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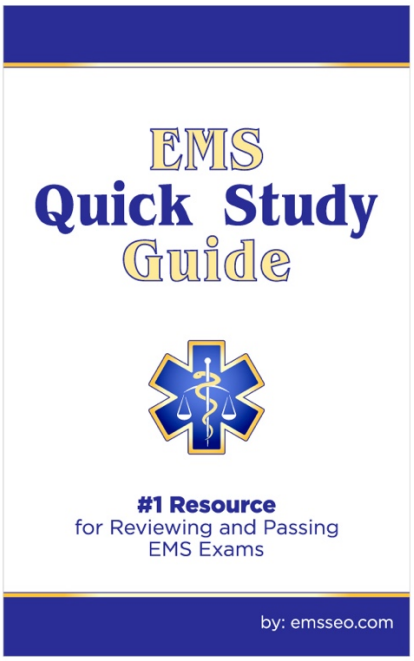
EMS Quick Study Guide



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EMS Quick Study Guide

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PREPARATORY

LEGAL

HISTORY OF EMS

- **1865** : **1st civilian ambulance service** in Cincinnati, Ohio
- **1869** : **NYC Health Department Ambulance Service** out of Bellevue Hospital
- **WW II** : system of **battlefield ambulance corps** for evacuation
- **1966** : " **Accidental Death and Disability: The Neglected Disease of Modern Society** " = " **The White Paper** "→ deficiencies in prehospital emergency care
- **National Highway Safety Act** established the U.S. Department of Transportation → **development of effective EMS system**
- **1969** : **Emergency Medical Technician program**
- **1971** : White House funded an **EMS model demonstration project**
- **1972** : Department of Health, Education and Welfare funded the **initiative for the development of regional EMS system**
- **1973** : Robert Wood Johnson foundation provided grants to establish regional EMS projects and communication systems
- **Emergency Medical Services Act** → additional funding for projects related to the **delivery of trauma care**
- **1974** : Phoenix FD → **prearrival instruction to callers by medically trained dispatchers**
    - " **KKK-A-1822 Federal Specifications for Ambulances** " by the General Services Administration in response to the request of the DOT
        - **Type I** - conventional cab and chassis on which a module ambulance body is mounted; no passageway between driver and patient compartment
        - **Type II** - standard van; body and cab form an integral unit; most have a raised roof
        - **Type III** - specialty van with forward cab; integral body with passageway from driver's to patient compartment
- **1977** : **1st paramedic curriculum**
- **1981** : **COBRA** – Consolidated Omnibus Budget Reconciliation Act → wiped out federal funding for EMS
- **1983** : American College of Surgeons Committee on Trauma → recommended a **standard set of equipment to be carried by providers of a BLS service**
- **1985** : Seattle EMS initiated a successful **program to instruct callers to do CPR**
- **1988** : American College of Emergency Physicians (ACEP) recommended a **list of ALS equipment** NHTSA (National Highway Traffic Safety Administration) → **Statewide EMS Technician Assessment Program**
    - EMS: Emergency Medical System. Components are defined by the Nat'l Highway Traffic Safety Administration
        - Fire service-based

- Third service
- Private ambulance service
- Hospital-based
- Volunteer systems

o EMD: Emergency Medical Dispatcher, assigns call based on distance to the call, time of day, level of care needed
- First Rule of Patient Care: do no harm
- Training and Certification: the National Standard Curriculum serves as the foundation for training EMT's.

TRAUMA CENTERS

Level I - Regional Trauma Center
- all types of specialty trauma
- 24 hours a day, 7 days a week

Level II - Area Trauma Center
- most common trauma emergencies
- surgical capability available 24 hours a day, 7 days a week
- will stabilize and transport specialty cases to the regional trauma center

Level III - Community Trauma Center
- special emergency department training
- some surgical capability
- will usually stabilize and transfer seriously injured patients to a higher level trauma center as needed

Level IV - Trauma Facility
- in remote areas
- small community hospital or medical care facility may be a designated trauma receiving facility
- • will stabilize and prepare trauma patients with moderate to serious injuries for transport to a higher level trauma center

DEFINITIONS

Allied Health Profession
Ancillary health care professions, apart from physicians and nurses

Medical Direction
Medical policies, procedures and practices that are available to providers either on-line or off-line

Medical Director
A physician who is legally responsible for all of the clinical and patient care aspects of an EMS system

Off-Line Medical Directions
Refers to medical policies, procedures and practices that medical direction has set up in advance of a call

On-Line Medical Direction
Occurs when a qualified physician gives direct orders to a prehospital care provider by either radio or telephone

Protocols
The policies and procedures for all components of an EMS system;
Predetermined, written guidelines for patient care

Standing Orders
Preauthorized treatment procedures; a type of treatment protocol;
Off-line medical control

Emergency Medical Dispatcher (EMD)
EMS person medically and technically trained to assign emergency medical resources to a medical emergency

Intervener Physician
A licensed physician, professionally unrelated to the patient on scene, who attempts to assist EMS providers and patient care
(*EPC:*
- if on-line medical direction exists ⇒ on-line physician is ultimately responsible
- if on-line medical direction does not exists ⇒ paramedic should relinquish responsibility to the physician after the physician identifies himself, demonstrates willingness to accept responsibility and documents the interventions as required by the local EMS system
- if his treatment differs from the established protocols ⇒ he must accompany the patient in the ambulance

Scope of Practice
The range of duties and skills paramedics are allowed and expected to perform

