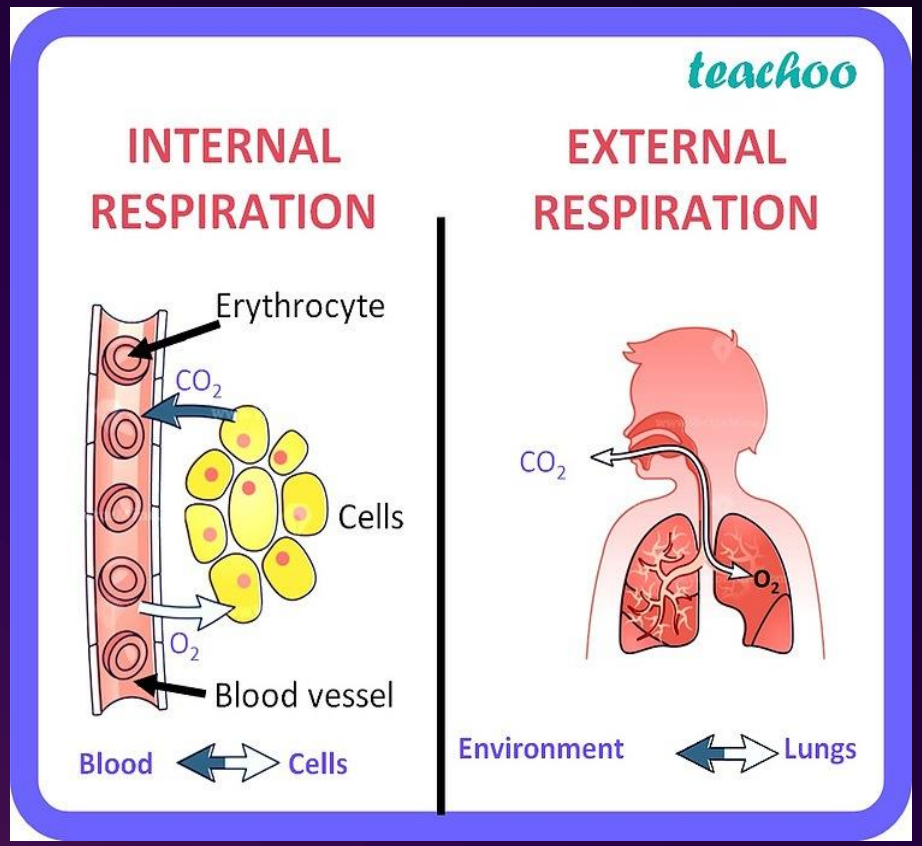
2. **Dispersion** of air throughout the bronchial tree of the lungs

3. **Diffusion** of oxygen and carbon dioxide molecules across the alveolar membrane

4. **Perfusion** is the movement of blood through the lungs and tissues.

WHAT IS RESPIRATION?

PAGE 362



- **Internal respiration** happens at the cellular level. Oxygen is released from hemoglobin to the cell and the cell In turn release carbon dioxide to the blood.

HOW IS RESPIRATION CONTROLLED? PAGE 363

Breathing is an ***involuntary***, automatic function controlled by the respiratory center located in the pons and medulla of the brainstem

Reflex Control Of Respiration

HOW IS RESPIRATION CONTROLLED?

PAGE 363

Messages are sent from the respiratory center to the respiratory muscles controlling the diaphragm and the intercostal muscle, thereby altering the respiratory rate or depth.

The pumping action of the heart brings blood through the lung capillaries, where diffusion of oxygen and carbon dioxide can take place across the alveolar membrane.

Carbon Dioxide is mainly carried as a bicarbonate ion in the blood until it reaches the lung.

Carbon dioxide diffused into the lungs is released with exhalation.

FACTORS INFLUENCING TEMPERATURE READINGS

PAGE 364

Measurement sites are the mouth, rectum, axilla(armpit), ear, and skin.

Rectal temperatures are usually 1 F higher and axillary temperatures are about 1 F lower than those measured orally.

Temporal artery thermometer is the most accurate noninvasive way to measure body temperature.

