Washington State Department of HEALTH

INTRAVENOUS THERAPY

EMT Special Skill Endorsement

DOH 530-263 July 2024

Introduction

Background / Scope:

- The IV therapy endorsement was created to provide specific, limited life-saving skills to rural areas that are unable to develop or maintain full ALS level service.
- The EMT IV endorsement is not a substitute for ILS or ALS level care in existing services.
- People who successfully complete the training are allowed to use the skills when the endorsement is added to the EMTs credential and upon approval of the County Medical Program Director (MPD).
- Refer to local department and MPD approved protocol regarding use of IV therapy skill.

Objectives

The objectives are divided into three categories:

- Cognitive
- Affective
- Psychomotor

Participant Requirements

To take this endorsement course an emergency medical technician (EMT) must have:

- Completed one year of certification as an EMT with a licensed EMS service
- Have an EMS agency recommendation
- MPD approval

Course Length

- Based on the competency of the individual and not the length of the training
- The time involved in educating an EMT-IV endorsed provider to an acceptable level of competence depends on many factors
- It is expected that the average program, with average students, will achieve results that meet the standard in approximately 42 hours

Course Completion Requirements

Required Lessons

- Lesson 1: Patient Assessment & Clinical Decision Making
- Lesson 2: Overview of Human Systems
- Lesson 3: Assessment and Management of Shock
- Lesson 4: Intravenous & Intraosseous Line Placement and Infusion

Clinical Internship Requirements

- Successful completion of 10 IV insertions on humans. At the option of the MPD, 5 may be performed on training aids.
- Lab skill proficiency required in: IO line placement

Field internship

- Competency determined by the County Medical Program Director.

Evaluations/Examinations

- Practical Skill Evaluations as identified in Appendix B
- Written course completion examination approved by the MPD.

Education / Training Maintenance

- This curriculum is intended to prepare a medically competent EMT-IV Therapy provider to operate in the field
- Continuing education is required to maintain an EMT-IV Therapy provider's endorsement and continued MPD approval to use the skill

Patient Assessment & Clinical Decision Making

Lesson 1 Cognitive Objectives:

At the completion of this topic, the EMT-IV student will be able to:

- Explain and demonstrate critical thinking skills
- Explain and demonstrate decision-making skills
- Explain and demonstrate assessment Based Patient Care

Patient Assessment & Clinical Decision Making

Lesson 1 Introduction & Key Concepts:

The cornerstones of effective EMT-IV practice:

- Gathering, evaluating, and synthesizing information
- Developing and implementing appropriate patient management plans
- Apply judgment and exercise independent decision-making
- Thinking and working effectively under pressure

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Patient Assessment & Clinical Decision Making

The pre-hospital environment:

- Unlike other environments where medical care is traditionally rendered
- Unique - heavily influenced by factors that do not exist in other medical settings.

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Patient Assessment & Clinical Decision Making

The spectrum of patient care in pre-hospital care:

- Obvious, critical life threats
- Potential life threats
- Non-life-threatening presentations

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Patient Assessment & Clinical Decision Making

Providing guidance and authority for EMT-IV action and treatments:

- Protocols, standing orders, & patient care algorithms
- Limitations of protocols, standing orders & patient care algorithms

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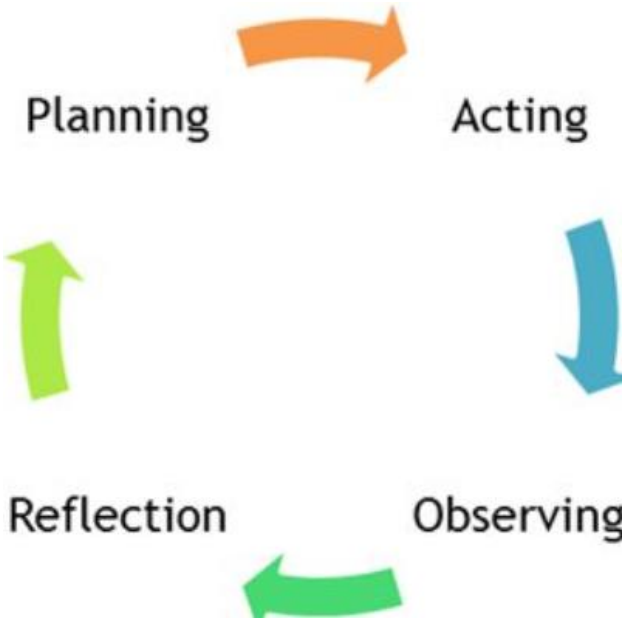
Patient Assessment & Clinical Decision Making

Components, stages, and sequence of critical thinking process:

- Concept formation
- Data interpretation
- Application of principle
- Evaluation
- Reflection on action



Patient Assessment & Clinical Decision Making

Fundamental elements of critical thinking for EMT-IVs:

- Adequate fund of knowledge
- Ability to pay attention
- Ability to gather and organize data and form concepts
- Ability to identify and deal with medical ambiguity

Patient Assessment & Clinical Decision Making

Fundamental elements of critical thinking for EMT-IVs:

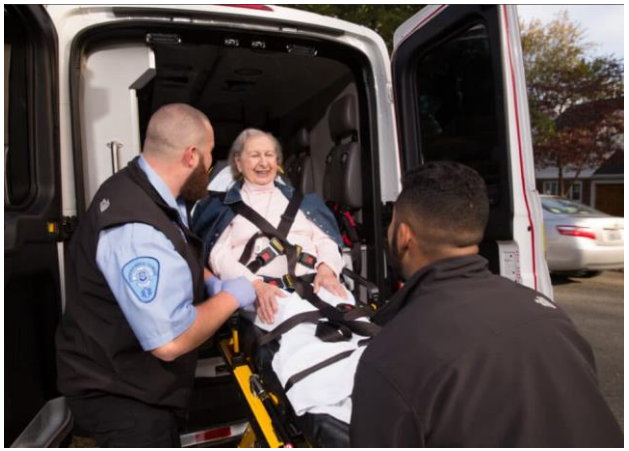
- Ability to differentiate between relevant and irrelevant data
- Ability to analyze and compare similar situations
- Ability to recall contrary situations
- Ability to articulate decision making reasoning and construct arguments

Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

The Patient Acuity Spectrum

- EMS is activated for countless reasons
- Few pre-hospital calls constitute true life-threatening emergencies



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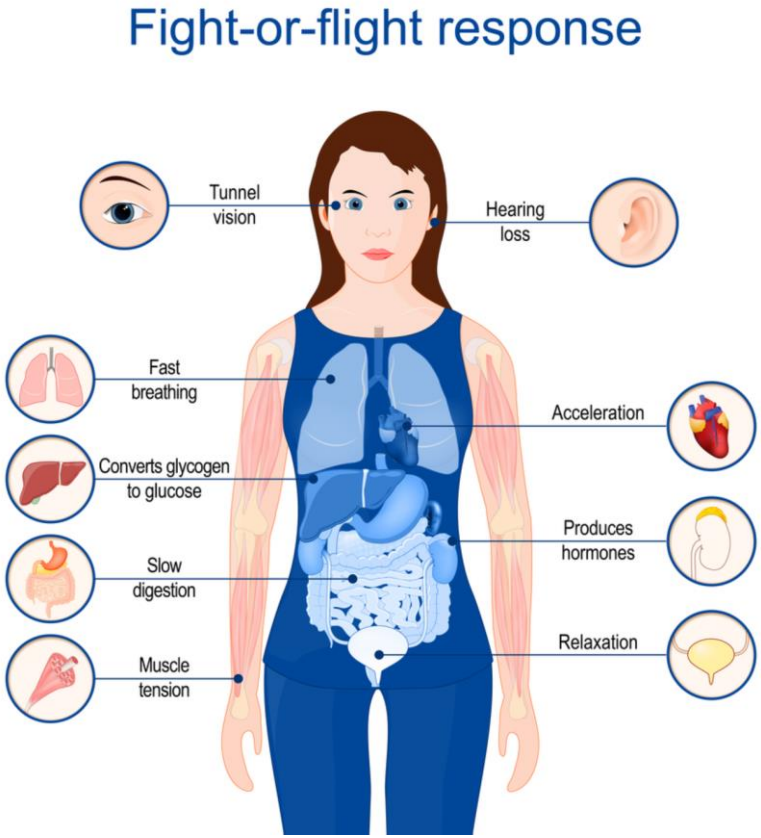
Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Thinking under pressure

- Hormonal influence
  i.e., "fight or flight" response
- Mental conditioning is the key to effective performance under pressure



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Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Mental checklist for thinking under pressure

- Stop and think
- Scan the situation
- Decide and act
- Maintain clear, concise control
- Regularly and continually reevaluate the patient

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Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Facilitating behaviors

- Stay calm, don't panic
- Assume and plan for the worst; err on the side of the patient
- Maintain a systematic assessment pattern

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Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Facilitating behaviors

- Balance analysis, data processing and decision-making styles
  - Situation analysis styles: reflective vs. impulsive
  - Data processing styles: divergent vs. convergent
  - Decision making styles: anticipatory vs. reactive

Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Situation awareness

- Reading the scene
- Reading the patient

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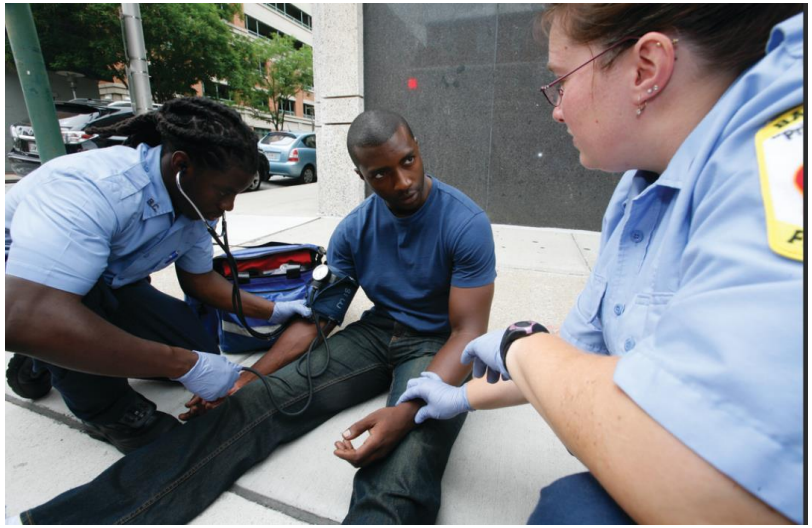
Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Putting it all together - “The Six R’s”



1. Read the patient
   - Observe the patient
   - Talk to the patient
   - Touch the patient
   - Auscultate the patient
   - Status of ABC’s-identifying life threats
   - Complete an accurate set of vital signs

Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Putting it all together - “The Six R’s”

2. Read the scene

- General environmental conditions
- Evaluate immediate surroundings
- Mechanism of injury

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Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Putting it all together - “The Six R’s”

3. React

- Address life threats in the order they are found
- Determine the most common and statistically probable that fits the patient’s initial presentation
- Consider the most serious condition that fits the patient’s initial presentation
- If a clear medical problem is elusive, treat based on presenting signs and symptoms

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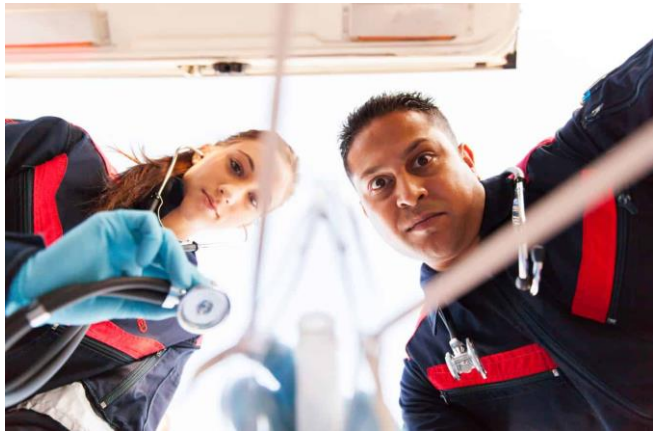
Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Putting it all together - “The Six R’s”

4. Reevaluate

- Focused and detailed assessment
- Response to initial management/interventions
- Discovery of less obvious problems



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Patient Assessment & Clinical Decision Making

Considerations with field application of assessment-based patient management:

Putting it all together - “The Six R’s”

5. Revise management plan

6. Review performance at run critique

Overview of Human Systems

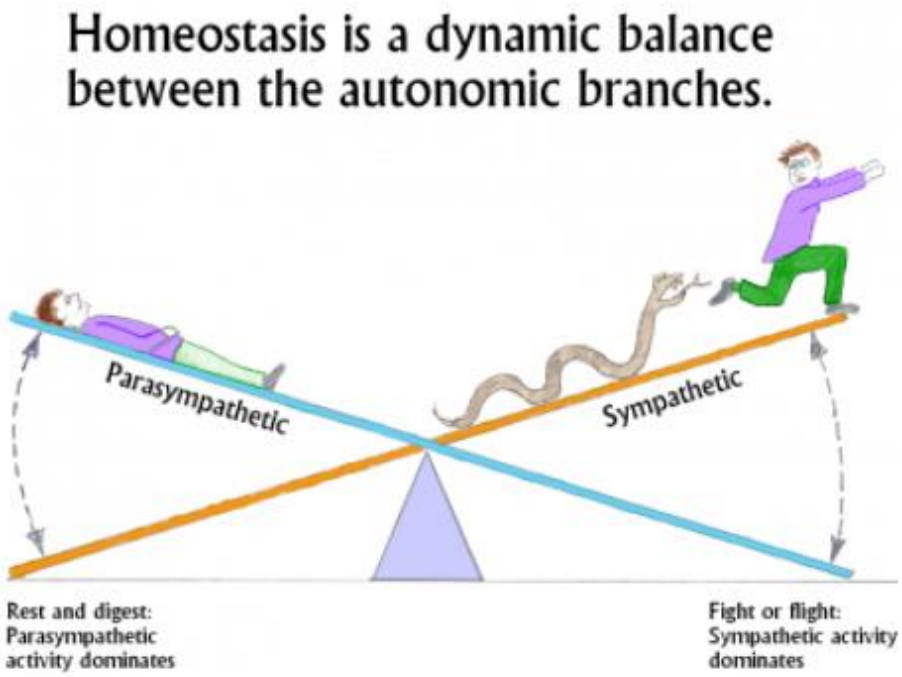
Lesson 2 Cognitive Objectives:

- At the end of this lesson the EMT-IV student will be able to explain how the anatomy and physiology of each body system relates and provides the foundation for the clinical practice of out of hospital emergency medicine.

Overview of Human Systems

Organization and General Plan of the Body:

- Define homeostasis



Overview of Human Systems

Organization and General Plan of the Body:

The Integumentary System

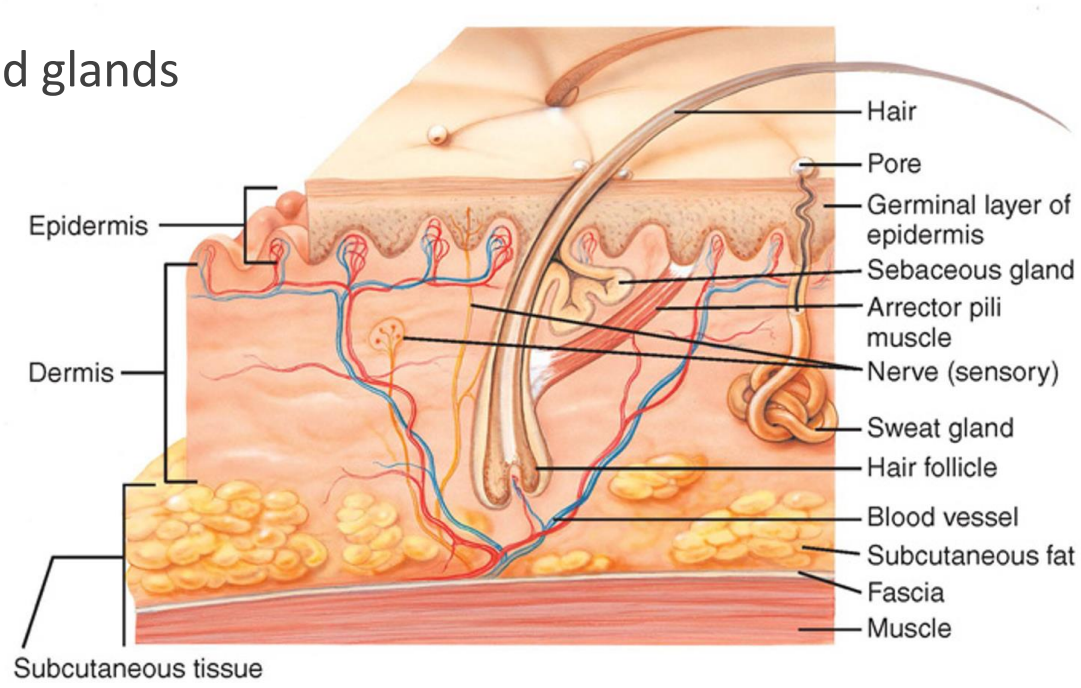
- Name the two major layers of the skin and the tissue of which each is made.
- Describe how the arterioles in the dermis respond to heat, cold, and stress.
- Name the tissues that make up the subcutaneous tissue and describe their functions.