Standard of Care
The degree of care, skill, and judgment that would be expected under like or similar circumstances by a similarly trained, reasonable paramedic in the same community

Certification
The process by which an agency or association grants recognition to an individual who has met its qualifications

Licensure
The process by which a governmental agency grants permission to engage in a given occupation to an applicant who has attained the degree of competency required to ensure the public's protection

Profession
Refers to the existence of a specialized body of knowledge or skills

Registration
The process of entering your name and essential information within a particular record (in EMS → in order for the state to verify the provider's initial certification and to monitor recertification)

Reciprocity
The process by which an agency grants automatic certification or licensure to an individual who has comparable certification or licensure from another agency

Professionalism
Refers to the conduct or qualities that characterize a practitioner in a particular field or occupation

Rules Of Evidence
Guidelines for permitting a new medication, process or procedure to be used in EMS

Quality Improvement
An evaluation program that emphasizes service and uses customer satisfaction as the indicator of system performance

Quality Assurance
A program designed to maintain continuous monitoring and measurement of the quality of clinical care delivered to patients

Continuous Quality Improvement
A program designed to refine and improve an EMS system, emphasizing customer satisfaction

Peer Review
An evaluation of the quality of emergency care administered by an individual, which is conducted by that individual's **peers [**others of equal rank **]** (An evaluation of articles submitted for publication)

Ethics
The rules or standards that govern the conduct of members of a particular group

Morals
Social, religious or personal standards of right and wrong

Bioethics
Ethics as applied to the human body

Beneficence
The principle of doing good for the patient

Nonmaleficence
The obligation not to harm the patient

Autonomy
A competent adult patient's right to determine what happens to his own body

Justice
The obligation to treat all patients fairly

Isometric Exercise
Active exercise performed against stable resistance, where muscles are exercised in a motionless manner

Isotonic Exercise
Active exercise during which muscles are worked through their range of motion

Target Heart Rate
1) measure your resting heart rate
2) 220 – your age ⇒ estimated maximum heart rate
3) est. max HR – resting HR x 0.7 + resting HR ⇒ Target Heart Rate

Circadian Rhythms
Biological cycles that occur at ~24 hour intervals
(hormonal and body temperature fluctuations, appetite and sleepiness cycles …)

Anchor Time
Set of hours when a night-shift worker can reliably except to rest $^{W}/_{O}$ interruption

Epidemiology
The study of factors that influence the frequency, distribution and causes of injury, disease and other health-related events in a population

Years Of Productive Life
Age at death subtracted from 65

Teachable Moment
The time shortly after an injury when patients and observers may be more receptive to teaching about how similar injuries may be prevented in the future

Stress
A hardship or strain; a physical or emotional response to a stimulus

Stressor
A stimulus that causes stress

Burnout
Occurs when coping mechanisms no longer buffer stressors, which can compromise personal health and well-being

Critical Incident
An event that has a powerful emotional impact on a rescuer that can cause an acute stress reaction

Critical Incident Stress Management (CISM)
A system of related interventions usually performed by regional, non-partisan, multi-disciplinary teams composed of EMS peers and specifically trained mental health workers

Critical Incident Stress Debriefing (CISD)
A process used to help rescuers work through their responses to a critical incident within 24-72 hours after the event

Cleaning
Washing an object with cleaners such as soap and water

Disinfecting
Cleaning with an agent that can kill some microorganisms on the surface of an object

Sterilizing
Use of a chemical or physical method such as pressurized steam to kill all microorganisms on an object

Stages Of Coping With Death

1. denial
2. anger
3. bargaining
4. depression
5. acceptance

Constitutional Law
Based on the U.S. Constitution

Common Law (Less Law ; Judge-Made Law)
Law that is derived from society's acceptance of customs and norms over time

Legislative Law (Statutory Law)
Law created by law-making bodies such as Congress and state assemblies

Administrative Law (Regulatory Law)
Law that is enacted by governmental agencies at either the federal or state level

Criminal Law
Division of the legal system that deals with wrongs committed against society or its members

Civil Law
Division of the legal system that deals with noncriminal issues and conflicts between 2 or more parties

Tort
A civil wrong committed by one individual against another

Negligence
Deviation from accepted standards of care recognized by law for the protection of others against the unreasonable risk of harm

Duty to act
A formal contractual or informal legal obligation to provide care

Breach of duty
An action or inaction that violates the standard of care expected from the paramedic

Malfeasance
A breach of duty by performance of a wrongful or unlawful act

Misfeasance
A breach of duty by performance of a legal act in a manner that is harmful or injurious

Nonfeasance
A breach of duty by failure to perform a required act or duty

Actual Damages
Refers to compensable physical, psychological or financial harm

Proximate Cause
Action or inaction of the paramedic that immediately caused or worsened the damages suffered by the patient

Standard Of Care
The degree of care, skill and judgement that would be expected under like or similar circumstances by a similarly trained, reasonable paramedic in the same community

Res Ipsa Loquitur ("the thing speaks for itself ")
A legal doctrine invoked by plaintiffs to support a claim of negligence

Good Samaritan Law
Laws that provide immunity to certain people who assist at the scene of a medical emergency

Immunity
Exemption from legal liability

Statute of Limitation
Law that sets the maximum time period during which certain actions can be brought in court

Contributory or Comparative Negligence
Some state laws will reduce or eliminate a plaintiff's award of damages if the plaintiff is found to have caused or worsened his own injuries

Defamation
An intentional false communication that injures another person's reputation or good name

Libel
The act of injuring a person's character, name or reputation by false statements made in writing or through the mass media with malicious intent or reckless disregard for the falsity of those statements - to defame another person in writing