FACTORS INFLUENCING TEMPERATURE READINGS

PAGE 364

- Measuring tympanic temperature involves inserting the thermometer probe into the auditory canal.
- ***A glass thermometer is NEVER used orally if the patient is uncooperative or at risk of biting on the thermometer. (such as a seizure disorder)***
- Rectal temperatures are taken when an accurate temperature cannot be obtained orally, and a tympanic or temporal artery thermometer is not available.
- Rectal temperatures are generally the choice for last resort.

PROBLEMS OF TEMPERATURE REGULATION

PAGE 365

- Hyperthermia- condition in which the patients temperature is above the normal range (100.2F) also known as fever, febrile state, or pyrexia.
- Very high fevers such as those greater than 105.8F cause damage to body cells, particular those of the Central Nervous System
- Hyperthermia may also occur after brain injury.
- Lifespan Consideration BOX
- ***If the fever is very high or if it lasts for an extended period, dehydration, delirium, and convulsions(febrile seizures)***
- What REALLY Happens Inside Your Body During a Fever? | Stunning 3D Medical Animation

PROBLEMS OF TEMPERATURE REGULATION

PAGE 366

- Hypothermia- the lowering of the temperature of the entire body, not just a portion of it.
- Nursing activities for treating the patient with a below-normal body temperature should focus on reducing heat loss and supplying additional warmth.
- Lifespan considerations box
- 1. provide additional clothing or blankets for warmth (hospitals may use "blanket warmers"
- 2. give warm fluids if permitted
- 3. adjust the temperature of the room to 72 F or higher
- 4. eliminate drafts
- 5. increase the patients muscle activity
- 6. submerge frostbitten areas in a warm bath, with water no warmer than 107 F.

TAKING BODY TEMPERATURE

PAGE 366

- Clinical goldmine BOX
- The tip of the thermometer or probe with a plastic sleeve or probe cover should be placed in the sublingual pocket. (fig 22.5)
- Don gloves and lubricate the tip of the rectal thermometer or probe; lift the upper buttock slightly so that the anus can be clearly seen.
- Insert the lubricated bulb into the rectum, directed toward the umbilicus, about 0.5-1.5 inches.
- Hold the thermometer in place for 3-5 minutes or until the correct temperature is indicated.
- Wipe the thermometer of probe form the stem toward the bulb or probe tip.
- **Page 372 BOX 22.3**

ELECTRONIC THERMOMETERS

PAGE 368

- The portable, battery-operated electronic thermometers register body temperature in 5 seconds to 1 minute. There may be an on-off button to activate the battery, and a warmup period may be required (Fig 22.8)
- The oral probe is placed in a plastic cover or sheath that is used one time and then discarded.
- Tympanic thermometer:
- These portable, battery-operated electronic thermometers register temperature in 1-2 seconds. The auditory canal probe is placed in a plastic cover that is used on time and then discarded. (fig 22.9)

ELECTRONIC THERMOMETERS

PAGE 368

- Temporal Artery Skin Thermometer:
- The temporal artery thermometer is moved over the skin of the forehead over the temporal artery. It is an electronic thermometer that is fast and accurate. It is less invasive than the tympanic thermometer and more reliable when used correctly. (fig 22.4)

DISPOSABLE THERMOMETERS

PAGE 368

- There are various types of single use, disposable thermometers that are available. They are temperature sensitive tapes that are placed on the forehead or abdomen to record the heat of the body. They are often used in newborn nurseries. (fig 22.10)
- Most disposable thermometers register the temperature within 2 mins.

WHAT PHYSIOLOGIC MECHANISMS CONTROL THE PULSE?

PAGE 361

- Cardiac contractions control the pulse. The surge of blood into the aorta causes a pressure wave that can be felt over a peripheral artery.
- Cardiac contractions are normally initiated by electrical impulse emerging from the sinoatrial(SA) node within the right atrium of the heart.
- When the heart contracts, an average of 60-70ml of blood is propelled into the aorta. ***Stroke Volume*** is the volume of blood pushed into the aorta with each heartbeat.
- Stroke volume affects the character of the pulse. A weak pulse may indicate a fall in stroke volume.
- The amount of blood circulating in the vascular system and the degree of vasodilation or vasoconstriction of the blood vessels can also affect stroke volume and the pulse.
- Cardiac output is the amount of blood pumped by the left ventricle in 1 minute. The pulse rate is multiplied by the stroke volume equals the ***cardiac input.***

MEASURE THE PULSE

PAGE 373

- The radial artery in the wrist is most often chosen to palpate (feel) the pulse when taking vital signs.
- **Skill 22.3**

- The apical, rather than the radial, pulse is also taken on children younger than 2 years of age.
- Occasionally you may need to take both a radial pulse and an apical pulse when the radial pulse is irregular, skip beats, or is difficult to count.