Overview of Human Systems

Organization and General Plan of the Body:

Tissues

- Epithelial tissue and glands
- Connective tissue
  - Blood
  - Plasma



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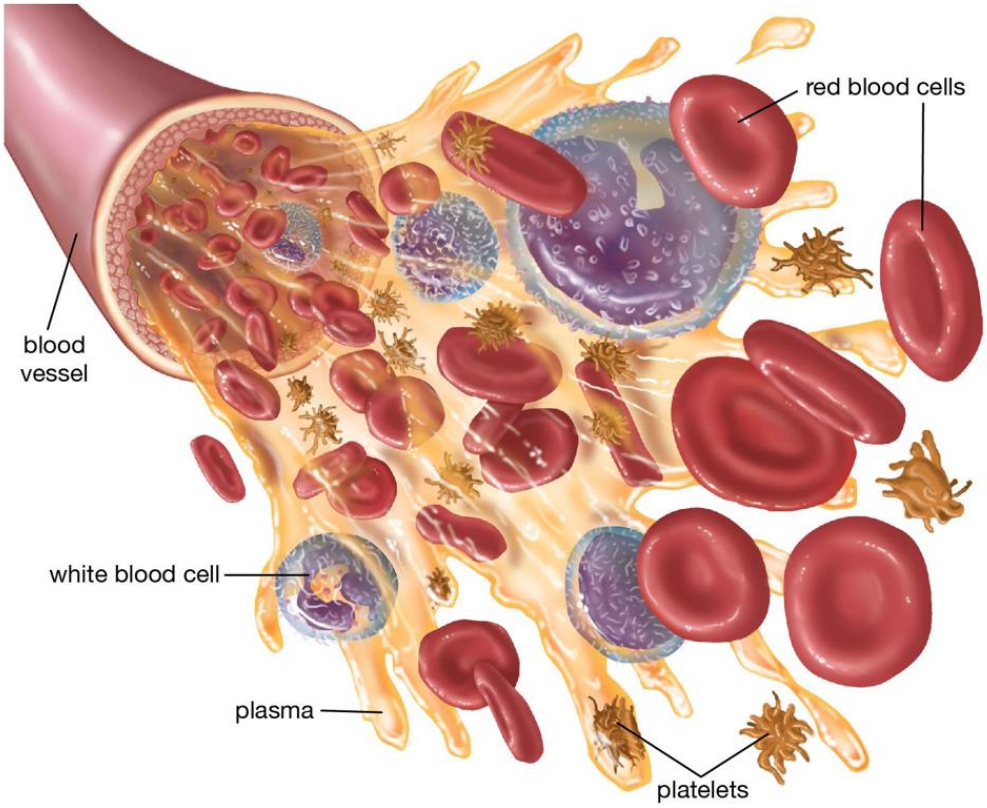
Overview of Human Systems

Organization and General Plan of the Body:

Tissues

- Blood cells
  - Red blood cells
  - White blood cells
  - Platelet



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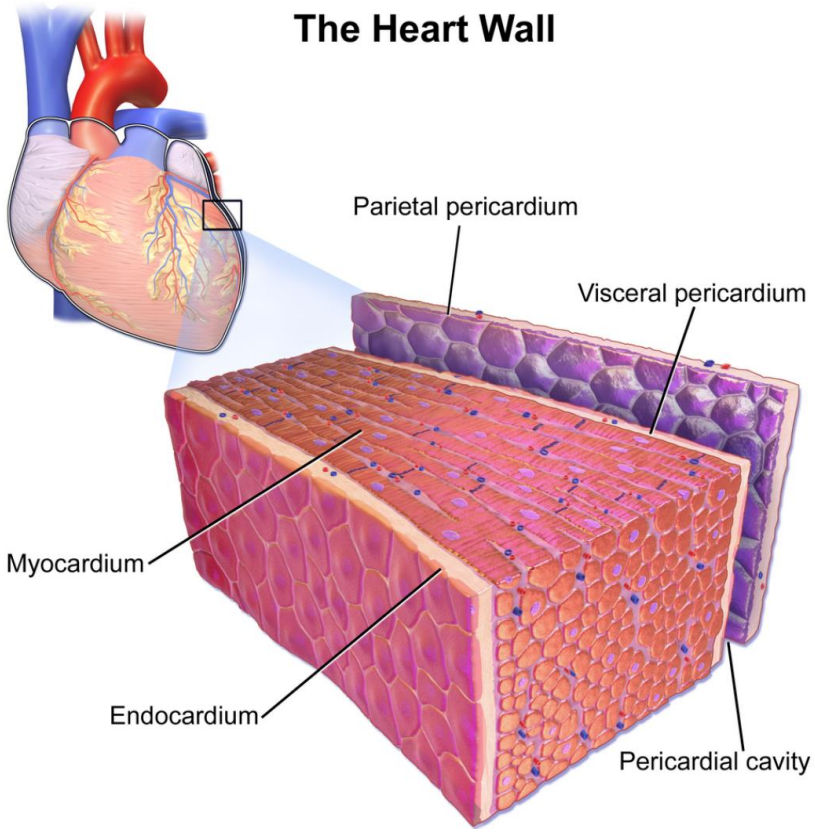
Overview of Human Systems

Organization and General Plan of the Body:

Tissues

- Cardiac muscle tissue
  - Involuntary muscle



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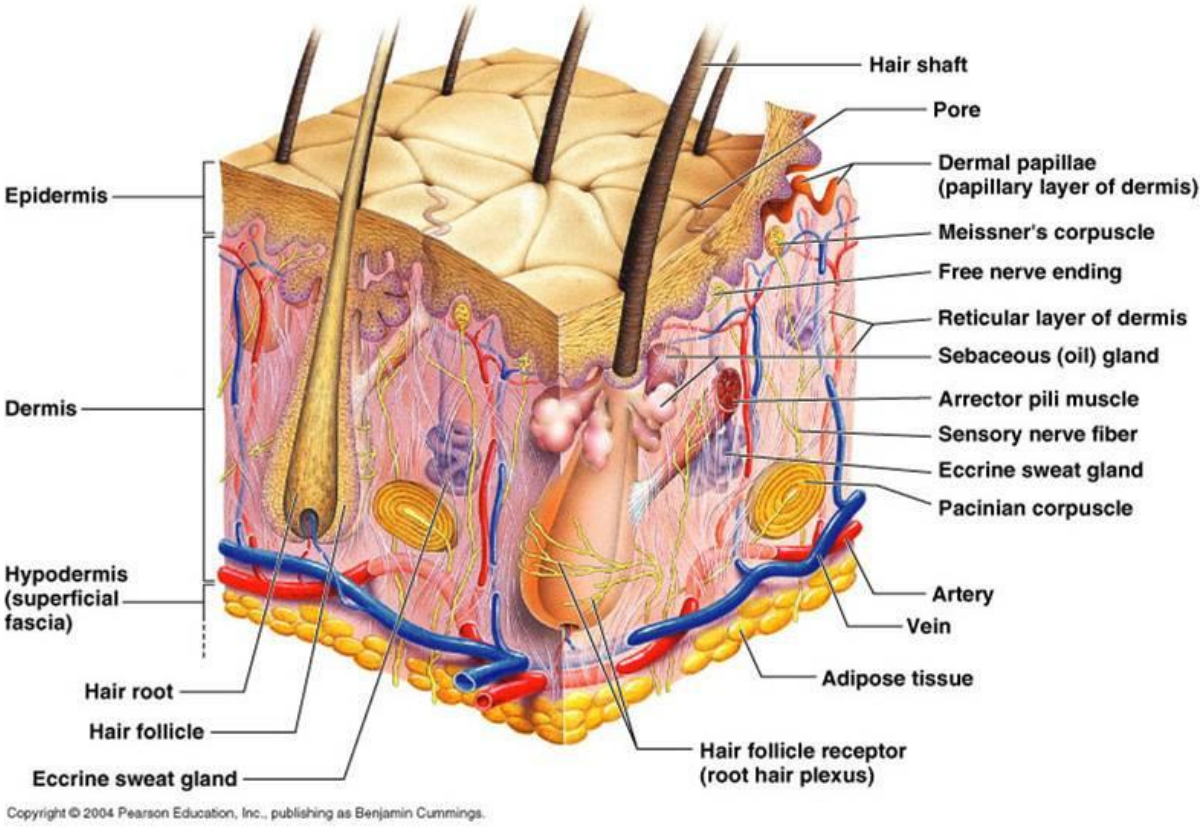
Overview of Human Systems

Organization and General Plan of the Body:

Integumentary system

- Epidermis

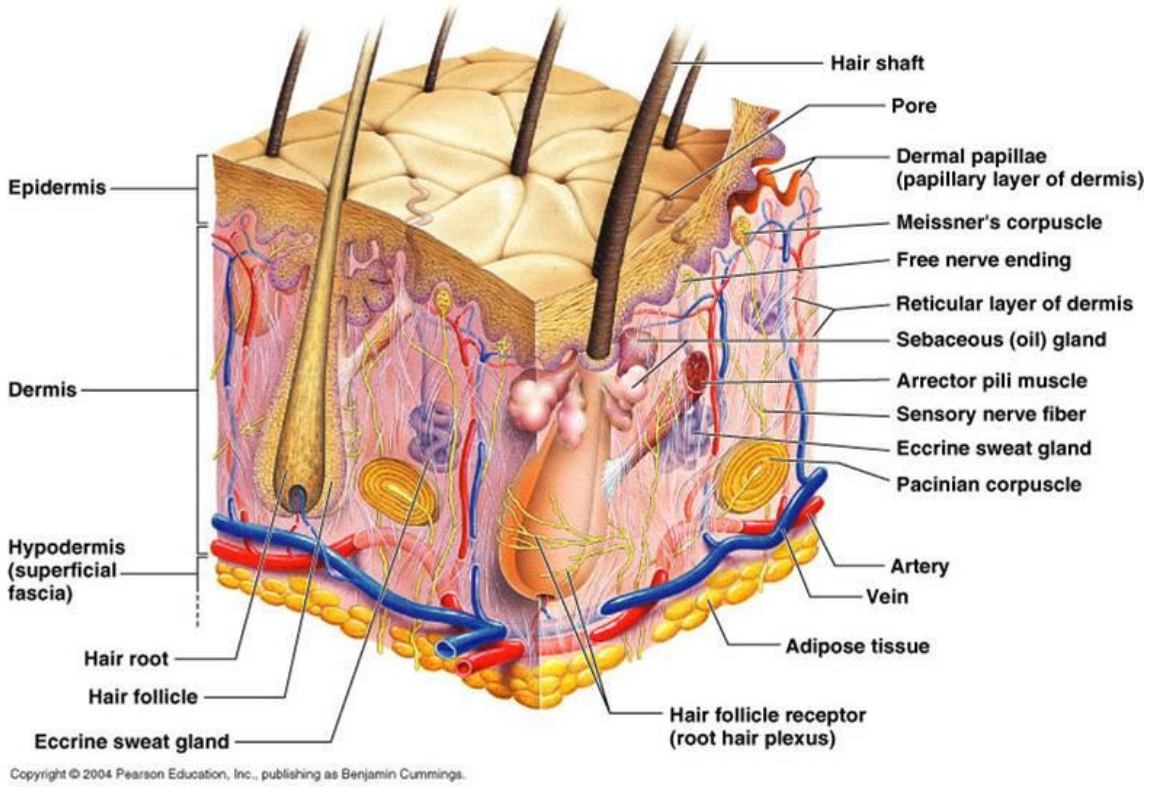


Overview of Human Systems

Organization and General Plan of the Body:

Integumentary system

- Dermis
  - Receptors
  - Glands
  - Blood vessels

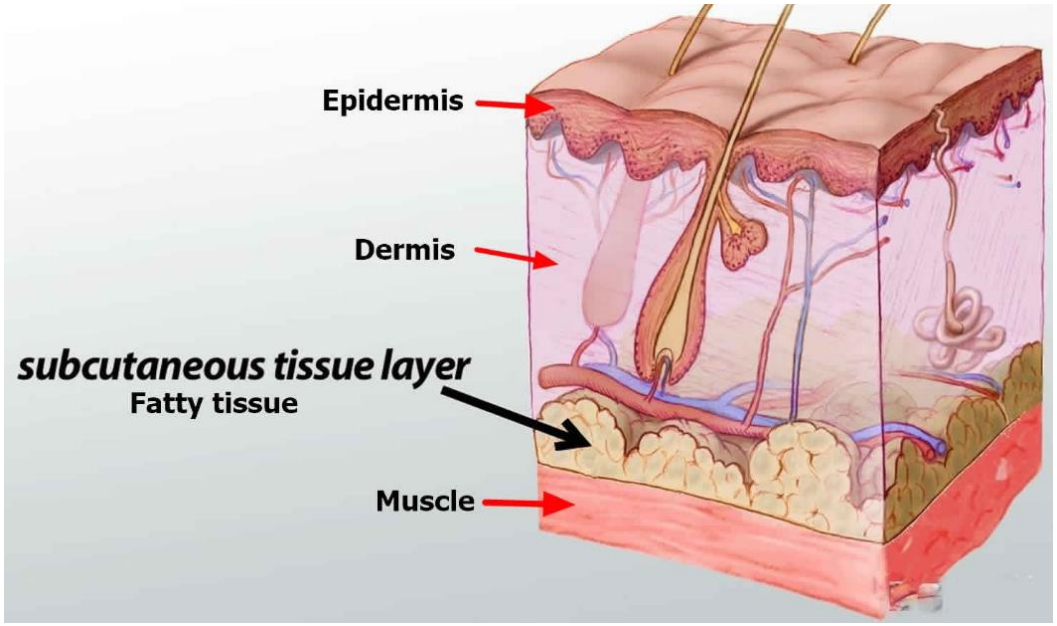


Overview of Human Systems

Organization and General Plan of the Body:

Integumentary system

- Subcutaneous tissue



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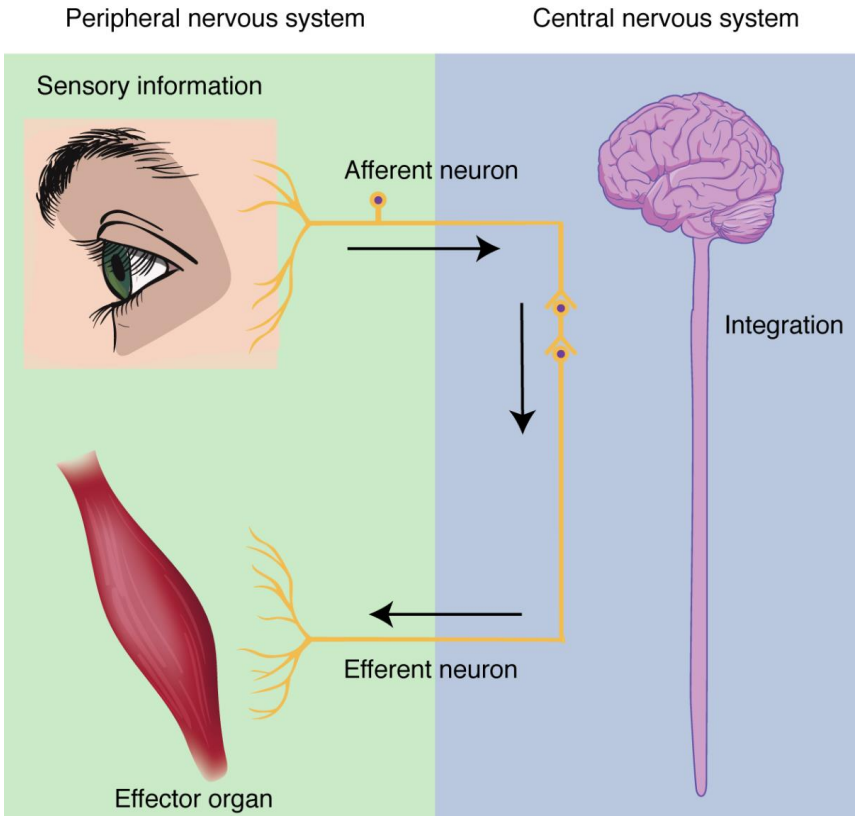
Overview of Human Systems

Organization and General Plan of the Body:

Nervous system

- Afferent impulses
- Efferent impulses



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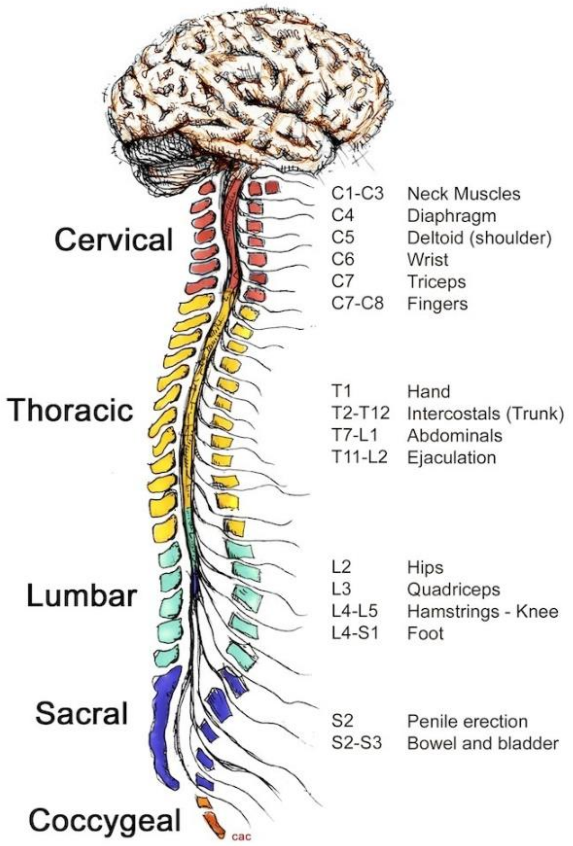
Overview of Human Systems

Organization and General Plan of the Body:

Nervous system

- Divisions of the spinal cord
  - Cervical
  - Thoracic
  - Lumbar

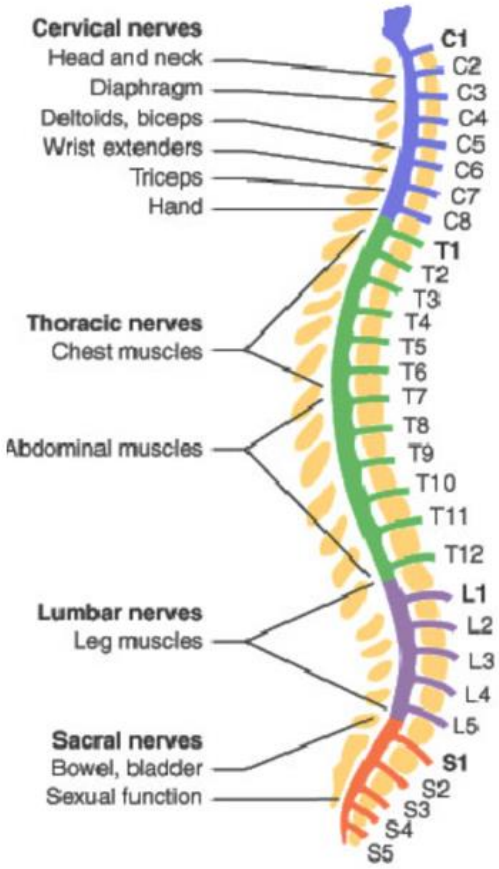


Overview of Human Systems

Organization and General Plan of the Body:

Nervous system

- Level of injury or disease of spinal cord
  - More serious the closer to the brain stem
  - Dynamics of neurogenic shock