Slander
Act of injuring a person's character, name or reputation by false or malicious statements spoken with malicious intent or reckless disregard for the falsity of those statements - to orally defame another person

Competent
Able to make an informed decision about medical care

Consent
The patient's granting of permission for treatment

Informed Consent
Consent for treatment that is given based on full disclosure of information

Expressed Consent
Verbal, nonverbal or written communication by a patient that he wishes to receive medical care

Implied Consent (Emergency Doctrine)
Consent for treatment that is presumed for a patient who is mentally, physically or emotionally unable to grant consent

Involuntary Consent
Consent to treatment granted by the authority of a court order

Minor
Depending on state law; usually a person under the age of 18 years

Emancipated Minor
A person under 18 years of age who is:
- married
- pregnant
- a parent
- a member of the armed forces
- financially independent
- living away from home

Abandonment
Termination of the paramedic-patient relationship $^{W}/_{O}$ assurance that an equal or greater level of care will continue

Assault
An act that unlawfully places a person in apprehension of immediate bodily harm $^{W}/_{O}$ his consent

Battery
The unlawful touching of another individual $^{W}/_{O}$ his consent

False Imprisonment
Intentional and unjustifiable detention of a person $^{W}/_{O}$ his consent or other legal authority

Reasonable Force
The minimal amount of force necessary to ensure that an unruly or violent person does not cause injury to himself or others

APPROACHES TO ETHICAL DILEMMAS SUGGESTED BY EPC :

Long method ethical test:

1) state the proposed action fully
2) list the possible consequences
3) compare the consequences to relevant values

Short method ethical test:

1) impartiality
2) universalizability
3) interpersonal justifiability

PARAMEDIC'S RESPONSIBILITIES AT AN MCI

- triage patients quickly
- initiate treatment
- call for additional resources

THINGS TO DO DURING SCENE SURVEY

Ask the following of yourself:

- BSI required
- is there an obvious mechanism of injury / nature of illness
- additional resources needed
- where are the patients
- are there multiple patients
- are there threats to your, your partner's or your patient's safety on scene

STAGING FOR HAZMAT

The following should be set up:

- Command post
- Staging area
- Decontamination corridor
- Treatment area

SCENE SAFETY AT A HAZMAT SCENE

- keep your distance until you are assured by HAZMAT trained officials that the scene is safe
- remain upwind
- try to identify contaminants by looking for identifying placards or signs (with binoculars)
- is the incident open or closed (is there potential for generation of additional patients)
- are there ambulatory contaminated patients

HOW DISPATCH INFO AFFECTS YOUR APPROACH TO THE SCENE

- general knowledge of area you are responding to and what kinds of hazards it might present
- additional help you may need depending on nature of emergency (i.e. backup for cardiac arrest …)
- what equipment you may need

COMMUNICATION

Radio Band
A range of radio frequencies
Radio Frequency
The number of times per second a radio wave oscillates
Very High Frequency
Radio frequency band from 30 to 300 megahertz
Ultrahigh Frequency
Radio frequency band from 300 to 3000 megahertz
PSAP
Public Safety Answering Point – the first place you get connected with when you call 911
Simplex
Communication system that transmits and receives on the same frequency
Duplex
Communication system that allows simultaneous two-way communications by using two frequencies for each channel
Multiplex
Duplex system that can transmit voice and data simultaneously
Trunking
Communication system that pools all frequencies and routes transmissions to the next available frequency
Digital Communication
Data or sounds are transmitted into a digital code for transmission
Mobil Data Terminal
Vehicle-mounted computer keyboard and display
Facsimile Machine
Device for electronically transmitting and receiving printed information
Echo Procedure
Immediately repeating each transmission received during radio communication

ANATOMY & PHYSIOLOGY

ANATOMINCAL POSITIONS

Supine	lying face up in the anatomical position
Prone	lying face down
Lateral recumbent position	lying on the side
Semi-Fowler's position	lying on the back with the upper part of the body elevated at an angle less than 45°
Fowler's position	lying on the back with the upper part of the body elevated at an angle of 45° or more
Trendelenburg position	lying on the back with the lower part of the body elevated at ~12″
Lithotomy position	lying face up with the legs flexed and the thighs abducted
Fetal position	lying on the side with the legs flexed and the thighs abducted

ANATOMICAL DIRECTIONS

Anterior	toward the front of the body
Ventral	belly side = anterior
Posterior	toward the backside of the body
Dorsal	backside = posterior
Superior	toward the top of the body; at a higher level
Inferior	toward the bottom of the body; at a lower level
Medial	toward the middle of the body (longitudinal axis)
Lateral	away from the midline of the body (longitudinal axis)
Proximal	toward an attached base; closer to the trunk of the body compared to another point
Distal	away from the attached base; farther from the trunk of the body compared to another point
Cranial (Cephalic)	referring to the head
Caudal	referring to the tail (in humans: coccyx)
Superficial	toward the exterior of the body; at, near or relatively close to the surface
Deep	toward the interior of the body; farther away from the surface

BODY MOVEMENTS

Flexion	the act of bending
Extension	the act of straightening
Abduction	a movement away from the body's median plane
Adduction	a movement toward the body's median plane
Pronation	the act of rotating the arm, bringing the palm of the hand to position facing downward
Supination	the act of rotating the arm, bringing the palm of the hand to a position facing upward