MEASURE THE PULSE -COMMON PULSE POINTS

PAGE 373

- Fig 22.2
- Radial artery- wrist at the base of the thumb
- Temporal artery- just in front of the ear
- Carotid artery- front side of the neck
- Femoral artery- in the groin
- Apical pulse over the apex, the pointed end of the heart
- Popliteal pulse behind the knee
- Pedal pulse- posterior tibial artery on the inside of the ankle behind the malleolus, in the groove between the malleolus and Achilles tendon and dorsalis pedis on the anterior aspect(top) of the foot. (fig 22.3)

MEASURE THE PULSE

PAGE 374

- Tachycardia- pulse greater than 100 beats per minute.
- Bradycardia- indicated a pulse that is less than 60 BPM.
- Medications may be prescribed to speed up the pulse when it is too slow or to slow it down when it is too fast.
- Table 22.2

- Pulse deficit- difference between the apical and radial pulse. Two nurses use one watch visible to both when counting the apical & radial pulse and begin and end counting at the same time. One counts the apical the other the radial. The radial pulse subtracted from the apical pulse equals the pulse deficit. (fig 22.11)
- ***Table 22.3 BOX-page 376***

MEASURING THE PULSE

PAGE 374

- As blood travels farther away from the heart, the distinct wave of the pulse begins to fade, but the pulse can be palpated at the ankle or top of the foot.
- Pedal pulses are checked to determine whether there is any blockages in the circulation in the artery up to that point, especially patients who have had cardiac catheterization or other procedures using the femoral artery for the insertion of the catheter or those who had surgery on the leg. Mark an X on the skin over the spot where the pedal pulse is felt so that Staff can use the same location.
- A doppler ultrasound can also be used when the pedal pulse is difficult to use.
- Nursing skills: Assessing distal pulses

PULSE CHARACTERISTICS

PAGE 376-377

- Begin timing with a beat that is not counted; the next beat is "1."
- What is an arrhythmia? An arrhythmia is an irregular pulse, a period of normal rhythm broken by periods of irregularity or skipped beats. Fig 22.13
- The volume or strength of the pulse is just as important as the rate.
- Weak and regular (Even beats with poor force), or 1+
- Strong and regular (even beats with moderate force) or 2+
- Full and bounding (even beats with strong force) or 3+
- Feeable (barely palpable)
- Irregular (rhythm that is not regular, both strong and weak beats occurring within 1 minute.
- Thready (generally indicates that it is weak and may be irregular)
- Absent (No pulse palpable or heard on auscultation)