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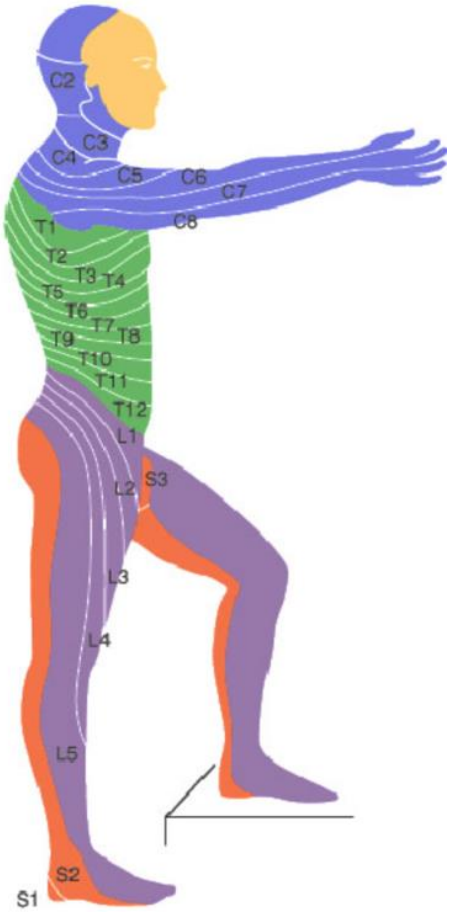
Overview of Human Systems

Organization and General Plan of the Body:

Nervous system

- Nerve root control
  - Cervical (shoulder girdle C5)
  - Thoracic
    - Sensation at nipple level (T4)
    - Sensation at the umbilicus level (T10)
  - Lumbar
  - Sacral



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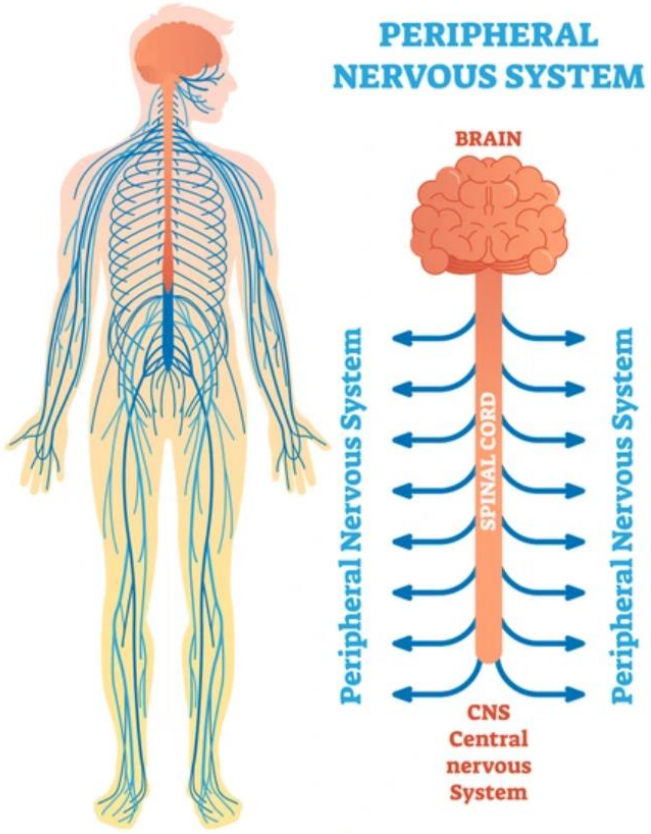
Overview of Human Systems

Organization and General Plan of the Body:

Peripheral nervous system

- Categories
  - Somatic sensory
    - Pain
    - Temperature
    - Touch
    - Pressure
    - Position or muscle sense
  - Somatic motor



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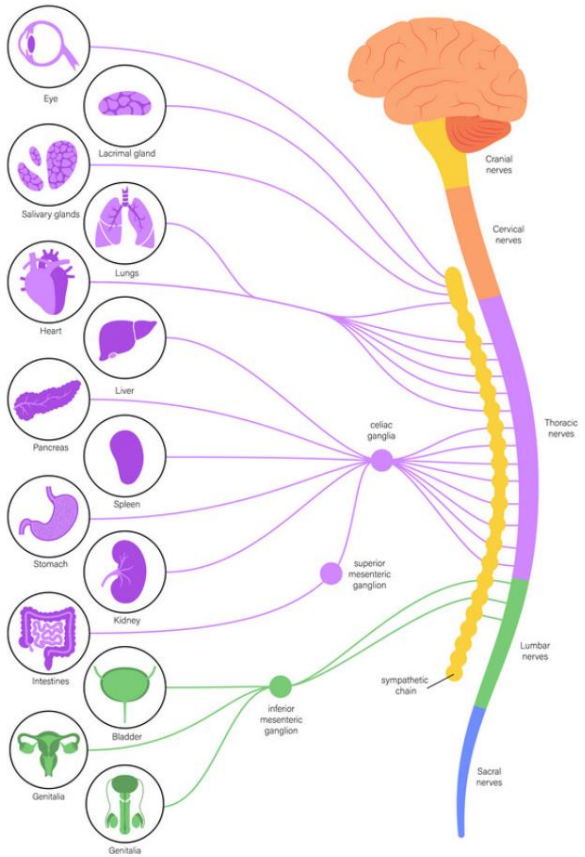
Overview of Human Systems

Organization and General Plan of the Body:

Peripheral nervous system

- Categories
  - Visceral sensory
  - Visceral motor



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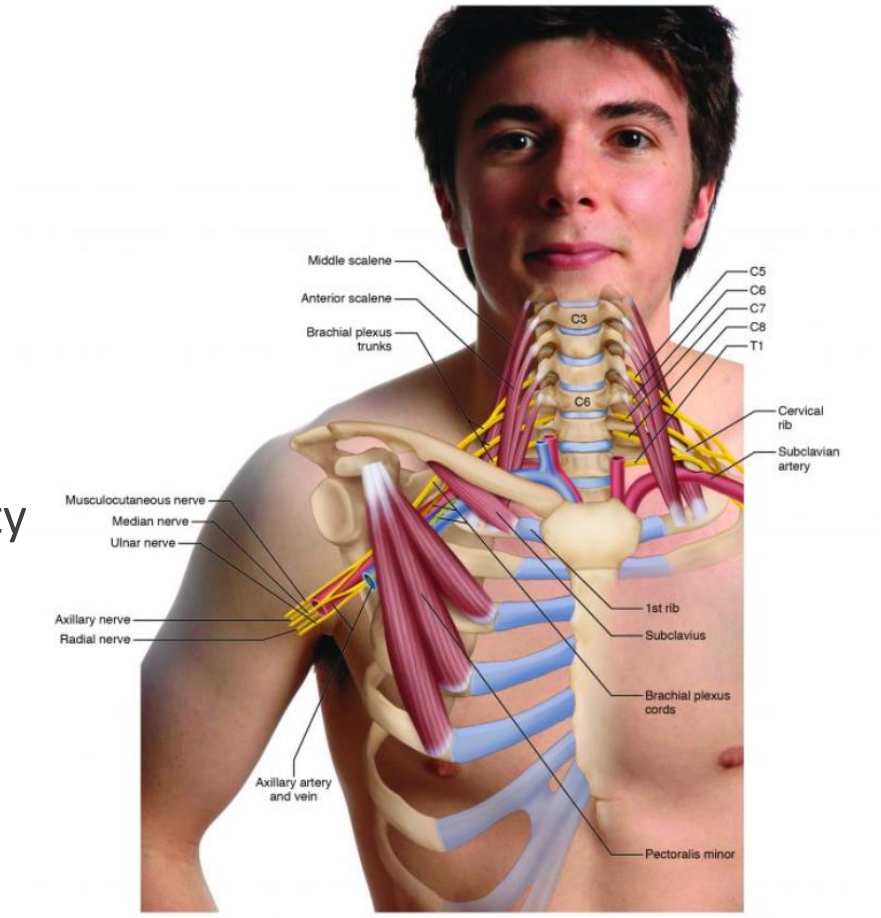
Overview of Human Systems

Organization and General Plan of the Body:

Peripheral nervous system

- Brachial plexus
  - Collection of nerves at the posterior triangle of the neck
  - May be injured at birth, or in injuries causing permanent disability
  - Major nerves



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Overview of Human Systems

Organization and General Plan of the Body:

Autonomic nervous system- Function beyond conscious control

- Divisions
  - Sympathetic
    - More widespread effects
    - Stimulation causes increased heart rate, increased BP, rise in blood sugar, bronchodilation
    - “Fight or flight”

Overview of Human Systems

Organization and General Plan of the Body:

Autonomic nervous system- Function beyond conscious control

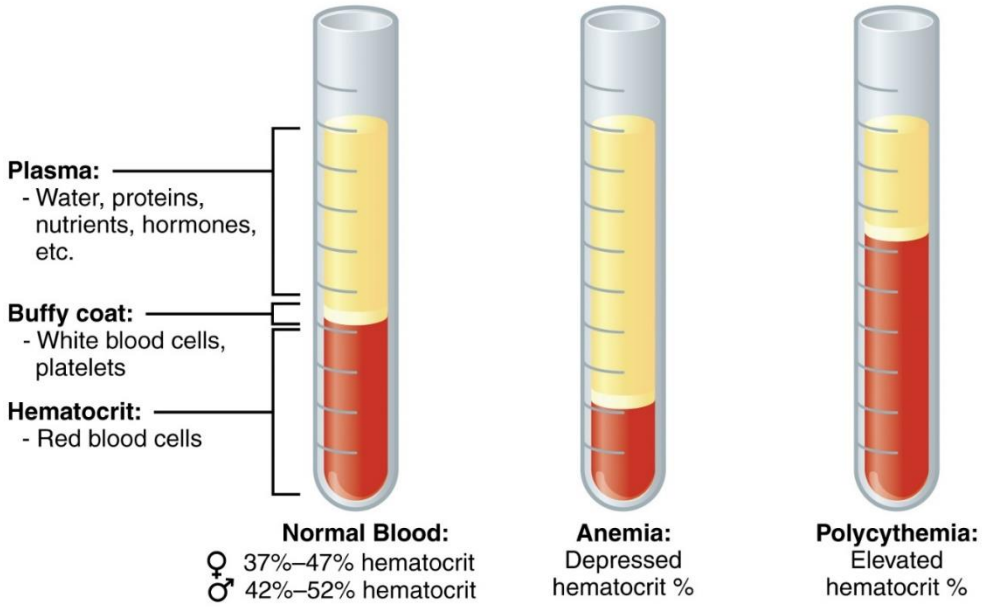
- Divisions
  - Parasympathetic
    - Effects more apparent in quiet state
    - Body conservation processes, i.e., digestion and storage of materials for well-being
    - Complementary effects

Overview of Human Systems

Organization and General Plan of the Body:

Blood

- Characteristics of blood
  - Amount
  - Color
- Plasma

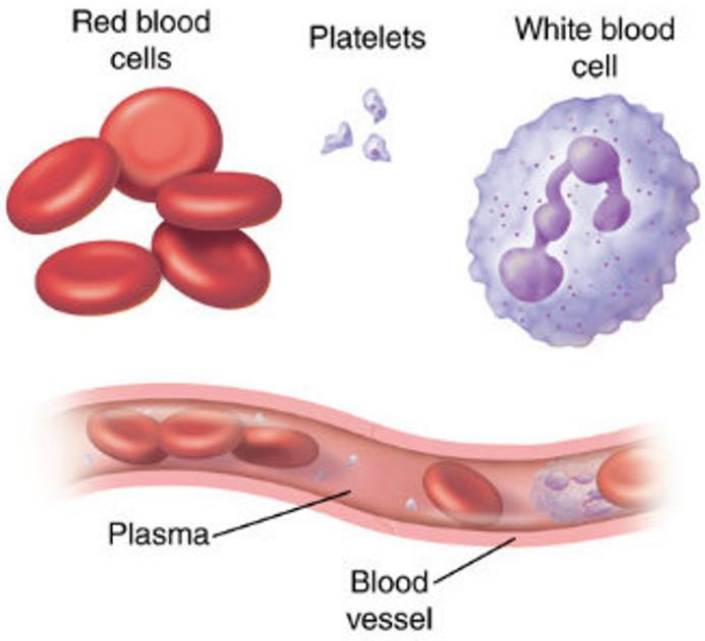


Overview of Human Systems

Organization and General Plan of the Body:

Blood cells

- Red blood cells
  - Function
  - Production and maturation
  - Blood types

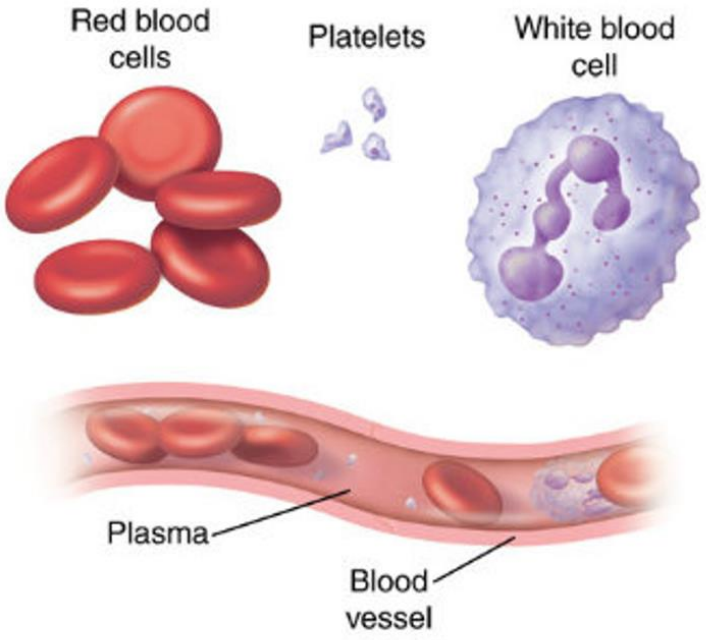


Overview of Human Systems

Organization and General Plan of the Body:

Blood cells

- White blood cells
  - Functions

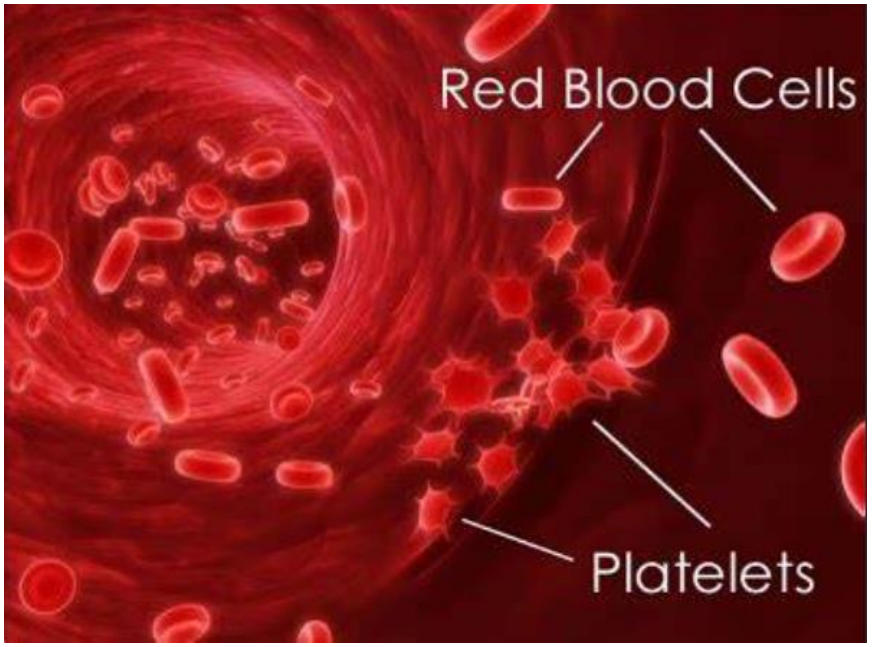


Overview of Human Systems

Organization and General Plan of the Body:

Blood cells

- Platelets
  - Functions
  - Blood clotting

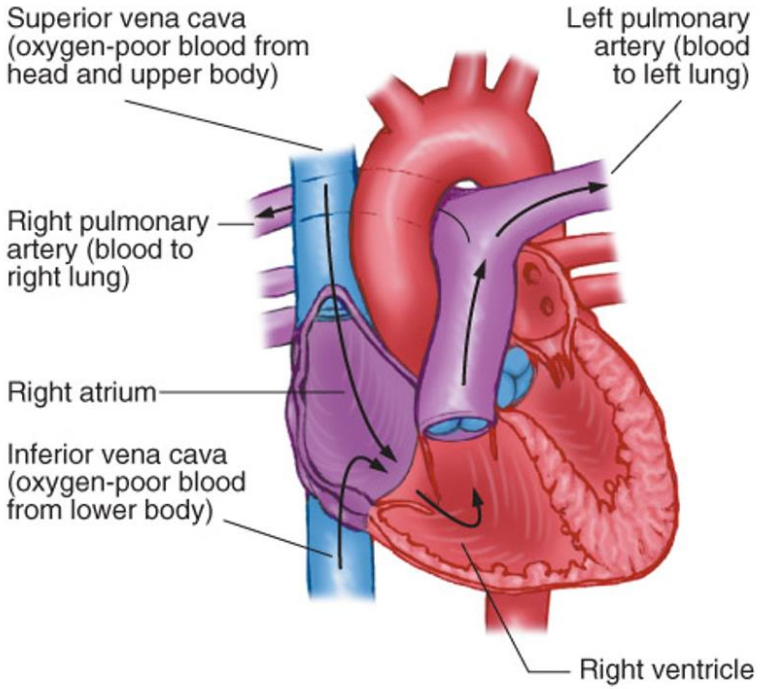


Overview of Human Systems

Organization and General Plan of the Body:

The Heart- Chambers, vessels, and valves

- Right atrium
  - Superior vena cava
  - Inferior vena cava
  - Tricuspid valve

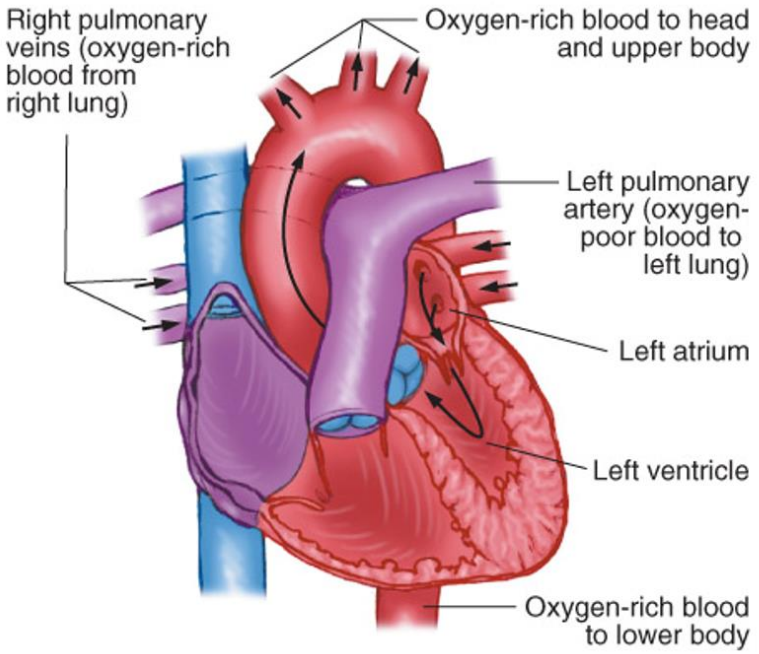


Overview of Human Systems

Organization and General Plan of the Body:

The Heart- Chambers, vessels, and valves

- Left atrium
  - Pulmonary veins
  - Mitral valve / bicuspid

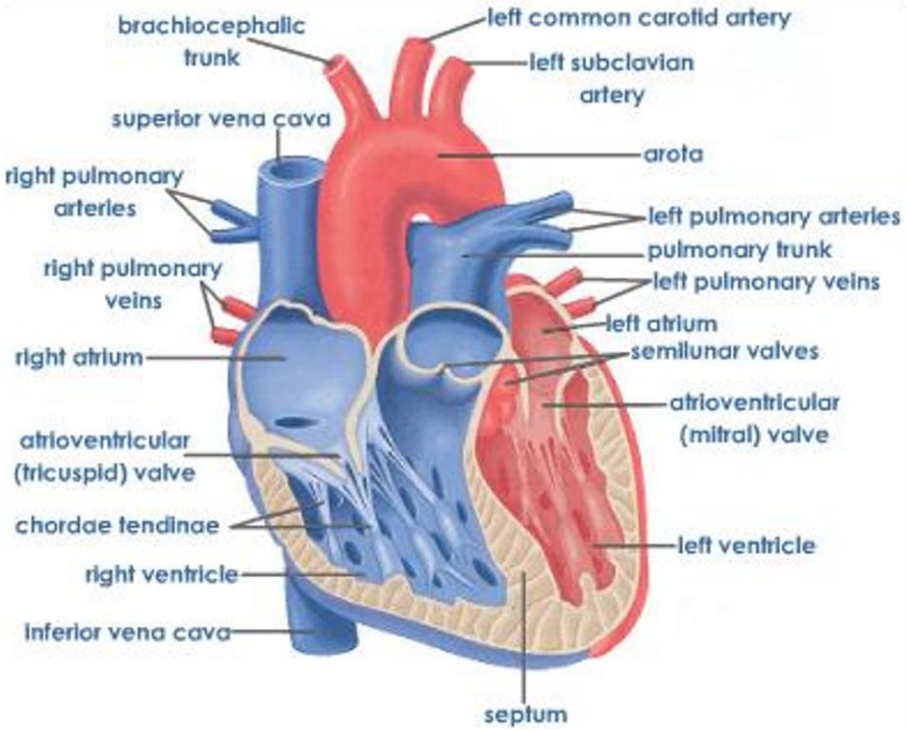


Overview of Human Systems

Organization and General Plan of the Body:

The Heart- Chambers, vessels, and valves

- Right ventricle
  - Pulmonary artery
  - Pulmonary semilunar valve



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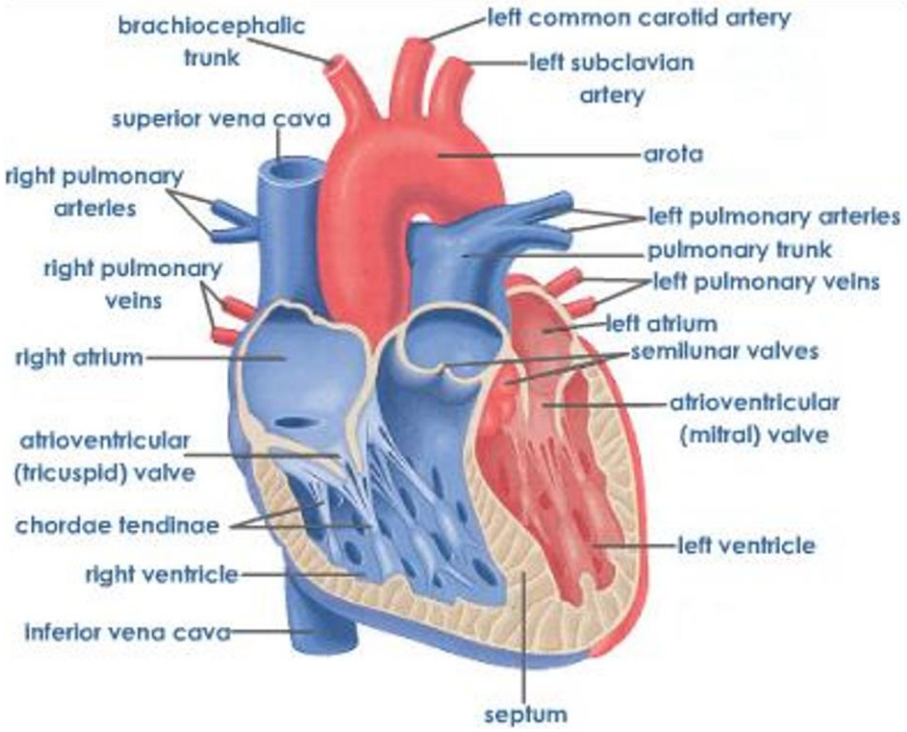
Overview of Human Systems

Organization and General Plan of the Body:

The Heart- Chambers, vessels, and valves

- Left ventricle
  - Aorta
  - Aortic semilunar valve



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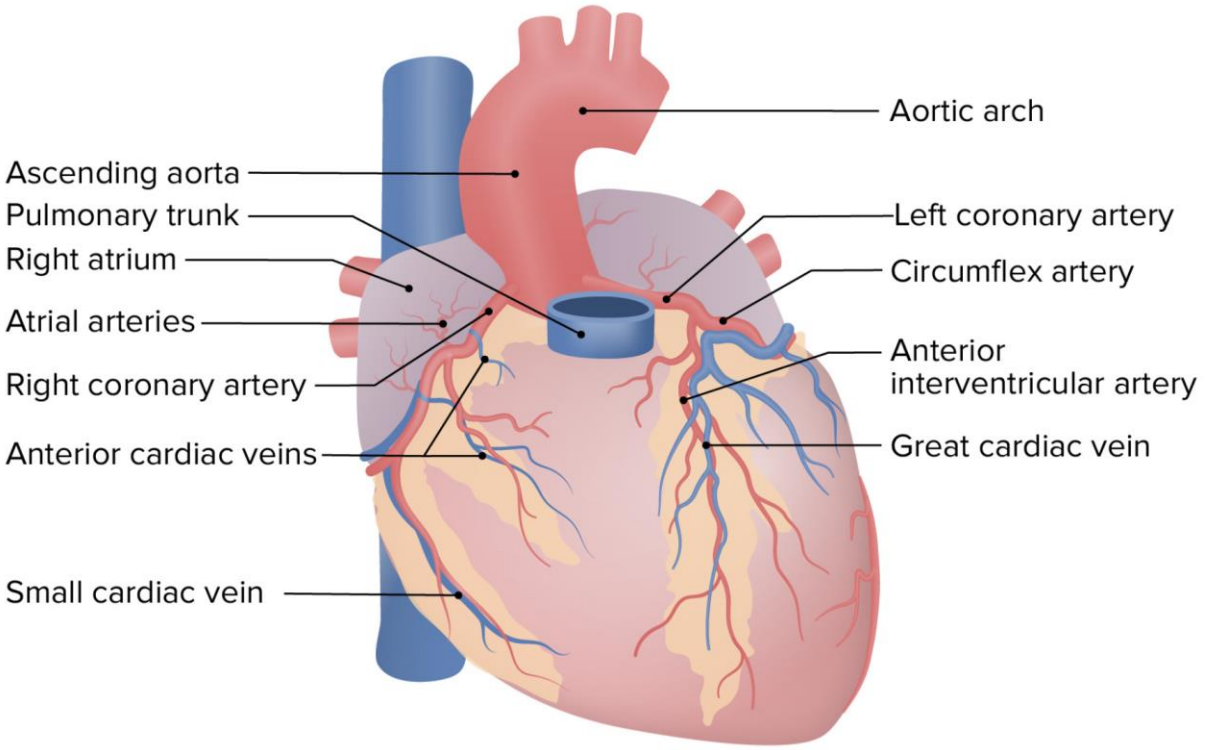
Overview of Human Systems

Organization and General Plan of the Body:

The Heart- Chambers, vessels, and valves

- Coronary vessels

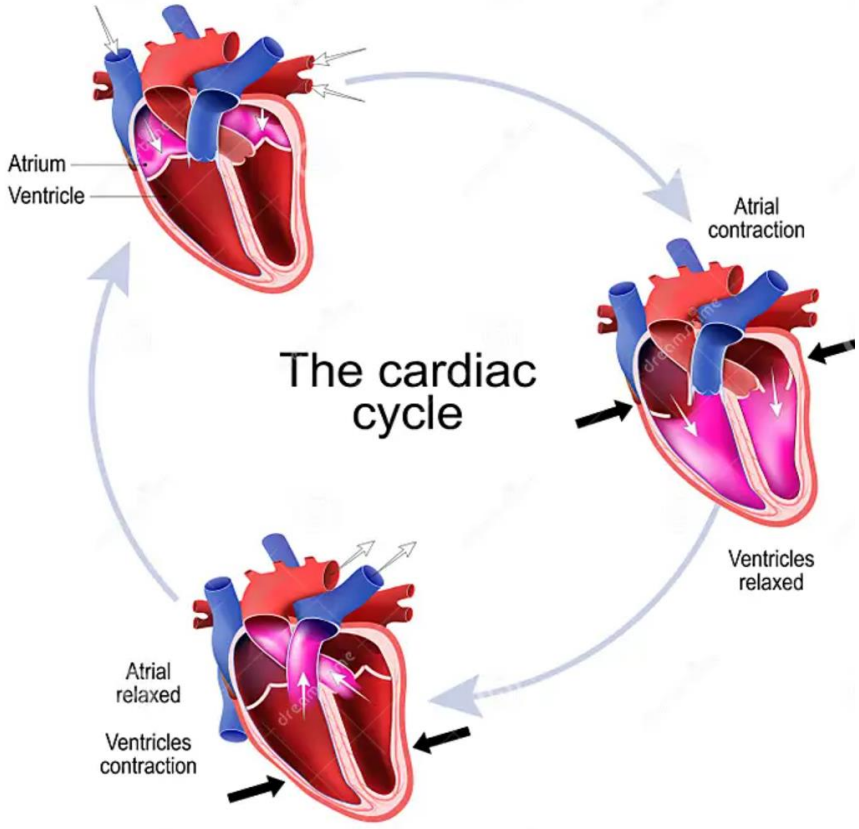


Overview of Human Systems

Organization and General Plan of the Body:

The heart- Cardiac cycle

- Systole
- Diastole



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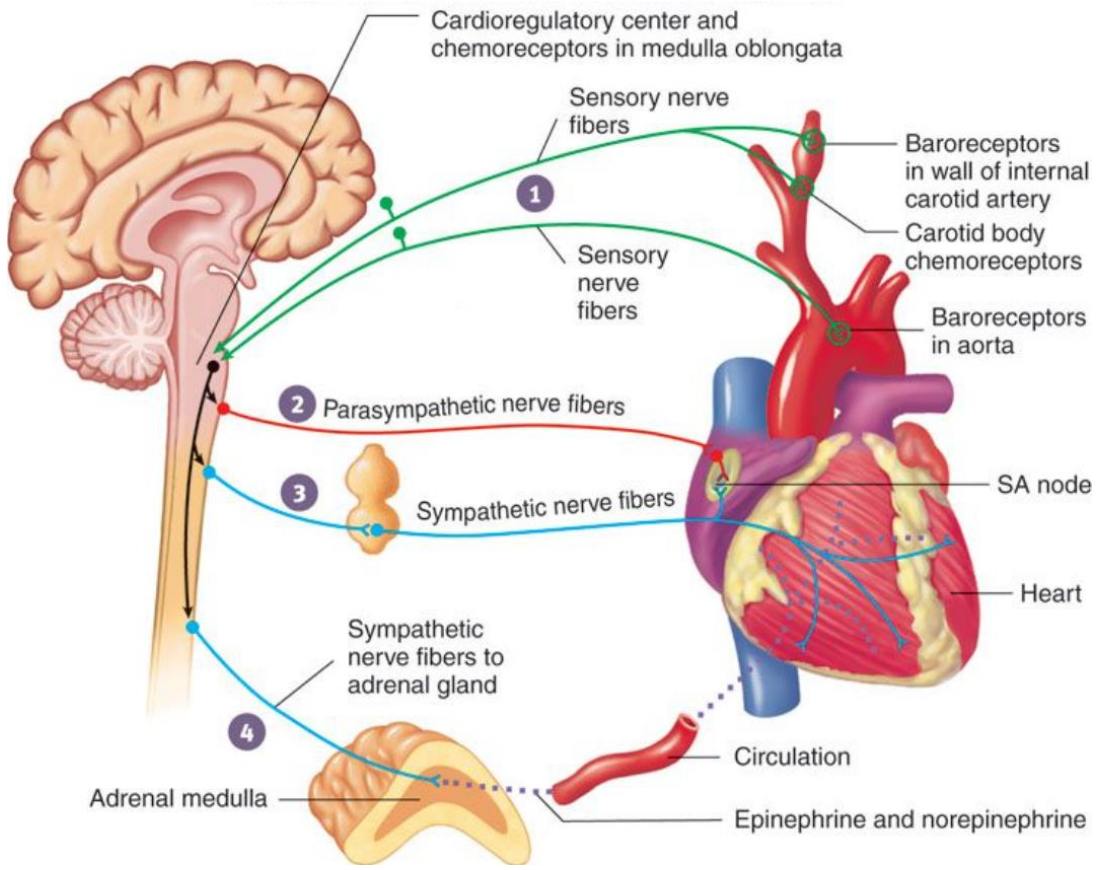
Overview of Human Systems

Organization and General Plan of the Body:

The heart- Cardiac output

- Heart rate
  - Baroreceptors



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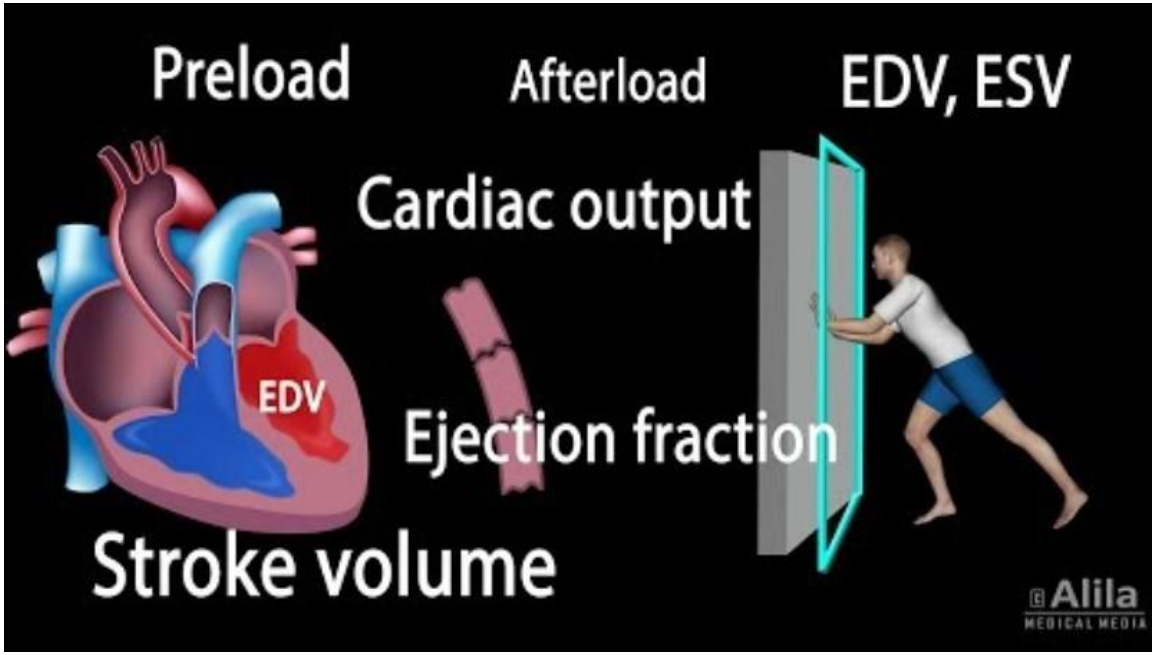
Overview of Human Systems

Organization and General Plan of the Body:

The heart- Cardiac output

- Stroke volume



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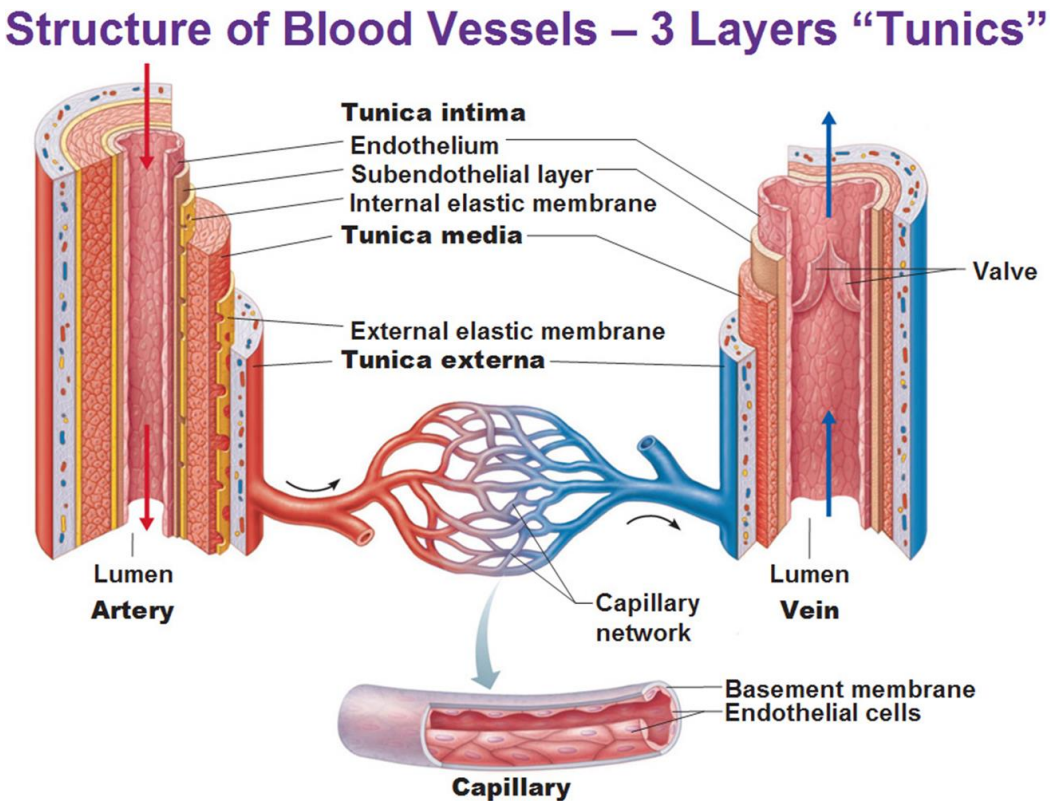
Overview of Human Systems