Opposition	the movement where the thumb pad is brought toward the finger pad and held together
Reposition	the movement of the thumb from a position of opposition back to its anatomical position
Protraction	a movement forward (drawing the shoulders forward)
Retraction	a movement backward (drawing the shoulders backward)
Circumduction	a combination of successive movement of flexion, abduction, extension and adduction to draw around or to form a circle
Dorsiflexion	flexion of the foot at the ankle (as if on the tiptoes)
Eversion of the foot	movement of the plantar surface of the foot, away from the median plane of the body
Rotation	the turning or revolving of a part of the body around its long axis
Lateral rotation	rotation away from the median plane
Medial rotation	rotation toward the median plane

ANATOMICAL REGIONS

Cephalic region	head (cephalon)
Cranial region	skull (cranium)
Occipital region	
Cervical region	neck (cervices)
Thoracic region	chest (thoracis)
Abdominal region	abdomen
Pelvic region	
Inguinal region	groin
Pubic region	anterior pelvis
Genital region	
Lumbar region	loin, lower back
Sacral region	
Gluteal region	buttocks
Axillary region	armpit (axilla)
Brachial region	arm (brachium)
Cubital region	forearm groove (fossa cubita)
Antebrachial region	forearm (antebrachium)
Manual region	hand (manus)
Femoral region	thigh
Popliteal region	
Crural region	anterior leg
Sural region	calf
Pedal region	foot (pes)
Plantar surface of the foot	
Dorsum of the foot	

LEVELS OF ORGANIZATIONS

Organism (human body)
Organ system (cardiovascular system)
Organ (heart)
Consists of 2 or more different tissues that work together to perform a specific function
Tissue (heart muscle tissue)
A group of specialized cells and cell products that perform a specific function
Cell (heart muscle cell)
The smallest living unit in the body
Molecular level (Chemical level) (protein filaments in a heart muscle cell)
Atom: smallest stable units of matter
Molecule: a compound containing 2 or more atoms that are held together by chemical bonds

Anatomy: study of the structure of an organism and its parts
Physiology: study of an organism's normal body functions
Pathophysiology: study of disease mechanisms
Homeostasis: normal state of balance between all the body's systems. Injury or illness interferes with homeostasis.

Body's building blocks: chemical > organelle > cell > organ > organ system > organism

Organ systems:
Skeletal
Muscular
Circulatory
Respiratory
Nervous
Gastrointestinal
Urinary
Reproductive
Immune
Endocrine
Integumentary
Special Sensory

Body Cavities:
Cranial cavity/spinal canal: houses nervous and special sensory systems
Thoracic cavity: cardiovascular and respiratory systems
Mediastinum: houses the heart, trachea, mainstem bronchi, esophagus and large blood vessels
Abdominal cavity: houses the gastrointestinal system and urinary system
Retroperitoneal space: kidneys and major blood vessels
Pelvic cavity: gastrointestinal, urinary and reproductive systems

Cellular Transport

Semipermeable: a cell that allows some substances to enter or leave while restricting others
Permeability: the rate at which substances pass through a membrane. This is determined by size and charge of molecules
Other regulating factors: ion pumps, active transport and diffusion
Water: the only substance that passes freely back and forth, OSMOSIS is the movement of water. Water moves to equalize a solute's concentration either inside or outside the cell
Active Transport: Requires energy, or ATP. Moves solutes against their concentration gradients
Passive Transport: Does not require energy, Diffusion and facilitated diffusion

Diffusion= continual movement of particles (SOLUTES) from higher to lower concentration until they are scattered evenly, examples are Oxygen, Nitrogen, Carbon Dioxide and Electrolytes (Potassium, Sodium)

Tonicity: The number of particles of solute per unit volume Isotonic: Osmotic pressure equal to body fluid
Hypotonic Osmotic pressure less than normal body fluids
Hypertonic: Osmotic pressure greater than normal body fluids

Cellular Metabolism and Respiration

Metabolism: combination of all chemical processes that take place in the body resulting in growth, generation of energy, elimination of waste and other bodily functions.

2 steps (with regards to distribution of nutrients in the blood ie glucose, amino acids and fats):
- Anabolism = constructive or building phase, smaller to bigger
- Catabolism = destructive or breakdown phase, larger to smaller

Krebs Cycle: Mitochondria uses amino acids and fats to produce energy. Amino acids can also be converted to glucose. Can be stored in the lever as glycogen, used as necessary to raise blood sugar.

Cellular Respiration: the mitochondria metabolizes glucose into ATP, CO2 and H2O. One glucose becomes 36-38 ATP in an aerobic environment (with O2)

Tissues

Four types:

- Epithelial - external and lines hollow organs, protective barrier and secretes stuff
- Connective - binds other tissues together, blood, adipose, fibrous and elastic plus bone and cartilage
- Muscle - contracts leading to movement. 3 types: skeletal, smooth and cardiac
- Nerve - brain, spinal cord and all nerves. Nerves generate and transmit impulses throughout the body, controlling all processes

Integumentary System: body's external surface: skin, hair, nails, sweat/oil glands. Temp regulation, defense against disease, maintain fluid balance, most nerves and blood vessels run through the dermis, extending small branches into the epidermis.

Skeletal System: 206 bones in the frame. Protect internal organs and with muscles provide movement. Store minerals like calcium. Produce red and white blood cells. 4 types: long, short, flat, irregular.