Think Critically box

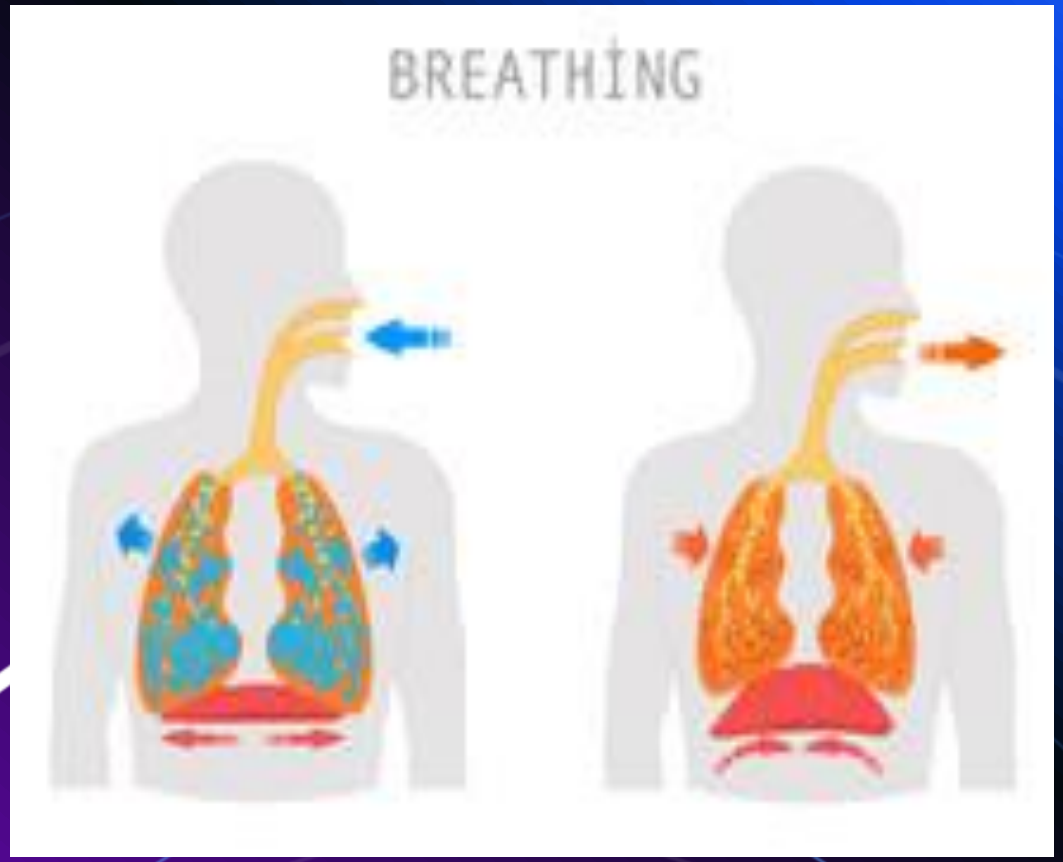
MEASURING RESPIRATIONS

PAGE 377

- A change in respiratory rate may indicate a change in a patient's condition but is always considered along with the other vital signs and assessment data. Count the respirations for 30 seconds and multiply by 2. In someone who is known to be very ill or who has irregular respirations, count for a full minute.

- Many of the factors that affect the pulse rate also affect the respiratory rate because the heart and lungs are closely connected in providing oxygen to sustain life.

- **Skill 22.5**



RESPIRATORY PATTERNS

PAGE 378-379

- Safety alert BOX
- Eupnea- a normal, relaxed breathing pattern is effortless, evenly spaced, regular, and automatic.
- Dyspnea- difficult and labored breathing
- Tachypnea-increased or rapid breathing
- Bradypnea- slow and shallow breathing

- Critical thinking page 378

RESPIRATORY PATTERNS

PAGE 378-379

- **Hypoxemia**-a decreased levels of oxygen in the blood.
- **Hyperventilation**- a pattern of breathing in which there is an increase in the rate and ***depth of breaths and carbon dioxide is expelled***, causing the blood level of carbon dioxide to ***fall.***
- **Kussmaul respirations**- increased rate and depth with panting and long, grunting exhalation.
- TYPES OF ABNORMAL BREATHING PATTERN ll CHEYNE-STOKES ll BIOT'S ll KUSSMUAL'S RESPIRATION #nursing

- **Biot** respirations- four to five breaths of equal depth alternating with irregular periods of **apnea** (absence of breathing)
- Cheyne-stokes- pattern of dyspnea followed by a short period of apnea. Respirations are faster and deeper, then slower, and are followed by a period of no breathing, with continuation of this cycle.
- **Figure 21-14 BOX**

TYPES OF ADVENTITIOUS BREATH SOUNDS

PAGE 379

- Crackles: abnormal, nonmusical sound heard on auscultation of the lungs during inspiration (pneumonia, chf)
- Gurgles(low-pitched wheeze)- continuous dry, rattling sounds heard on auscultation of the lungs caused by partial obstruction.
- Stertor-snoring sound produced when patients are unable to cough up secretions from the trachea or bronchi.
- Stridor-crowing sound on inspiration caused by obstruction of the upper air passages, as occurs in croup or laryngitis.
- Wheeze- whistling sound of air forced past a partial obstruction, as found in asthma or emphysema.
- 8 types of sounds your Lungs make #volumeup