Organization and General Plan of the Body:

The vascular system

- Layers of blood vessels
  - Tunica intima/endothelium
  - Tunica media
  - Tunica externa

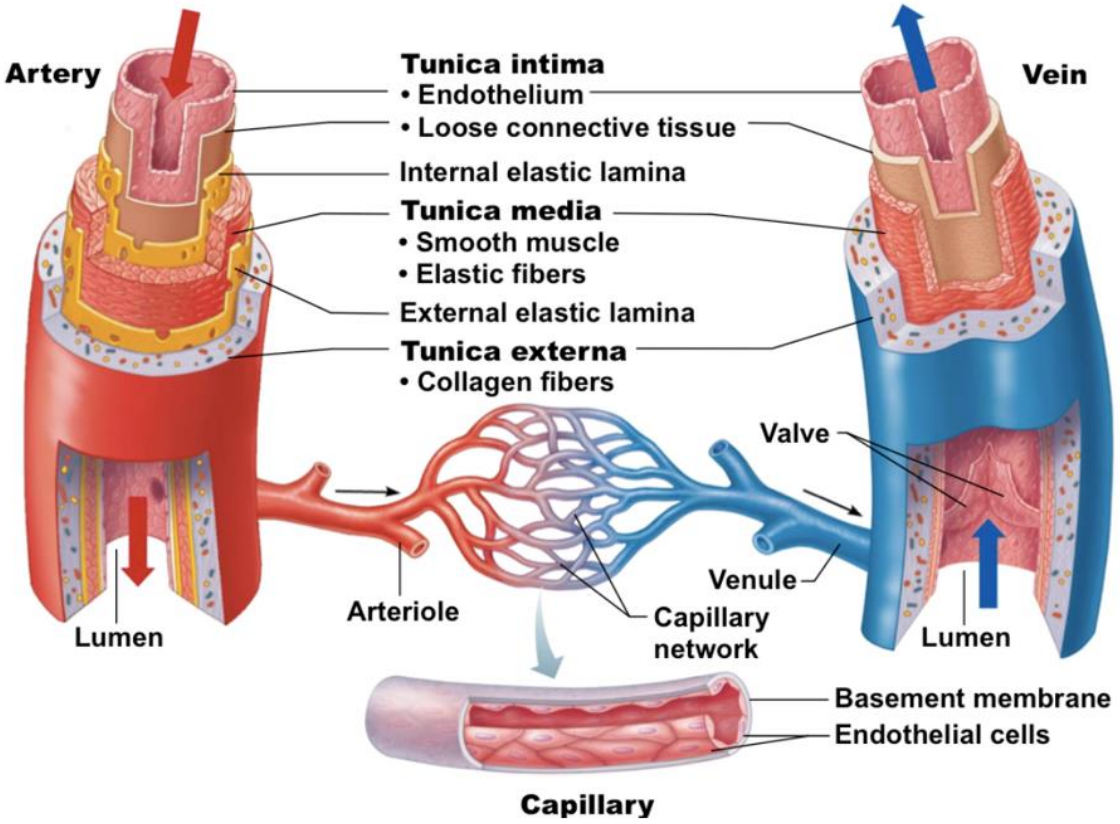


Overview of Human Systems

Organization and General Plan of the Body:

The vascular system

- Arteries
- Veins
- Valves
- Capillaries



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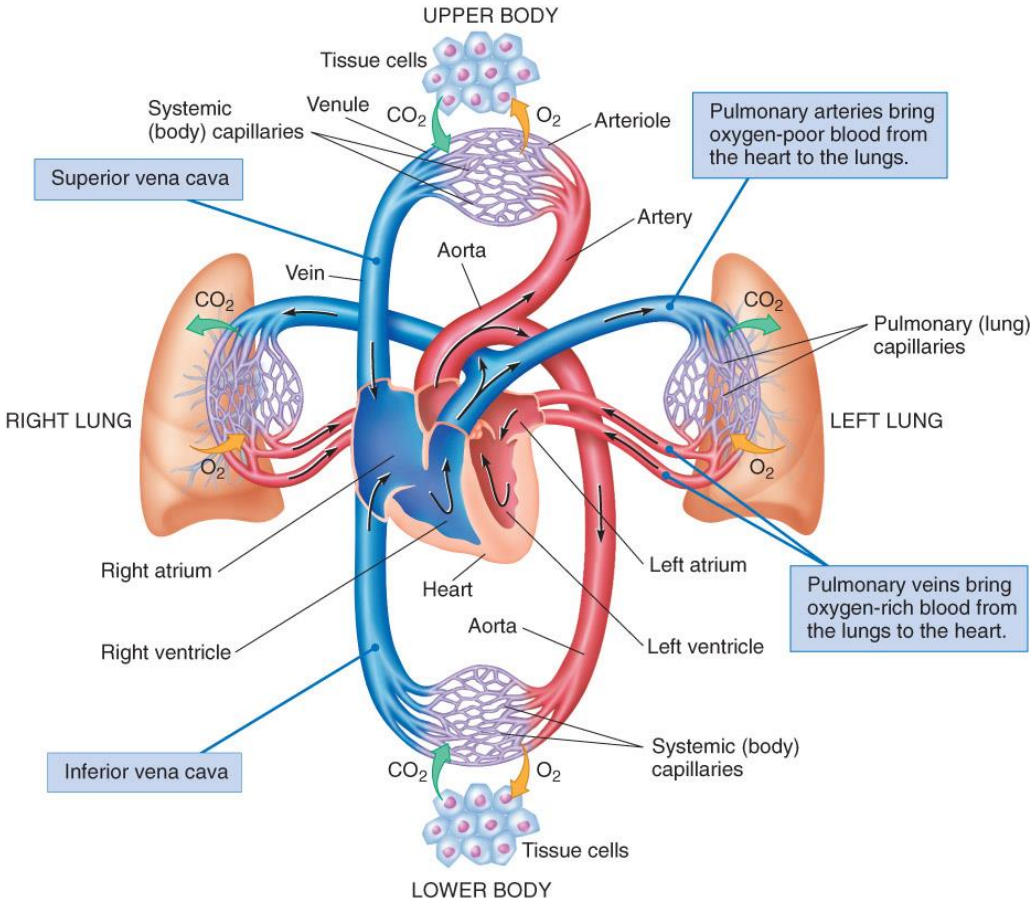
Overview of Human Systems

Organization and General Plan of the Body:

Exchange in the capillaries

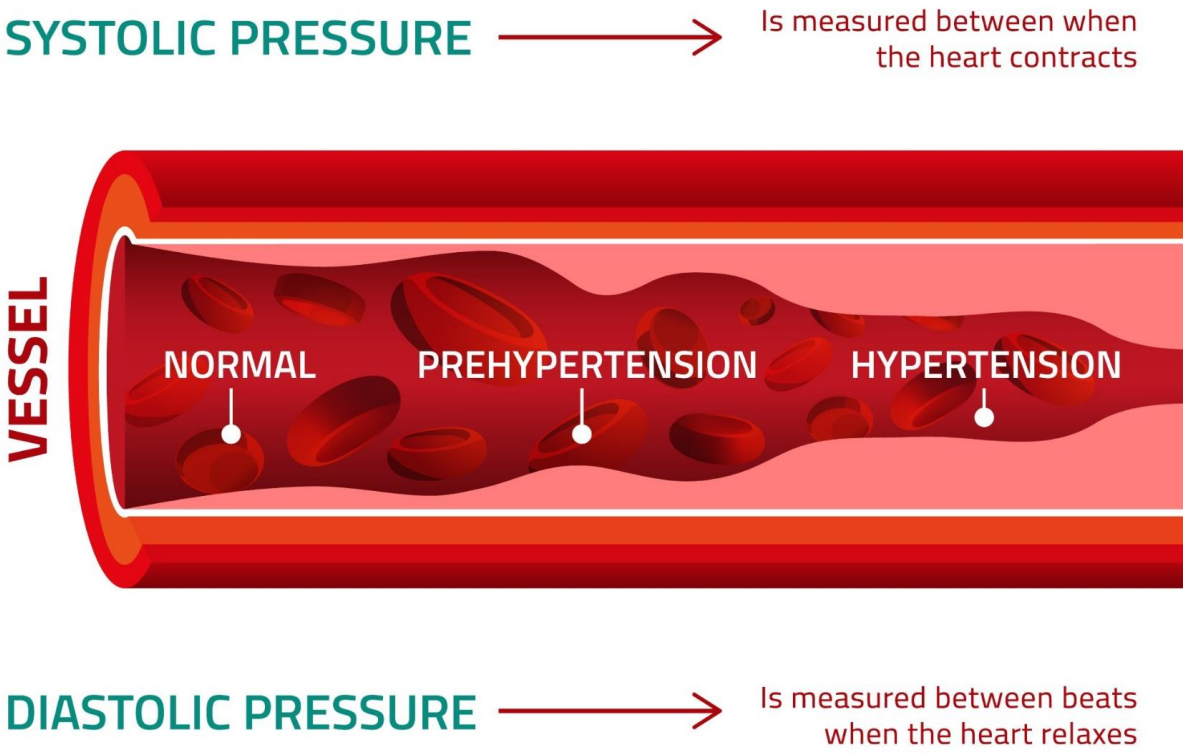
- Gas exchange
- Fluid exchange



Overview of Human Systems

Organization and General Plan of the Body:

- Blood pressure



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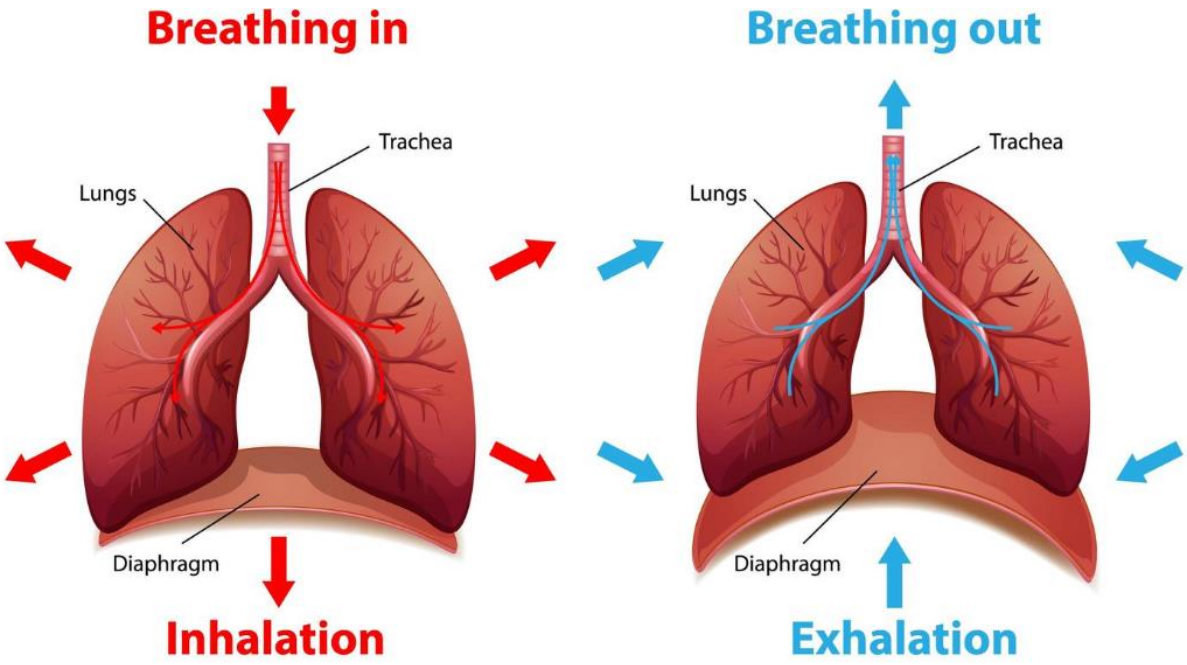
Overview of Human Systems

Organization and General Plan of the Body:

Respiratory system

- Breathing mechanics
  - Inhalation
  - Exhalation



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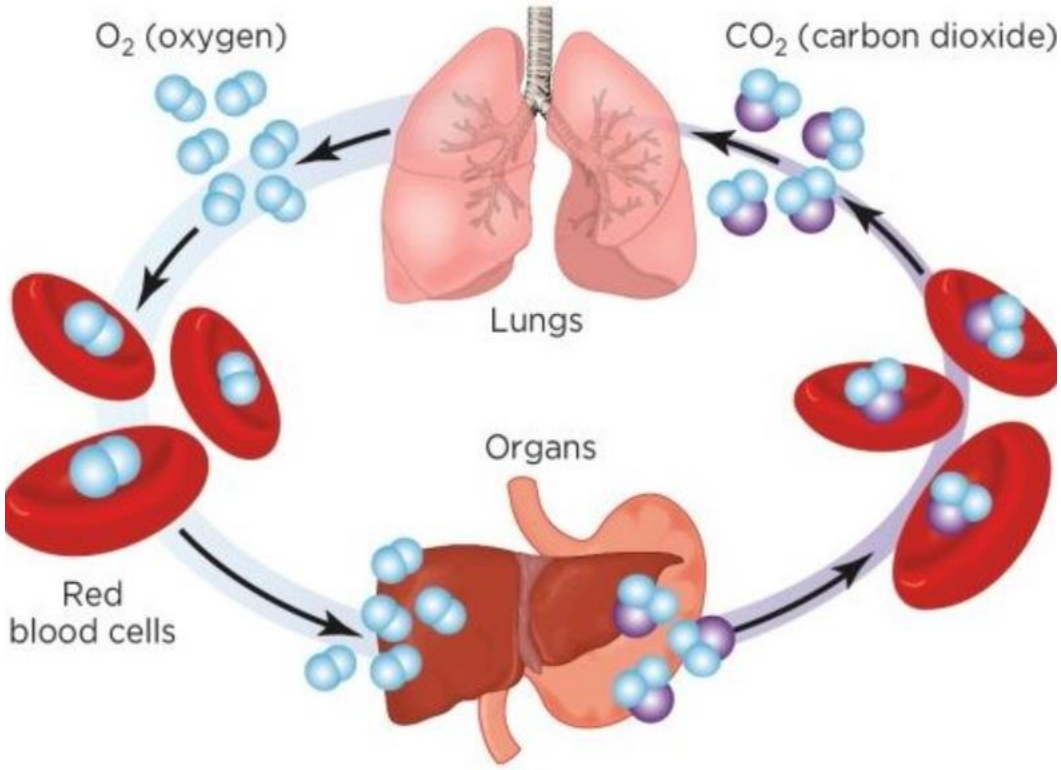
Overview of Human Systems

Organization and General Plan of the Body:

Respiratory system

- Exchange of gasses
  - Diffusion of gasses
  - Transportation of gases



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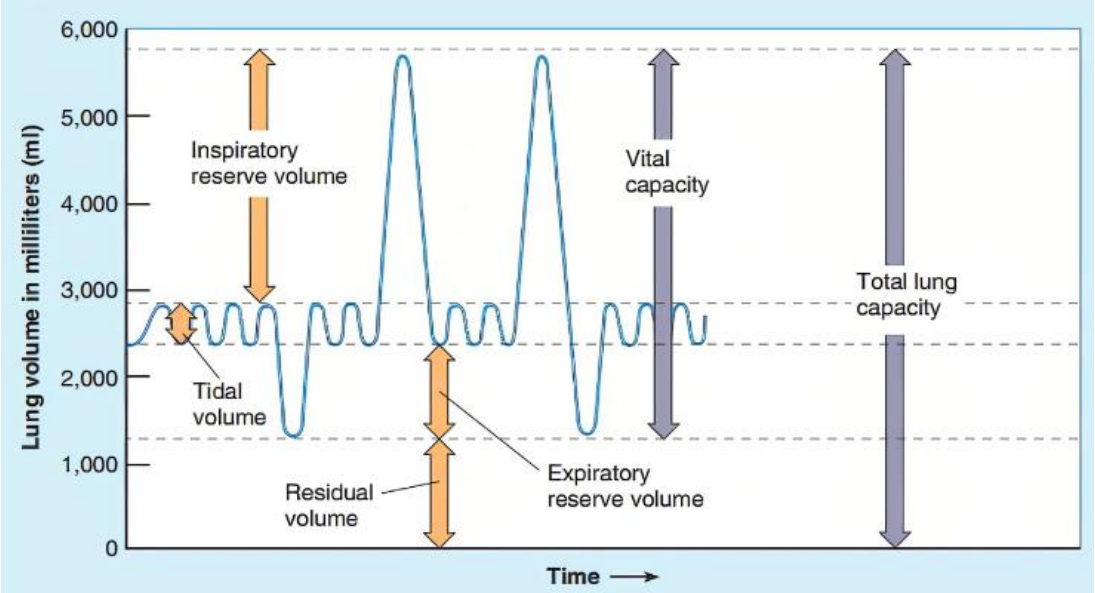
Overview of Human Systems

Organization and General Plan of the Body:

Respiratory system- Pulmonary volumes

- Tidal volume
- Minute respiratory volume
- Inspiratory reserve
- Expiratory reserve
- Vital capacity
- Residual air

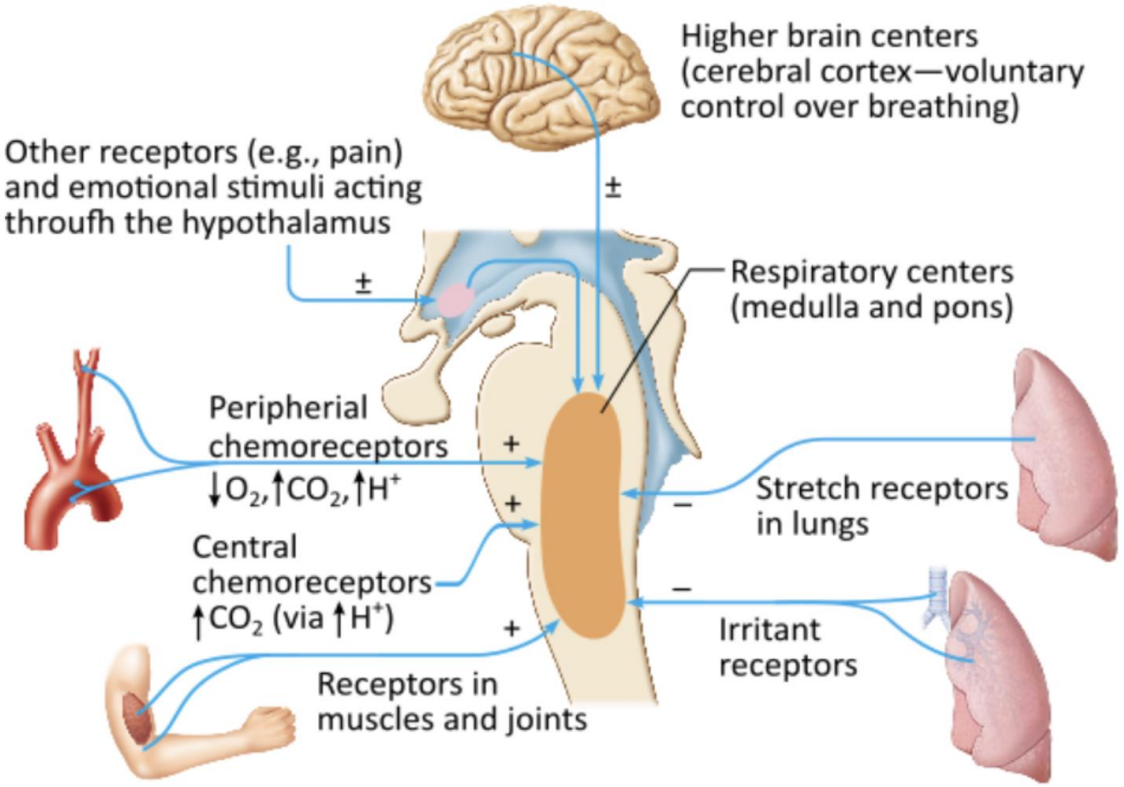


Overview of Human Systems

Organization and General Plan of the Body:

Respiratory system

- Regulation of respiration
  - Nervous control
  - Chemical control



Assessment & Management of Shock

Lesson 3 Cognitive Objectives:

- At the end of this lesson, the EMT-IV student will be able to utilize the assessment findings to formulate a field impression and implement the treatment plan for the bleeding patient or the patient in shock.