Axial Skeleton: skull> cranium and face
Spine> 7 cervical vertebra #1 is Atlas, #2 is Axis
12 thoracic
5 Lumbar
5 Sacrum
4 Coccyx
10 ribs connected + 2 floating

Appendicular Skeleton:
Scapula> shoulder girdle/clavicle
Arm> humerus, radius, ulna
Hand>carpals, metacarpals, phalanges
Pelvic girdle> ilium, ischium, pubis
Leg> femur, patella, tibia, fibula
Feet> tarsals, metatarsals, phalanges
Joints: where two or more bones meet, articulate and move, movement aided by cartilage 3 types:
- Immovable, cranium
- Slightly movable: spine
- Movable: ball and socket, hinge

Ligaments join bone to bone
Tendons join muscle to bone

Nervous System: controls involuntary and voluntary movement made up of Central Nervous System and Peripheral Nervous System.

Nerve cells>neurons
- Cell body = soma
- Dendrites = receives impulses
- Axons = carries impulses away
  Synapse - region surrounding the point of contact between 2 neurons or a neuron and its effector organ
  Sensory nerves - transmits back to brain Motor nerves - transmits toward muscles

Nerve impulses are carried by changing the electrical charge of each cell. Sodium, potassium and calcium ions move in and out of the cells, changing their charge.
- Resting state - polarized

- Nerve impulse hits - depolarized
- Impulse moves on - repolarized

Central Nervous System:

Brain> Cerebrum
Diencephalons >hypothalamus, thalamus, pituitary
Brainstem> Medulla (heart rate, breathing, vasodilation, vomit, swallow) Pons (sleep, respiration)
Midbrain (exit of cranial nerves)
Cerebellum
Spinal Canal - through the Foramen Magnum down to the 2nd lumbar vertebra, below that it divides into the Cauda Equina
Meninges and CSF: 3 layers cover the brain and spinal cord
- Dura Mater
- Arachnoid membrane \ CSF circulates
- Pia Mater / between these

Lymphatic System:

Primary function is to absorb fat from the intestines and to trap infectious organisms like bacteria and viruses.

Electrolytes:
Cations + Anions -
Sodium Chloride
Potassium Bicarbonate
Calcium Phosphate Magnesium

Acid Base Balance:
Hydrogen is an acid
pH = Hydrogen ion concentration, the balance of acid produced and acid eliminated

The higher the amount of H, the lower the pH The lower the amount of H the higher the pH

Normal blood pH is 7.35-7.45 Maintain pH with 3 systems:
- Buffers = chemical sponges. Bicarbonate (HCO3)/carbonic acid (H2 CO3) balance (better with acidosis)
- Lungs - regulate the CO2 and H2 CO3 in the body
- Kidneys - excrete H and HCO3 as indicated by the pH of the blood. Deals with Alkalosis or Acidosis equally well but takes 10-12 hours.

Respiratory Acidosis:
Breathing too low, too much CO2, too much Carbonic Acid (H2 CO3), low pH
S&S:
- Hypoventilation
- Shallow respirations
- Disorientation
- Stupor

Respiratory Alkalosis:
Breathing too high, too little CO2, too little Carbonic Acid, High pH S&S:

- Hyperventilation
- Numbness, tingling - Mental Restlessness - Agitation, hysterical - Unresponsiveness

Metabolic Acidosis:
Too much H, too much Carbonic Acid (H2 CO3), low Bicarbonate (HCO3), low pH S&S:

- Starvation
- Renal impairment
- Diabetes (diabetic ketoacidocis)
- Prolonged diarrhea - Kussmaul breathing - Weakness
- Disorientation
- Coma

Metabolic Alkalosis:
Too little H, low Carbonic Acid (H2 CO3), high Bicarbonate (HCO3), High pH S&S:

- Excess baking soda
- Prolonged vomiting

PHARMACOLOGY

CATEGORIES OF DRUGS

- adsorbents
- antiarrhythmics
- sympathomimetics
- sympatholytics
- parasympathomimetics
- parasympatholytics
- nitrates
- thrombolytics
- diuretics
- opiates
- benzodiazepines
- paralytics
- antihistamines
- anticonvulsants
- antiemetics
- steroids

FORMS OF MEDICATIONS

Solution → drug dissolved in water (possibly syrup too)
Tincture → alcohol extract from a plant or animal
Suspension → solid particles suspended in liquid
Elixir → drug in alcohol solvent (often with syrup flavoring)
Syrup → concentrated solution of sugar and medication in water
Spirits → volatile chemicals dissolved in alcohol
Pills → shaped in a form that is easy to swallow
Powders
Tablets → compressed powders
Suppositories → solid base that melts at body temperature
Capsules → gelatin containers filled with powdered drug
Inhalants → powdered or liquid drug administered by inhalation

SPECIAL CIRCUMSTANCES TO BE CONSIDERED WHEN ADMINISTERING MEDICATIONS

- age / size
- tolerance (if patient is already prescribed high doses)
- possible trauma in your medical patient / vice versa
- pregnancy

6 RIGHTS OF MEDICATION ADMINISTRATION

Right **medication**
Right **patient**
Right **dose**
Right **route**
Right **time**
Right **documentation**

DRUG CONCENTRATION

- divide the weight of the drug by the volume of the solution it is in
  (Example: 25mg of Naloxone in a 100ml solution has a concentration of 1mg/4ml or 0.25mg/ml)
- percentages
  Concentration may be expressed in percentages
  Each percent = 1g / 100ml
  (Example: a 35% solution has 35g / 100ml)
- proportions
  Concentrations may be expressed in proportions
  (Example: 10 mg : 300 ml means that the concentration is 10mg / 300ml)