MEASURING OXYGEN SATURATION OF THE BLOOD

PAGE 380

- Another method of monitoring the function of the respiratory system is pulse oximetry. (measurement the oxygen).
- Oxygen Saturation level 90-100%
- Pulse oximeter (a machine that measures oxygen in the blood)
- Device measures oxygen saturation by determining the percentage of hemoglobin that is bound with oxygen
- A finger or toe-clip on probe is most commonly used. A clip-on probe is available for use on an earlobe or an infant's foot.
- how the pulse oximeter works. #medical #viral #medicalreels #animation #medicaleducation

WHAT IS BLOOD PRESSURE

PAGE 363

Blood pressure is the pressure exerted on the arterial wall.

Systolic pressure is the maximum pressure exerted on the artery during left ventricular contraction (systole)

Diastolic pressure is the lower pressure exerted on the artery when the heart is at rest between contractions (diastole)

Systolic vs. Diastolic: Blood Pressure 101

MEASURING THE BLOOD PRESSURE

PAGE 380

- By measuring blood pressure, you obtain information about the effectiveness of the heart contractions, the adequacy of the ***blood volume*** in the system, and the presence of any obstruction or interference to flow through the blood vessels.
- **Table 22.5 & Table 22.6 BOX**
- Vasodilation-parasympathetic nervous system stimulation increase blood vessel lumen diameter, thereby LOWERING blood pressure
- Vasoconstriction- Sympathetic nervous system stimulation decreases blood vessel lumen diameter, thereby RAISING blood pressure.

MEASURING THE BLOOD PRESSURE

PAGE 380

- Reduced blood volume- blood pressure decreases in response to inadequate blood volume, as from decreased cardiac output, hemorrhage, or shock
- Increased blood volume- excessive fluid volume in the cardiovascular system increases blood pressure.
- Blood pressure can vary from minute to minute as the heart adjusts to the demands and responses of the body and mind.
- It is important to know each patients usual range of blood pressure and some of the factors that may influencing it, rather than to make judgements based on just one measurement.

EQUIPMENT USED FOR MEASURING BLOOD PRESSURE

PAGE 380

- Sphygmomanometer (device used to indirectly measures blood pressure) with an occlusive cuff and stethoscope are commonly used pieces of equipment for measuring blood pressure.
- Many nurses are becoming reliant on the electric sphygmomanometer but it will not give nurses the opportunity to hear the pulse and identify an arrhythmia or other abnormality, as they could if using manual manometers.
- Using the wrong size produces errors as great as 25mm Hg. (millimeters of mercury)
- The typical adult blood pressure cuff will fit an adult with a 27-34cm arm circumferences.
- **Skill 22.6 BOX**

KOROTKOFF SOUNDS

PAGE 382

- When measuring blood pressure you will hear certain sounds that relate to the effect of the blood pressure cuff on the arterial wall.
- Phase 1: Tapping- systolic pressure indicated by faint, clear tapping sounds that gradually grow louder
- Auscultatory gap- NO sound- silence as cuff deflates for 30-40mmHg
- Phase 2: Swishing-murmur or swishing sounds that increase as the cuff is deflated
- Phase 3: Knocking- Lounder knocking sound that occurs with each heartbeat
- Phase 4: Muffling- A sudden change or muffling of the sound

KOROTKOFF SOUNDS

PAGE 382

- Phase 5: Silence- Disappearance of sound (which marks diastolic pressure in adults)
- Box 22.4
- Lifespan considerations
- Korotkoff Sounds- How to Record a Manual Blood Pressure (BP).

HYPERTENSION

PAGE 382-385

- Prolonged hypertension can cause permanent damage to the brain, the kidneys, the heart, and the retina of the eye. It is the cause of many strokes.
- Hypertension is more common In African Americans, who get it earlier and more frequently than Caucasian or Hispanics. Other risks factors include older age, BMI over 30, unhealthy lifestyles, and long lasting stress.
- Before age 45 men get hypertension more frequently
- After age 65 women are affected to a greater degree.
- A systolic pressure 130 mm Hg or higher and a diastolic pressure 80mm Hg or higher are regarded as being outside of the normal range **Think Critically**
- Hypertension - High Blood Pressure, Animation