Assessment & Management of Shock

Lesson 3 Cognitive Objectives:

- Describe the epidemiology, including the morbidity/mortality and prevention strategies, for shock and hemorrhage.
- Discuss the anatomy and physiology of the cardiovascular system.
- Predict shock and hemorrhage based on mechanism of injury.
- Discuss the various types and degrees of shock and hemorrhage.
- Emphasize that placing an IV should not delay transport of the patient.

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage- Epidemiology

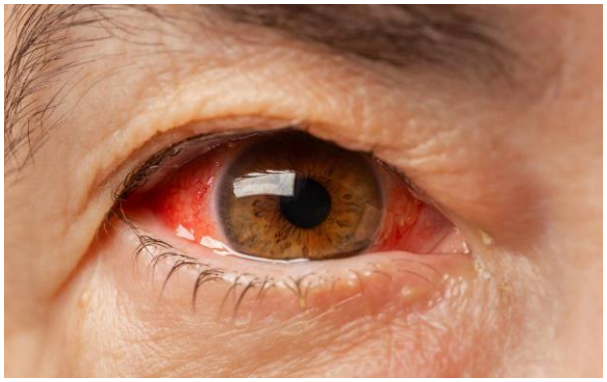
- Incidence
- Mortality/morbidity
- Prevention strategies

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage- Pathophysiology

- Location
  - External
  - Internal
  - Trauma
  - Non- trauma
  - Common sites
  - Uncommon Sites

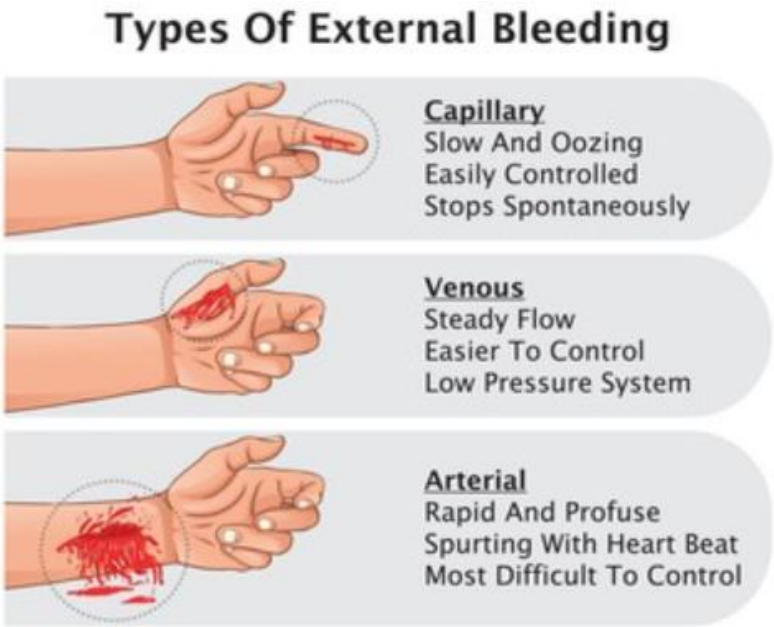


Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage- Anatomical type

- Capillary
- Venous
- Arterial



Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage

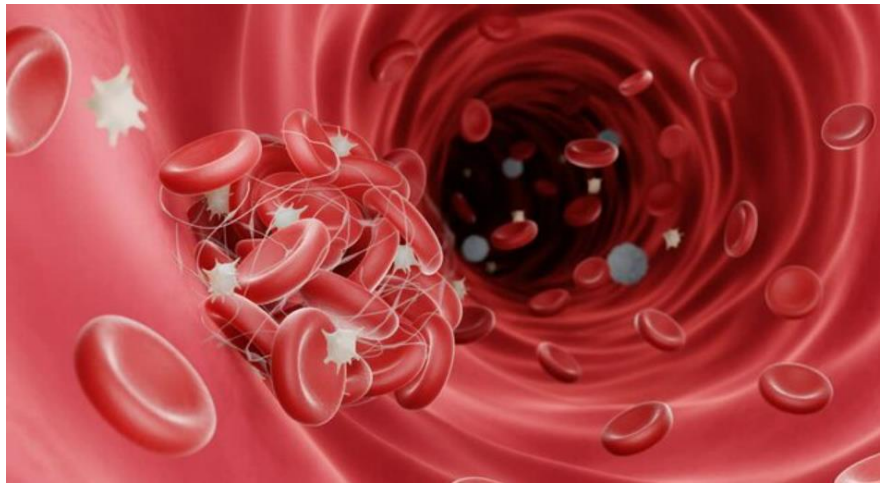
- Timing
  - Acute
  - Chronic
- Severity
  - Amounts of blood loss tolerated

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage

- Physiological response to hemorrhage
  - Clotting
  - Localized vasoconstriction

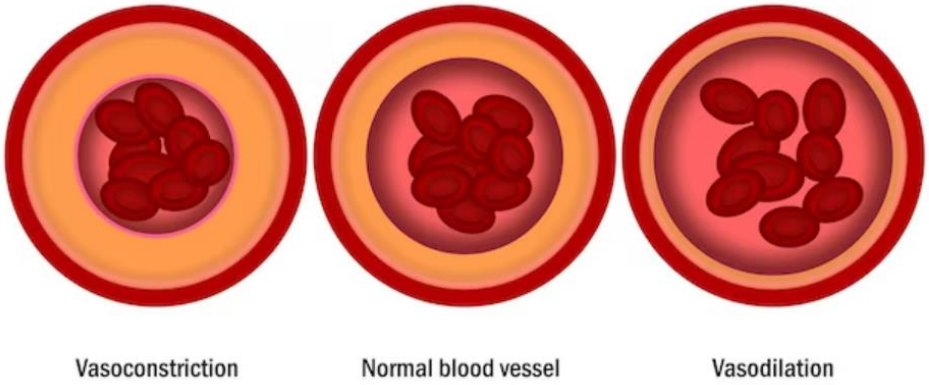


Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Stages of hemorrhage

- Stage 1
  - Up to 15% intravascular loss
  - Compensated by constriction of vascular bed
  - Blood pressure maintained



Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Stages of hemorrhage

- Stage 1
  - Normal pulse pressure, respiratory rate, and renal output
  - Pallor of the skin
  - Central venous pressure low to normal

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Stages of hemorrhage

- Stage 2
  - 15-25% intravascular loss
  - Cardiac output cannot be maintained by arteriolar constriction
  - Reflex tachycardia
  - Increased respiratory rate
  - Blood pressure maintained

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Stages of hemorrhage

- Stage 2
  - Catecholamines increase peripheral resistance
  - Increased diastolic pressure
  - Narrow pulse pressure
  - Diaphoresis from sympathetic stimulation
  - Renal output almost normal

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Stages of hemorrhage

- Stage 3
  - 25-35% intravascular loss
  - Marked tachycardia
  - Marked tachypnea
  - Decreased systolic pressure
  - 5-15 ml per hour urine output
  - Alteration in mental status
  - Diaphoresis with cool, pale skin

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Stages of hemorrhage

- Stage 4
  - Loss greater than 35%
  - Extreme tachycardia
  - Pronounced tachypnea
  - Significantly decreased systolic BP
  - Confusion and lethargy
  - Skin is diaphoretic, cool, & extremely pale

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage- Assessment

- Bright red blood from wound, mouth, rectum or another orifice
- Coffee ground appearance of vomitus
- Melena and hematochezia
- Dizziness or syncope on sitting or standing
- Orthostatic hypotension
- Signs and symptoms of hypovolemic shock

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage- Management

- Airway and ventilatory support
- Circulatory support
  - Bleeding from nose or ears after head trauma
    - Refrain from applying pressure
    - Apply loose sterile dressing

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage management- Bleeding from other areas

- Control bleeding
  - Direct pressure
  - Tourniquet- Recognize characteristics of MAJOR bleeding and the need to possibly apply a tourniquet as a first intervention in some cases.
  - Packing of large gaping wounds with sterile dressings
  - Splinting

Assessment & Management of Shock

Pathophysiology, Assessment, and Management of Hemorrhage:

Hemorrhage management- Bleeding from other areas

- Apply sterile dressing and pressure bandage
- Transport considerations
- Psychological support
- Communication strategies

Assessment & Management of Shock

Shock:

Epidemiology

- Mortality/morbidity
- Prevention strategies

Assessment & Management of Shock

Shock:

Pathophysiology- Stages of shock

- Compensated or nonprogressive
  - Characterized by signs and symptoms of early shock
  - Arterial blood pressure is normal or high
  - Treatment at this stage will typically result in recovery

Assessment & Management of Shock

Shock:

Pathophysiology- Stages of shock

- Decompensated or progressive
  - Characterized by signs and symptoms of late shock
  - Arterial blood pressure is abnormally low
  - Treatment at this stage will sometimes result in recovery

Assessment & Management of Shock

Shock:

Pathophysiology- Stages of shock

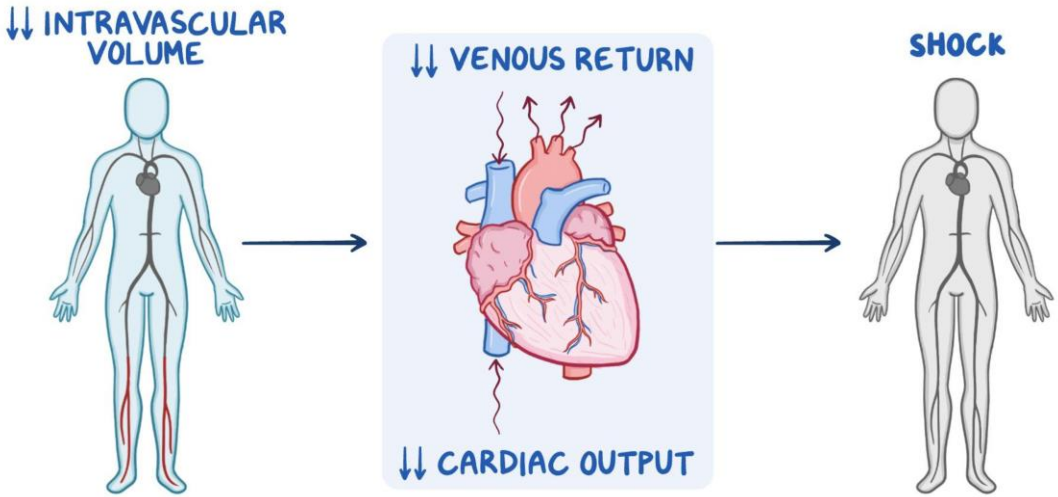
- Irreversible
  - Characterized by signs and symptoms of late shock
  - Arterial blood pressure is abnormally low
  - Even aggressive treatment at this stage does not result in recovery

Assessment & Management of Shock

Shock:

Pathophysiology- Etiologic classifications

- Hypovolemic
  - Hemorrhage
  - Plasma loss
  - Fluid and electrolyte loss
  - Endocrine

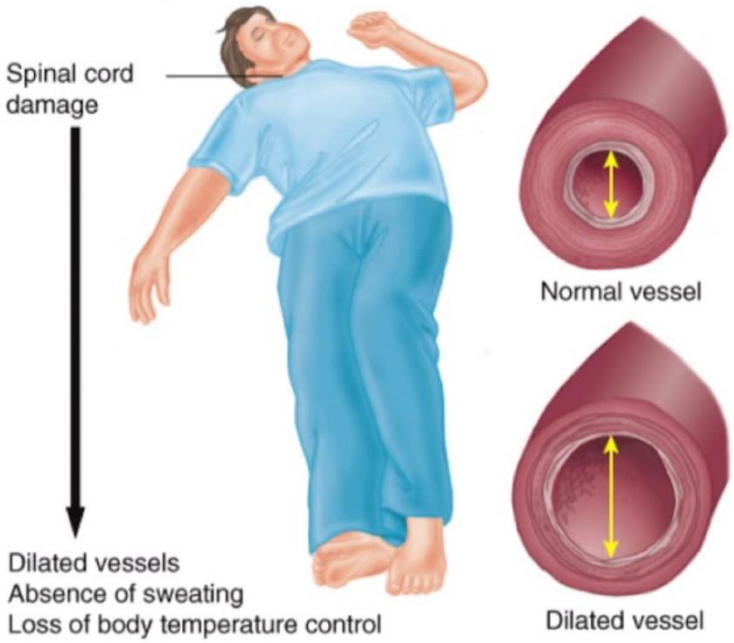


Assessment & Management of Shock

Shock:

Pathophysiology- Etiologic classifications

- Distributive (Vasogenic)
  - Increased venous capacitance
  - Low resistance, vasodilatation

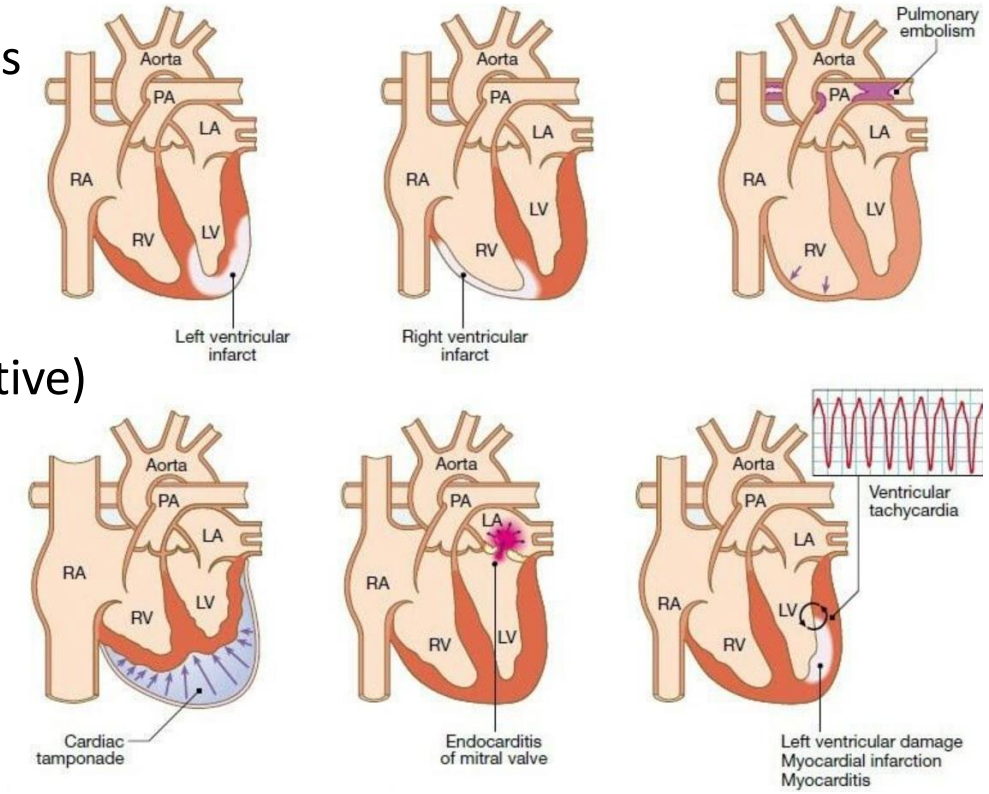


Assessment & Management of Shock

Shock:

Pathophysiology- Etiologic classifications

- Cardiogenic
  - Myocardial insufficiency
  - Filling or
    outflow obstruction (obstructive)



Assessment & Management of Shock

Shock:

Assessment- Hypovolemic shock due to hemorrhage

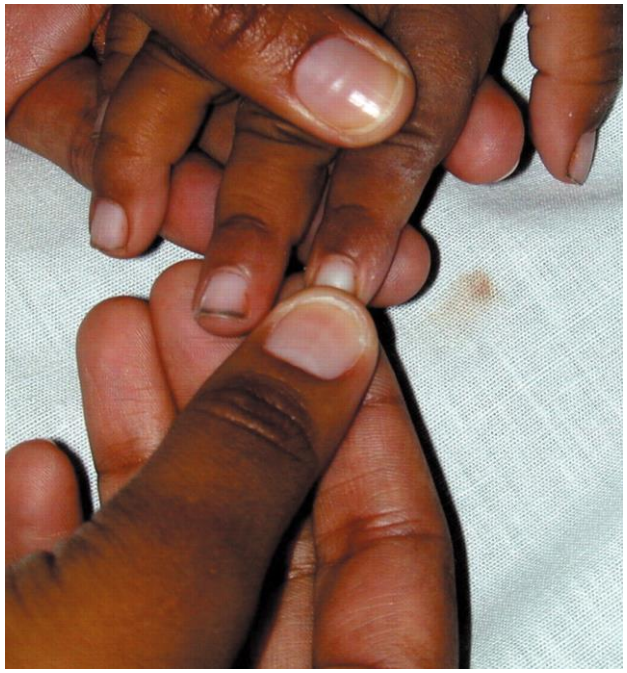
- Early or Compensated Shock
  - Tachycardia
  - Pale, cool skin
  - Diaphoresis
  - Level of consciousness- normal or anxious
  - Blood pressure maintained