COMMON ETT DRUGS

Lidocaine
Atropine
Naloxone
Epinephrine

MEDICATIONS THROUGH ET TUBE

The medication should be increased:

- adults → 2 - 2.5 times the IV dose
- pediatrics: → same
  except : Epinephrine → 10 times higher
  except : pediatric anaphylactic reaction → remains the same

The medication should be diluted with Normal Saline
Max volume that may be administered via ET tube, by the patient's age:

- adult (18+) → 10 ml
- pediatric (<18) → 3 – 5 ml
- infant → 3 ml

The total volume of NS and meds shouldn't exceed 10 ml

EFFECTS OF A β_2 AGONIST

Bronchodilation

EFFECTS OF A β-AGONIST

B_1 -
- increased heart rate (positive chronotrope)
- increased myocardial conductivity (positive dromotrope)
- increased heart contractility (positive inotrope)

- renin release by the kidney (positive renotrope)

B_2 - bronchodilation
- dilation of the arterioles
- inhibition of uterine contractions
- muscle tremors

MEDICATIONS THAT COMBAT ENHANCED VAGAL TONE

The vagus nerve is a cranial nerve with parasympathetic outflow ⇒

Atropine (a parasympatholytic) or any other parasympatholytic can be used to combat enhanced vagal tone

RESTORIL

Restoril (Temazepam) is a benzodiazepine

PHENOBARBITAL

Phenobarbital is a barbiturate

NARCAN

Narcan is an opiate antagonist

LIDOCAINE DRIP

4:1 concentration → 400mg in a 100 ml bag or 1000 mg (1g) in a 250 ml bag

PATIENT ASSESSMENT

PHYSICAL EXAM BEGINS

When you first see your patient

FORMS OF PHYSICAL ASSESSMENT

Order of physical exam

1) **Inspection**

   Informed observation, "looking with a purpose"

2) **Palpation**

   Using sense of touch to gather information about temperature, moisture, texture, & movement

   - pads of fingers → sensitive ⇒ good for checking position, size, consistency, masses, fluid, crepitus
   - palm → best at sensing vibrations (such as fremitus)
   - back of hand → good at sensing temperature

   - light palpation → should be performed first
     - press in ~1 cm

   Abdominal palpation

   - first use light palpation with one hand to assess for tenderness, then use two hands, keeping the one underneath relaxed to aid in sensitivity
   - observe patient's facial expressions while palpating

3) **Percussion**

   The production of sound waves by striking one object against another →
   in this case, one hand against the other

   - to perform: strike distal knuckle of bottom hand with a finger of the percussing hand in a snap-at-the-wrist motion
     - dense material → quiet tones
     - less dense material → louder tones
   - when percussing the chest ⇒ fingers should lie between the ribs and parallel to them

4) **Auscultation**

   Listening for sounds produced by the body, primarily the heart, lungs, intestines, and major blood vessels

   - Always auscultate after using other techniques,
     except when assessing the abdomen → in that case auscultation should be first

ORDER OF ABDOMINAL EXAM

- place the patient supine
- ask patient to point to areas that are painful → examine that area last

1) **inspection** of skin, umbilicus; look for peristalsis, and for pulsations
2) **auscultation** for bowel sounds, bruits
3) **percussion** of all four quadrants

4) **palpation** of all four quadrants with one hand (lightly, inspecting for tenderness)
palpate all four quadrants with two hands (deeply, inspecting for masses)

ORDER OF RESPIRATORY ASSESSMENT

- inspect
- palpate
- percuss
- auscultate

EVALUATION OF MENTAL STATUS

Several components make up a mental status exam (aside from basic AVPU)

- general appearance
- behavior
- orientation
- memory
- sensorium (level of awareness)
- perceptual process
- mood and affect
- intelligence
- thought processes
- insight
- judgment
- psychomotor

DECORTICATE AND DECEREBRATE POSTURING

Decorticate posturing

Arms flexed, fists clenched, legs extended

- associated with injury / lesion / hypoxia at or above the upper brainstem

Decerebrate posturing

Stiff and extended extremities, retracted head

- associated with deep brain stem injury / lesion

GLASGOW COMA SCALE

		ADULT		PEDIATRIC	
Eye Opening	→	**4**	Spontaneous	**4**	Spontaneous
		3	To voice	**3**	To speech
		2	To pain	**2**	To pain
		1	None	**1**	None
Verbal Response	→	**5**	Oriented	**5**	Happy, coos, babbles, cries spontaneously
		4	Confused	**4**	Irritably crying but consolable
		3	Inappropriate words	**3**	Cries to pain, weak cry
		2	Incomprehensible sounds	**2**	Moans to pain
		1	None	**1**	None

Motor Response	→ **6**	Obeys command	**6**	Spontaneous movement
	5	Localizes pain	**5**	Withdraw to touch
	4	Withdrawal	**4**	Withdraw to pain
	3	Flexion	**3**	Abnormal flexion
	2	Extension	**2**	Abnormal extension
	1	None	**1**	None

ASSESSING SKIN TURGOR

Pick up a fold of skin above a bony prominence and release it

- skin with good turgor should rebound immediately back to its original position
- skin with poor turgor will exhibit 'tenting' → this suggests dehydration

CYANOSIS

Cyanosis is a reflection of the color of deoxygenated hemoglobin and is a late sign of hypoxia / anoxia

HOW DOES SpO_2 WORK

- SpO_2 device emits two wavelengths of light → one that is absorbed by oxygenated hemoglobin, and one that is absorbed by deoxygenated hemoglobin
- a computer compares the amount of each wavelength that has been absorbed, and interprets the result into a percentage of saturated hemoglobin readout from 0 – 100 %