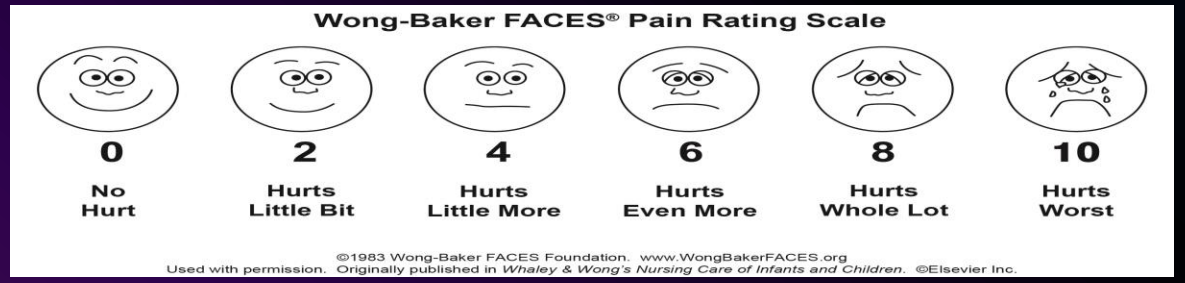
HYPOTENSION

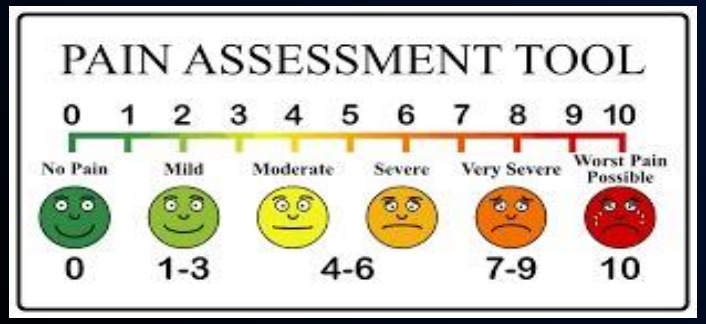
PAGE 385

- What is hypotension? Low blood pressure. some people have blood pressure that is normally below 90/60 mm Hg, and they are healthy with no other symptoms
- Understanding Hypotension: Blood Pressure 101
- Hypotension with symptoms of shock (circulatory collapse) is a dangerous condition that can rapidly progress to death unless treated.
- Shock is caused by hemorrhage, vomiting, diarrhea, burns, and MI, among other conditions.
- Signs and symptoms of shock include a decrease in blood pressure, and increase in pulse rate, cold and clammy skin, dizziness, blurred vision, and apprehension.
- Orthostatic hypotension-a drop in blood pressure occurring with a change from supine to standing or from siting to standing position, drug therapy, a neurologic problem or dehydration.
- **Box 22.4 & Box 22.5**

PAIN, THE FIFTH VITAL SIGN

- Pain is assessed and findings are often recorded along with the other vital signs in the health record.
- Assessment must include pain location, intensity, character, frequency, and duration.
- Pain is subjective- the patients report is the most reliable indicator.
- **Evidence-based practice box**





KEY POINTS

PAGE 388

- **Temperature-** Normal body temperature ranges from 97.5 F to 99.5 F. average temperature of a healthy adult is 98.6 F.
- A temperature over 100.2 F is abnormal and is termed pyrexia or fever. A temperature of 105.8 F or higher may cause damage to body cells
- **Pulse**- initiated by contractions of the heart sending blood out into the arteries.
- Normal pulse rate in the adult ranges from 60 to 100 BPM with average being 72 BPM. 100BPM or greater is called tachycardia, 60 BPM or lower is called bradycardia

KEY POINTS

PAGE 388

- **Respiration** rate is always considered in conjunction with other assessment date because many factors can affect it.
- Normal respiration rate for healthy adult is 12-20 per minute
- Symptoms of hypoxia include restlessness, confusion, change in level of consciousness, and cyanosis.
- **Blood pressure-** tools used sphygmomanometer and stethoscope are used to measure blood pressure.
- The cuff must be the appropriate size for the patient for blood pressure measurement to be accurate
- 120/80 mm Hg for a healthy adult, pressure over 120/80 mmHg or below 90/60 mmHg is considered abnormal