Assessment & Management of Shock

Shock:

Assessment- Hypovolemic shock due to hemorrhage

- Early or Compensated Shock
  - Narrow pulse pressure
  - Orthostatic hypotension
  - Dry mucosa
  - Complaints of thirst
  - Weakness
  - Possible delay of capillary refill



Assessment & Management of Shock

Shock:

Assessment- Hypovolemic shock due to hemorrhage

- Late or Progressive Shock
  - Extreme tachycardia
  - Extremely pale, cool skin
  - Diaphoresis
  - Significant decrease in level of consciousness
  - Hypotension
  - Dry mucosa
  - Nausea
  - Cyanosis with white waxy looking skin

Assessment & Management of Shock

Shock:

Differential shock assessment findings

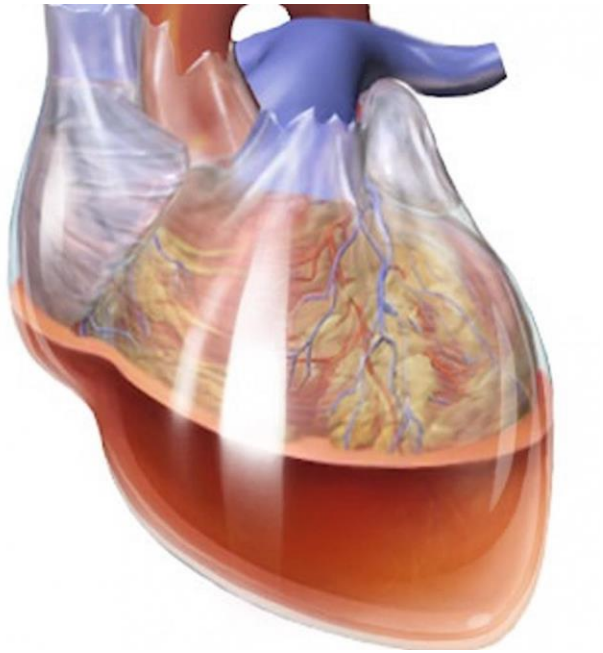
- Shock is assumed to be hypovolemic until proven otherwise
- Cardiogenic shock is differentiated from hypovolemic shock by one or more of following
  - Chief complaint- Chest pain, dyspnea, tachycardia
  - Heart rate- Bradycardia or excessive tachycardia
  - Signs of congestive heart failure- Jugular vein distention (JVD), rales
  - Dysrhythmias

Assessment & Management of Shock

Shock:

Differential shock assessment findings

- Obstructive shock (filling or outflow obstruction) is differentiated from hypovolemic shock by presence of signs and symptoms suggestive of-
  - Cardiac tamponade
  - Tension pneumothorax
  - Pulmonary Embolism



Assessment & Management of Shock

Shock:

Differential shock assessment findings

- Distributive shock (Vasogenic) is differentiated from hypovolemic shock by presence of one or more of following-
  - Mechanism that suggests vasodilatation
  - Warm, flushed skin, especially in dependent areas – and possibly normal to “Shocky” skin findings in areas not affected by the spinal cord injury.
  - Lack of tachycardia response

Assessment & Management of Shock

Shock:

Management / Treatment Plan

- Airway and ventilatory support
  - Ventilate and suction as necessary
  - Administer high concentration oxygen

Assessment & Management of Shock

Shock:

Circulatory support

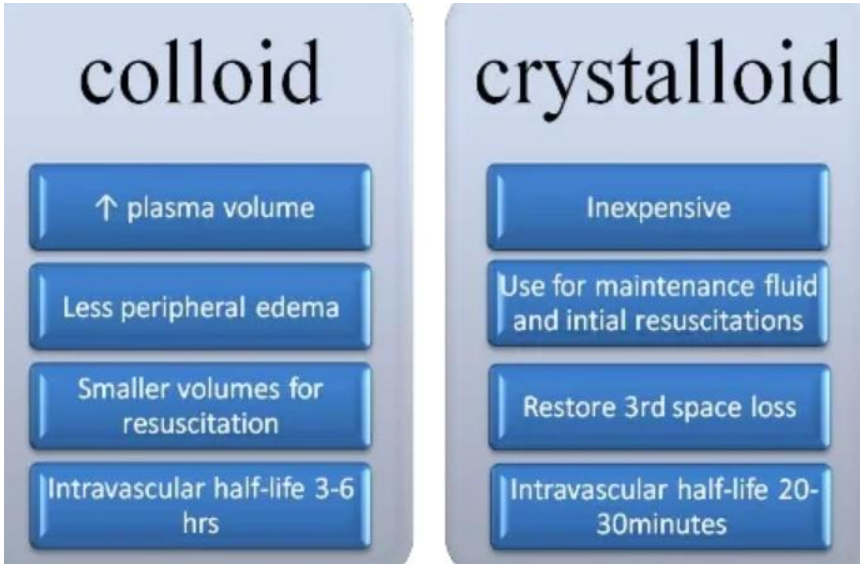
- Hemorrhage control
- Intravenous volume expanders
  - Types
  - Rate of administration

Assessment & Management of Shock

Shock:

Fluid replacement

- Hypovolemic shock, Cardiogenic shock, Distributive shock, Obstructive shock
  - Volume expanders



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Assessment & Management of Shock

Shock:

- Psychological support & Communication strategies

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Assessment & Management of Shock

Shock:

Transport considerations

- Indications for rapid transport
- Indications for transport to a Trauma Center

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

- Definition:
  - The placement of a catheter into a vein. It is used to administer fluids, or medications directly into the circulatory system. It can also be used to obtain venous blood specimens for laboratory determinations.
  - Because IV fluids are drugs, on-line medical direction/control or standing orders are required for the EMT-IV to administer IV fluids.

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

- Indications:
  - Replacement of circulatory volume
  - To establish a medication administration route

- Contraindications - Cannulation of a particular site is contraindicated in:
  - Sclerotic veins
  - Burned extremities

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

- Universal precautions & body substance isolation (BSI) in medication administration

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IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Equipment- Intravenous (IV) solutions

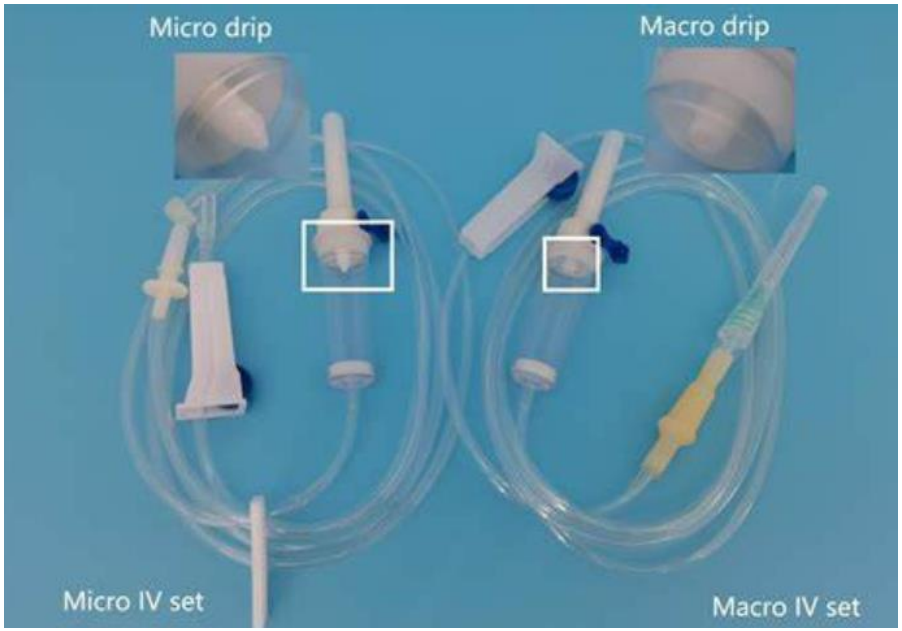
- Types of solutions
  - Crystalloids
  - Colloids - Informational only
- Types of containers
- Variety of volumes

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Equipment- Intravenous (IV) administration sets

- Components
  - Piercing spike
  - Drip Chamber
    - Macro drip chamber-type
    - Micro drip chamber-type

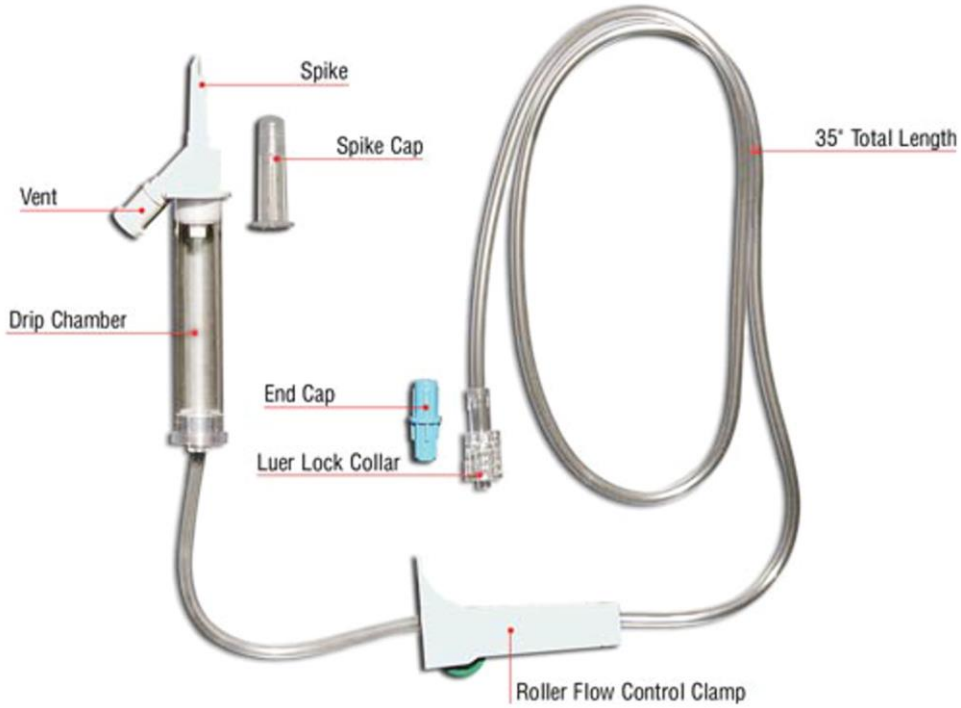


IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Equipment- Intravenous (IV) administration sets

- Components
  - Flow clamp
  - Drug administration port
  - Connector end
  - Variety of extensions

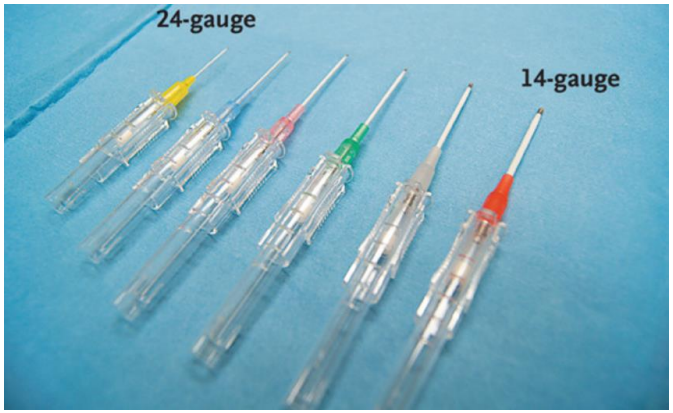


IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Equipment- Needles / Catheters

- Types
  - Over the needle
- IV catheter size



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IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Equipment- Supplies & materials

- Personal protective equipment to maintain BSI
- Tourniquet
- Chlorhexidine /Alcohol/Povidone/Iodine
- Sterile dressings
- Tape
- Arm boards – if necessary
- Vacutainer holder and assorted blood collection tubes for blood samples

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Explain the need for IV cannulation and describe the procedure to the patient.
- Ask if the patient has any allergies (especially to iodine if using iodine pads to cleanse the skin).

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IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Select IV solution to be used and check to make sure it is:
  - The proper solution
  - Clean, without particulate matter
  - Not outdated
  - Not leaking
  - Warmed or cooled as indicated

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Select an appropriate size catheter
  - 14 to 16 gauge for trauma, volume replacement, or cardiac arrest
  - 18 to 20 gauge for medical conditions
  - 22 to 24 gauge for pediatrics and geriatrics

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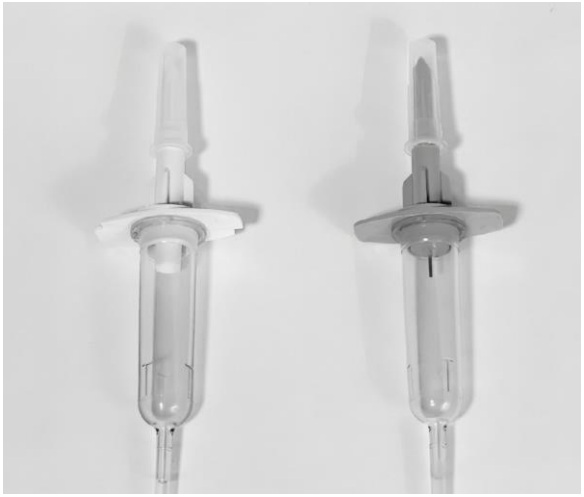
IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Select the proper administration set
  - Macro for trauma
  - Micro for medical conditions & drug administration



IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation :

- Instructor- Consider inserting a video here in conjunction with the following placement instruction slides

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Prepare the IV bag and administration set
  - Remove IV bag from its protective envelope & gently squeeze to detect any leakage
  - Steady the port of the IV bag with one hand and remove the protective cap
  - Remove the administration set from its protective wrapping
  - Slide the flow control valve close to the drip chamber
  - Close off the flow control valve

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Prepare the IV bag and administration set
  - Remove the protective cap from the spike
  - Invert the IV bag
  - Insert the spiked end of the administration set into the tubing insertion port
  - Turn the IV bag right side up and squeeze the drip chamber to fill it half- way.
  - Open the control valve to flush IV solution through the entire tubing

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Cut or tear several pieces of tape of different lengths.
- Employ Standard Precautions
- Carefully inform the patient
- Use the correct IV solution, correct gauge needle, and the correct location

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- If possible, place the patient into a suitable position with the selected extremity lower than the heart
- Apply a tourniquet
  - Use caution when applying and removing the tourniquet

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Select a suitable vein by palpation and sight
  - Avoid areas of the veins where a valve is situated.
  - Avoid using Fistulas, shunts or graphs
  - Standard practice is to look at distal (hand) veins first and work your way up the arm. If you are using a hand vein, place the tourniquet near the hand.
  - If the vein rolls, or feels hard or rope-like, select another vein.

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Procedure for performing IV cannulation

- Stabilize the vein by anchoring it with the thumb and stretching the skin downward

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IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Perform the venipuncture without contamination

- Advise patient there will be a poke or pinch as the needle enters
- Hold the end of the venipuncture device between thumb and the index/middle fingers:
  - Maintain visualization of the flashback chamber.
  - Avoid touching any portion of the catheter, because a contaminated device is not usable.

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

- Depending on manufacturer recommendations, hold the needle at a 15, 30- or 45-degree angle to the skin
- Penetrate the skin with the bevel of the needle pointed up
  - If significant resistance is felt, do not force the catheter
  - Instead, withdraw the needle and catheter together as a unit
- If possible, penetrate the vein at its junction or bifurcation with another vein

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

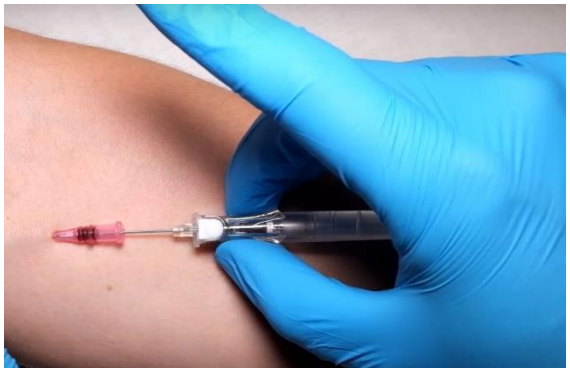
- Enter the vein with the needle from either the top or side
  - Normally, a slight “pop” or “give” is felt as the needle passes through the wall of the vein
  - Be careful not to enter too fast or too deeply, because the needle can go through the back wall of the vein

- Note when blood fills the flashback chamber

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

- Lower the venipuncture device and advance it another 1 to 2 mm until the tip of the catheter is well within the vein
- Advance the catheter into the vein following the manufacturer's recommendations
- Once the catheter is within the vein, apply pressure to the vein beyond the catheter tip with a finger to prevent blood from leaking out of the catheter hub once the needle is completely withdrawn



IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

To draw a blood sample:

- Stabilize the catheter with one hand and attach a Vacutainer holder with a multi-sample IV Luer-lock adapter or a syringe to the hub
- If using a Vacutainer device, insert the blood collection tube fully into the holder and allow its internal vacuum to draw blood out of the vein

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

To draw a blood sample:

- Once enough blood collection tubes have been filled or the syringe is completely full, release the tourniquet from the patient's arm
- Reapply pressure to the vein beyond the catheter tip with a finger to prevent blood from leaking out of the catheter hub once the blood drawing device is disconnected
- Disconnect the syringe or Vacutainer device from the hub of the catheter by holding the hub between the first finger and thumb and pulling the device free with the other hand

IV & IO Line Placement & Infusion

- Connect the IV tubing to the catheter hub. Be careful not to contaminate either the hub or connector prior to insertion
- Open the IV flow control valve and run the IV for a brief period of time to ensure the line is patent. To ensure proper IV flow rates, the IV fluid container must hang at least 30 to 36 inches above the insertion site
- Cover the IV site with a sterile dressing or a bandage – preferably one that is transparent.