BECK'S TRIAD

Associated with pericardial tamponade

- falling BP (hypotension)
- JVD
- muffled heart sounds
- narrowing pulse pressure

BABINSKY REFLEX

When the sole of the foot is stimulated ⇒
big toe dorsiflexes and the other toes fan out
(normal in babies)

TYPES OF PULSES

Pulsus Paradoxus

Systolic blood pressure (and tactile strength of pulse) drops more than 10mmHg during inspiration due to compression of the great vessels or ventricles by the pleural cavities

- associated with COPD and pericardial tamponade

Pulsus Alternans

Pulse alternates between weak and strong

- indicates pump related cardiac condition

Bigeminal Pulse

Pairs of pulses separated by intervals

- occurs with regular PVC's

UNEQUAL BLOOD PRESSURES

- when blood pressure changes with patient position (sitting / laying ; standing / laying)→ **orthostatic hypotension** ⇒
  - sign of poor compensation by the cardiovascular system
- when blood pressure differs from one arm to another ⇒
  - arterial stenosis
  - vascular disease
  - a dialysis shunt
  - aneurysm
  - trauma
  - pulmonary embolism

AIRWAY

DIFFERENCES IN PEDIATRIC AIRWAYS VS. ADULTS

Pediatric airway:

- abdominal breathers
- newborns breathe through their nose
- faster respiratory rate
- head larger in proportion to body
- flat nose and face
- baby teeth
- tongue proportionally larger
- larynx is more anterior
- smaller airway structures
- abundant secretions

NARROWEST PARTS OF THE AIRWAY

- adults : glottic opening
- pediatrics : cricoid cartilage

AGGRESSIVE AIRWAY MANAGEMENT

Aggressively securing the airway

- examples:
  - intubating patients who cannot protect their airway, are threatened with impending airway closure,
    or are in impending respiratory failure (respiratory burns, status asthmaticus, no gag reflex, AMS…)
  - may also indicate the use of a needle cricothyroidotomy

LARYNGOSCOPE BLADES

Macintosh blade

- it fits in the **vallecula [**supraglottic space**]**

Miller blade

- lifts the epiglottis

TIME LIMITS WHEN INTUBATING

- max recommended for each attempt: 30 seconds (or, the amount of time you can hold your breath)
- between attempts the patient should be hyperventilated with a BVM for ~ 30 seconds

SECONDARY CONFIRMATION OF ETT PLACEMENT

(Primary confirmation : visualization of the vocal cords)

- bulb syringe
  - squeeze the bulb syringe (as before suctioning a baby), attach it to the ET tube → if it inflates ⇒ it's in the trachea
    if it doesn't inflate ⇒ it's in the stomach (no air to inflate it)

- $ETCO_2$ detector
    - purple = problem
    - yellow = yes
    - Capnography waveforms
- chest rise
- auscultation of breath sounds in the chest cavity and absence of breath sounds over the epigastrium
- condensation in the ET tube

LIMITATIONS TO $ETCO_2$ DETECTORS

- patients in cardiac arrest may give false negative readings on an $ETCO_2$ device due to lack of perfusion →
  the lungs may be getting ventilated, but circulation may be inadequate to deliver CO_2
- patients that have recently consumed carbonated drinks may give false positive readings

COMPLICATIONS OF INTUBATIONS

- hypoxia due to missed attempts at ET intubation
- improper stylet placement:
    - laceration of the pharynx, larynx, tongue, carina or trachea
    - puncture of the ET tube or cuff
    - subcutaneous emphysema
    - hemorrhage
- over- or underinflation of the cuff:
    - ineffective ventilations
    - tube not secured & may extubate with patient movement
    - trauma to the airway

CONTRAINDICATIONS FOR AN OROGASTRIC / NASOGASTRIC TUBE

- NG tubes are always contraindicated when craniofacial trauma is present

TRAUMA

CRITERIA FOR TRANSPORT TO A TRAUMA CENTER

- falls greater than 20 feet (3 times the victim's height)
- pedestrian or bike vs. car
- struck by vehicle traveling over 5 mph
- thrown or run over by vehicle
- motorcycle accident over 20 mph
- ejection from vehicle
- severe vehicle impact
- speed at impact was greater than 40 mph
- intrusion of more than 12 inches into passenger compartment
- vehicle deformity greater than 20 inches
- rollover with signs of serious impact
- death of another occupant in the vehicle
- extrication lasting more than 20 minutes
- Trauma Score less than 11
- GCS less than 14
- SBP below 90 mmHg
- RR less than 10 or greater than 29 breaths per minute
- HR less than 50 or greater than 120 beats per minute
- penetrating trauma (except distal extremities)
- two or more proximal long bone fractures
- flail chest
- pelvic fracture
- limb paralysis
- burns to more than 15% of body
- burns to face or airway

BURNS

Burns may be divided by their level of severity (depth) or by the damage process that produces them

Types of burn by damage process

These all produce basically the same results as far as tissue damage, however, they are different mechanisms of injury

- **Thermal Burn**

  Heat causes damage to cells at the molecular level

  - thermal burns may be transmitted through exposed tissue to underlying tissue

- **Electrical Burn**

  Electricity passing through the body encounters resistance, which generates heat

  - electrical burns have an entrance and exit wound, and also damage tissues between the two

- **Chemical Burns**

  Chemical burns change the biochemical makeup of cells

- chemical burns do not transmit through tissue as do thermal and electrical burns