IV & IO Line Placement & Infusion

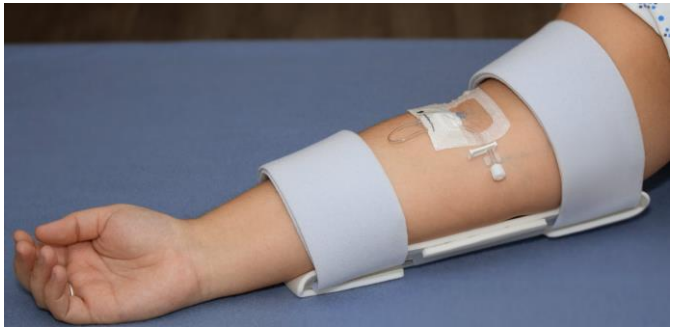
- Secure the catheter, administration set tubing, and sterile dressing in place with tape.
  - Tubing should be looped and secured with tape above the IV cannulation site.
  - Do not make the loop so small that it kinks the tubing and restricts fluid flow.
- Adjust the appropriate flow rate for the patient's condition.
- Dispose of the needle(s) in a proper biomedical waste container.

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Armboards may be:

- Avoided simply by choosing a venipuncture site well away from any flexion areas.
- Necessary when a venipuncture device is inserted near a joint or in the dorsum of the hand
- Used along with restraints in confused or disoriented patients.
- Useful with pediatric patients.



IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Regulating fluid flow rates:

- Flow rates should be adjusted as ordered by medical control & local protocol
- Fluid resuscitation guidelines should be 20ml/kg boluses for adults, children, and infants. Newborns or neonates should be 10ml/kg boluses

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Regulating fluid flow rates:

- The EMT-IV must know the volume to be infused, the period of time over which the fluid is to be infused, and the number of drops per milliliter the infusion set delivers.
  - The following formula can be used to calculate IV solution drip rates per minute - Drops per min. = volume to be infused x drops/ml of administration set, divided by total time of infusion in minutes.

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Regulating fluid flow rates:

- After determining the rate, open the clamp slowly to start fluid dripping into the drip chamber
  - Determine drops per minute and adjust the flow clamp as needed to obtain the correct drip rate
  - Check the flow rate periodically

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Documenting IV cannulation:

- Date and time of the venipuncture
- Type and amount of solution
- Type of venipuncture device used, including the length and gauge
- Venipuncture site
- Number of insertion attempts (if more than one)
- IV flow rate
- Any adverse reactions and the actions taken to correct them
- Name or identification number of the EMT-IV initiating the infusion
- Follow local protocols regarding additional documentation

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

When the IV does not flow:

- Was the venous tourniquet removed?
- Is there swelling at the cannulation site?
- Is the flow regulator or clamp in an open position?
- Is the tip of the catheter positioned against a valve or wall of the vein?
- Is the IV bag high enough?
- Is the drip chamber completely filled with IV solution?

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Complications:

- Pain
- Catheter shear
- Cannulation of an artery
- Hematoma or infiltration
- Phlebitis or infection
- Extravasation
- Air in tubing/air embolism
- Circulatory overload and pulmonary edema
- Allergic reaction
- Pulmonary embolism
- Failure to infuse properly

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Steps to discontinue an IV infusion:

- Equipment
  - Gloves, Sterile gauze pad, Adhesive bandage

- Technique
  - Close the flow control valve completely
  - Carefully remove all tape, and remove the dressing
  - Hold the sterile gauze pad just above the site to stabilize the tissue and withdraw the catheter by pulling straight back until the catheter is completely out of the vein
  - Immediately cover the site with the sterile gauze pad and hold it against the puncture site until the bleeding has stopped
  - Tape the dressing in place or cover with an adhesive bandage

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Drawing blood:

- Purpose
  - To obtain blood samples for analysis
- Equipment
  - Blood tubes
- Locations to obtain blood samples
  - Anatomical sites
  - From the established intravenous catheter
  - Other locations

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Techniques for obtaining a blood sample:

- Each tube should be filled completely
- Blood samples should be acquired prior to flushing line or administrating fluid to prevent diluting sample
- Blood should be withdrawn from IV angio-catheters sized 20 gauge or larger using a Leur-lock syringe or vacutainer device (it may be necessary to use a smaller gauge angio-catheter in pediatric patients)

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Techniques for obtaining a blood sample:

- Transfer blood into collection tubes using a needle free device or vacutainer blood transfer device
  - Once the blood is obtained, the outside of the tube should be labeled with the patient's name, date, time drawn and by whom
  - Any information that may be useful, such as, "drawn before the administration of 50% dextrose"
  - The filled blood collection tubes should be stored in an appropriate bag to prevent contamination from accidental breakage

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Saline IV access locks:

- Saline lock devices maintain intravenous access while avoiding the risk of inadvertent rapid-fluid administration and the inconvenience of manipulating IV tubing and fluid bags while moving and handling patients

- Equipment
  - Infusion adapter device
  - Vial of normal saline for injection
  - Syringe with needle
  - Alcohol wipe

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

Saline IV access locks:

- Candidates for saline locks
  - Patients who would have an IV placed to establish venous access prophylactically
  - Patients who would have an IV placed to administer medication
  - Patients who will need to have continued IV access AFTER a solution or medication has been fully administered

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

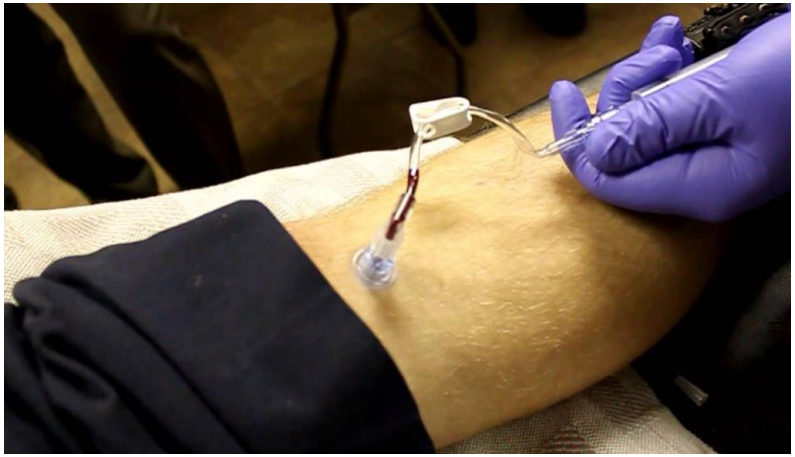
- Candidates for conventional IV therapy with appropriate solutions and administrations sets
  - Patients requiring volume resuscitation
  - Patients requiring continuous drip infusion of medication. Patients with medications other than IV fluids are beyond the scope of EMT-IV Therapy providers.
  - Patients requiring cardiac or other resuscitation with frequent medications in sequence

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

The chief indications for IO line insertion

- Compensated & Uncompensated Shock
  - Hypovolemia
  - Sepsis
  - Cardiac problems



IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

The chief indications for IO line insertion

- Children respond to shock by
  - an increase in heart rate
  - an increase in respiratory rate
  - peripheral vasoconstriction
- The child's blood pressure does not decrease until later, when the child is no longer able to compensate by an increase in heart rate and vasoconstriction

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

The chief indications for IO line insertion

- Signs of compensated (early) shock are-
  - Tachycardia
  - Tachypnea
  - cool clammy extremities

- Signs of uncompensated shock are-
  - Decreased level of consciousness
  - Weak or absent pulses
  - Hypotension

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

The chief indications for IO line insertion

- Cardiac arrest
  - A protocol for obtaining vascular access is helpful in making a decision about the use of an intraosseous line when venous access cannot be obtained rapidly. An intraosseous line is usually attempted after other means of vascular access are unsuccessful or unavailable. Local protocols will dictate when IO access can/should be attempted

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

Contraindications for IO line insertion:

- An intraosseous line should not be inserted when there is a known fracture of the bone chosen for line placement
- An intraosseous line should not be inserted when there is infection present in the leg chosen for line placement
- Insertion of an intraosseous needle should not be attempted on the same leg two times, as the hole made by the attempted insertion does not close rapidly and fluid will extravasate

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

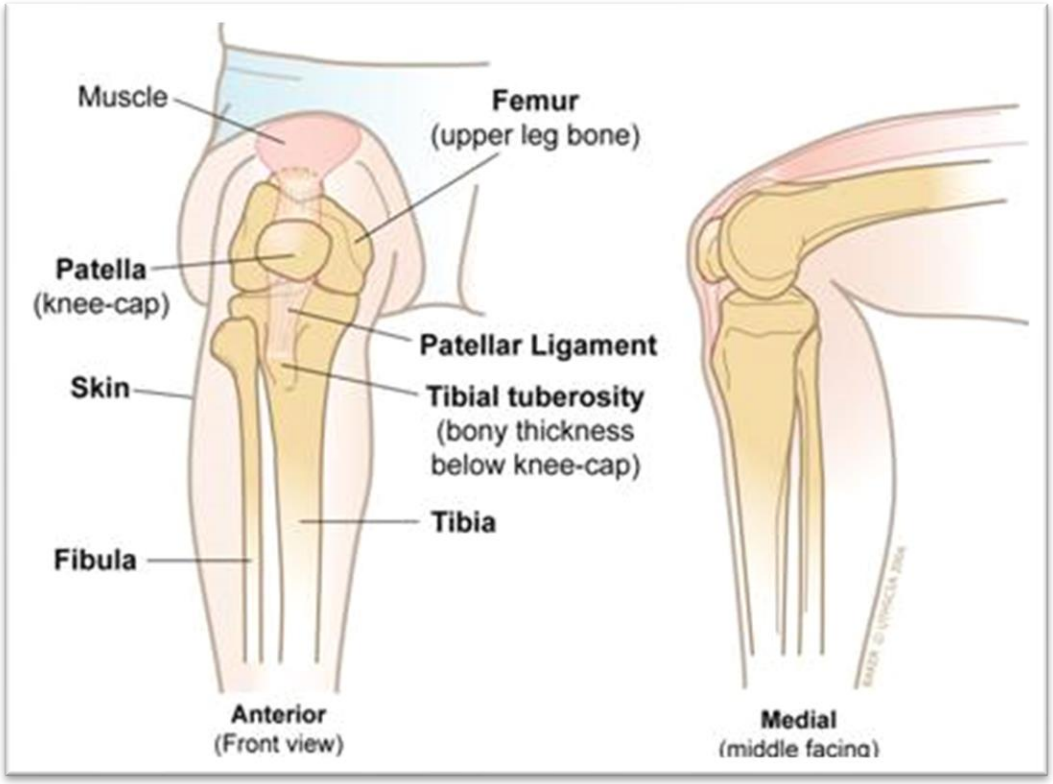
Sites for IO line insertion:

- Proximal Tibia
  - The proximal tibia is the preferred location for intraosseous insertion in a child six years and under because
    - The site is easily identified
    - A large marrow cavity exists with no adjacent structures that are likely to be damaged
- Distal Femur
- Distal Tibia
- Proximal Humerus

IV & IO Line Placement & Infusion

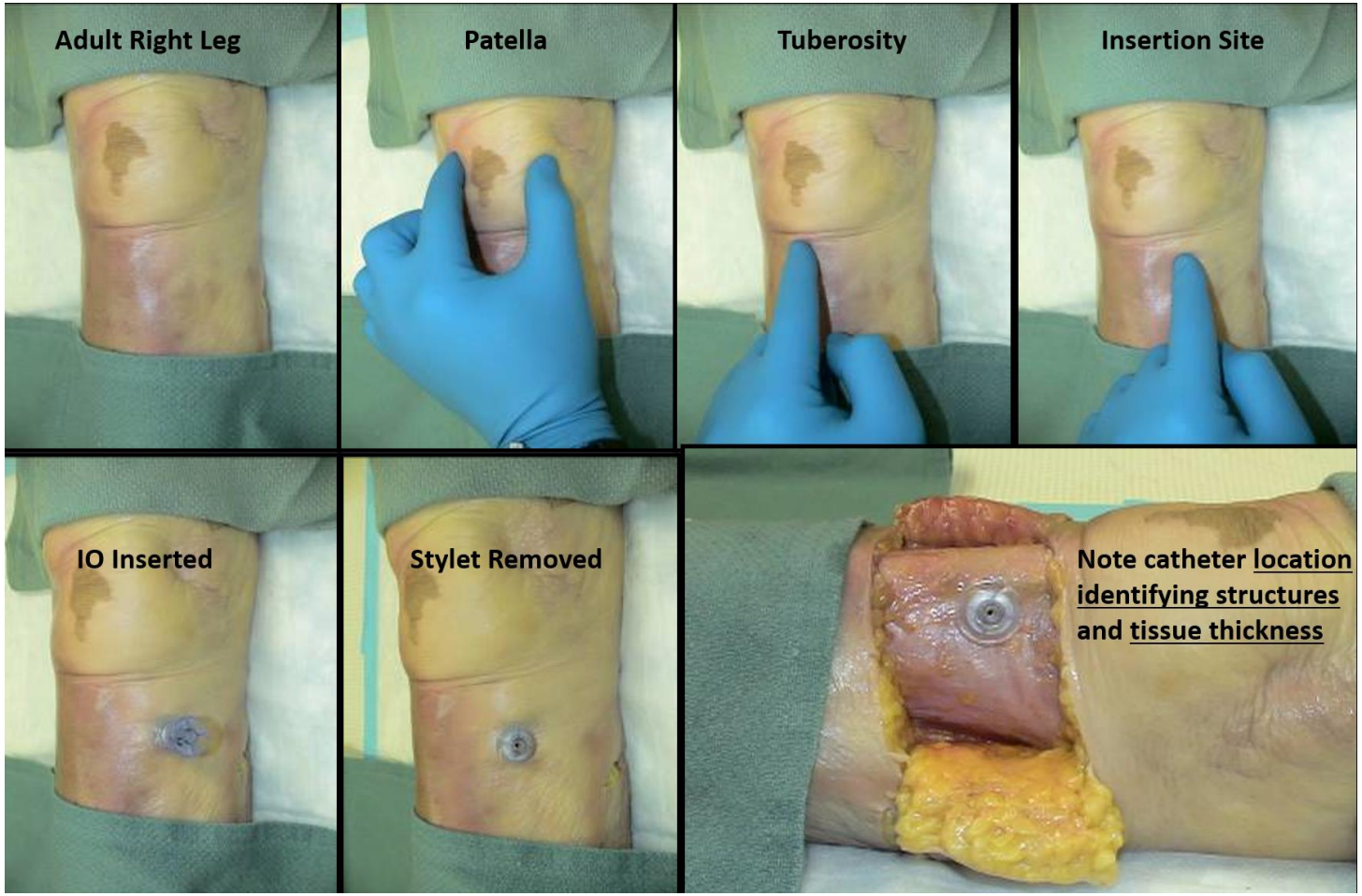
Lesson 4 Intraosseous line placement:

Proximal Tibia anatomy:



IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:



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IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

- Instructor- Consider inserting a video here in conjunction with the following placement instruction slides

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

Equipment for IO line insertion:

- Needles
  - Either an intraosseous or bone marrow aspiration needle may be used
  - They may contain a trocar or stylet, which minimizes the risk of occlusion from bone marrow
  - They are shorter, sturdier and less flexible
  - They are less likely to be dislodged in transport because they are threaded and shorter
  - Some of these needles have side infusion ports within the threads so a stylet or trocar is not necessary
  - Some needle lengths can be adjusted

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

Other equipment for IO line insertion:

- Chlorhexidine or Iodine solution - for cleaning insertion site-
- Sterile towels and gloves - to maintain sterility during insertion
- 4x4 gauze pads - for cleaning and for use in applying pressure if needle is withdrawn
- Two 5 or 10 cc syringes - to aspirate bone marrow and to infuse saline
- IV solution (normal saline or lactated Ringer's solution) and administration tubing
- Towel/blanket, or rolls of gauze, or another small IV bag - for stabilizing leg during and after insertion of the intraosseous needle
- Blood tubes - for bone marrow aspirate
- Pressure infusion bag
- Volume limiting device

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

4 steps for IO line insertion:

- Step one - Stabilize the extremity
  - Position the leg with the knee slightly bent
  - Place a support under the knee for support, and to prevent movement
  - Tape in place if necessary

- Step two - Prepare the insertion site
  - Clean the skin with iodine solution and 4x4 gauze pads
  - Wipe in a circular motion starting at the planned insertion site and moving outward
  - Wipe the area dry with a sterile 4x4 gauze pad

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

4 steps for IO line insertion:

- Step three - Insert the needle
    - Check the needle packaging for additional instructions. Some needles require back and forth or a clockwise motion
        - Use aseptic technique
        - When using the tibial site, the needle should be directed slightly away from the knee in order to decrease the risk of insertion into the growth plate
        - Apply pressure to the top of the needle in order to push through the cortex of bone
        - A slight give will be felt as the tip enters the marrow cavity
        - If the needle is properly inserted, it will stand without support

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

4 steps for IO line insertion:

- Step three –

- **Caution:** If too much pressure is applied, the needle may exit through the bone on the other side
  - Fluid will infiltrate into the tissue and Compartment syndrome may develop
  - Remove the needle
  - A site on the other extremity must be chosen for the next insertion attempt

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

4 steps for IO line insertion:

- Step four - Confirm needle placement
  - Remove the stylet from the needle
  - Connect a syringe to the hub of the needle
  - Aspirate approx. 1cc of bone marrow. Marrow may not always be aspirated
  - Bone marrow aspirate can be used for various lab studies
  - 5 - 10 cc of normal saline may be used to flush the syringe and intraosseous needle while observing for extravasation
  - If the needle placement cannot be confirmed, remove the needle
  - Do not attempt to re-insert the needle on the same site
  - If the needle is removed, apply pressure for 5 minutes and cover the insertion site with a sterile dressing

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

Securing the IO needle:

- Connect the IV tubing to the hub of the correctly placed needle
  - IV fluid should flow without obstruction when the needle is correctly positioned
  - IF the IV fluid is not flowing and correct insertion cannot be verified, remove the intraosseous needle and attempt insertion at another location
- When correct insertion is confirmed, tape the tubing onto the patient to assist in preventing dislodgment
- Carefully monitor the insertion site for signs of infiltration
  - Remove the needle if infiltration is observed
  - The needle should not be left in place for over 12 hours

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

Increasing the rate of infusion:

- Pressure bag
- A syringe with a three-way stopcock directly attached to the IV line flowing to the intraosseous needle will allow administration of fluid boluses
- Carefully monitor the amount of fluid administered to the pediatric patient to prevent fluid overload
- A child in shock may require several 20 cc/kg boluses of fluid

IV & IO Line Placement & Infusion

Lesson 4 Intraosseous line placement:

Potential complications:

- Extravasation of fluid
  - This is generally the result of improper needle placement or multiple insertion attempts
  - Collection of fluid in the tissue can lead to compartment syndrome
- Skin infection
  - The infection rate for intraosseous is lower than that found with intravenous cannulation
  - Osteomyelitis (very rare)
- Complications from intraosseous insertion and infusion are rare

IV & IO Line Placement & Infusion

Lesson 4 Intravenous Cannulation:

- Disposal of contaminated items & sharps
  - Follow local protocol for disposition of contaminated items and sharps

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