- **Radiation Burns**

  Radiation burns cause damage to tissues by the transmission of subatomic particles or pure energy through the tissues

TYPES OF BURN BY DEPTH

1° Superficial Burn

Involves only the epidermis

- it is an irritation of the living cells of the region
- signs & symptoms
  - pain
  - minor edema
  - erythema
  - bright red skin
  - no blistering or whitening of the skin

2° Partial Thickness Burn

Penetrates to the dermis

- It is differentiated from the superficial burn by blistering of the skin
- complete healing of the skin may be possible
- sign & symptoms
  - extremely painful

3° Full Thickness Burn

Extends below the dermis, possibly all the way to the bone

- healing is difficult or impossible
- signs & symptoms
  - may appear white, black or leather-like
  - damage to nerves results in an absence of pain at the site of the full thickness burn, but partial thickness burns surrounding it may be very painful

Fourth Degree Burn

A full thickness injury penetrating to muscle, fascia, periosteum, or bone ⇒
Third Degree Burns would then be burns that fully destroy dermis & epidermis but not underlying tissue

TREATMENT FOR THERMAL BURNS AND INHALATION BURNS

- intubate patients with suspected airway burns
- local cooling to stop burning process
- remove clothing that may constrain edema
- cover burns with dry sterile dressings
- IV fluids PRN

RULE OF 9'S

Adult		Infant & Child	
1 %	genitalia	1 %	genitalia
9 %	head and neck	13.5 %	each lower extremity
	upper back	9 %	each upper extremity
	lower back		anterior head & neck
	anterior chest		posterior head & neck
	anterior abdomen		upper chest
	each upper extremity		lower chest
	each anterior lower extremity		upper back
	each posterior lower extremity		lower back

HOLLOW AND SOLID VISCERAL ORGANS - TYPICAL INJURY PATTERNS

Solid organs → dense but without the resiliency of muscle

- liver
- spleen
- kidneys
- pancreas
- brain

Penetrating injuries

- the temporary cavity provides the most injury
- hemorrhage is often severe

Blunt injuries

- rupture
- severe hemorrhage
- tearing of ligaments that hold the organ in place

Hollow organs → fluid that often fills these organs is non-compressible and rapidly transmits impact energy outwards

- bowel
- stomach
- bladder
- heart

Penetrating injuries

- organ may explode or leak fluid

Blunt injuries

- rupture
- hemorrhage
- spillage of contents

INJURIES EXPECTED WITH DOWN & UNDER AND UP & OVER PATHWAYS IN AN MVA

- **Down and Under Pathway**

  Occupant slides downward

  Common injuries:

  - knees into firewall (knee femur fracture, hip dislocation)

- chest into steering wheel (flail chest, myocardial contusion, aortic tearing)
- tracheal and vascular injury in neck
- paper bag syndrome (lung tissue rupture – from taking a deep breath in anticipation of the crash)

- **Up and Over Pathway**
  Occupant tenses legs, thrown upward
  - occurs in ½ of all vehicle deaths
  - common injuries:
    - bilateral femur fracture from steering wheel
    - abdominal injuries from steering wheel
    - traumatic compression force with diaphragmatic rupture
    - lower chest injury from steering wheel
    - skull & facial fractures due to impact on dashboard or windshield
    - neck injuries from hyperextension & hyperflexion
    - spinal fracture (due to axial loading)
- **Ejection**
  Up & over and through the windshield
  (or through the side or rear windows)
  - two impacts → one with the vehicle & windshield → then with the ground or other objects
  - presents same injuries as up & over with additional injury from second impact

TERTIARY PHASE OF AN EXPLOSIVE BLAST

Injury from structural collapse or a blast victim being thrown against a wall, object, or to the ground

Phases of a blast injury:

- **Primary (pressure wave) blast injuries**:
  - burns
  - lung injury
  - middle / inner ear trauma
  - damage to hollow organs
- **Secondary (projectile) blast injuries**:
  - penetrating & blunt trauma
- **Tertiary (personnel displacement) blast injuries**:
  - blunt trauma
  - crush injuries (from structural collapse)

TREATMENT FOR A FLAIL SEGMENT

- high concentration O_2
- positive pressure ventilation (if necessary)
- stabilize with a bulky dressing over the site
- transport

OCCLUSIVE DRESSING ON A NECK INJURY

To prevent an air embolus from entering a neck vein

CATEGORIES OF HEMO- / PNEUMOTHORAX

- **Simple** (closed) **Pneumothorax**
  Air leaks from the lungs into the pleural space, no communication with the atmosphere
  - may be caused by a penetrating injury, but the external wound stays closed
- **Open Pneumothorax** (sucking chest wound)
  Collapse of a lung due to air in the pleural space from an external entry wound
- **Tension Pneumothorax**
  An open or simple pneumothorax that generates or maintains a pressure within the thorax that's greater than the atmospheric pressure
- **Spontaneous Pneumothorax**
  A closed pneumothorax that occurs spontaneously when lung tissue ruptures
  - often seen in patients with COPD
- **Hemothorax**
  An accumulation of blood in the pleural space due to internal hemorrhage

DIFFERENCE BETWEEN A HEMO AND PNEUMOTHORAX

- hemothorax is blood in the pleural space
- pneumothorax is air in the pleural space

SIGNS AND SYMPTOMS OF PNEUMOTHORAX, HEMOTHORAX AND TENSION PNEUMOTHORAX

Pneumothorax

- chest trauma
- dyspnea
- ventilation - perfusion mismatch
- hypoxemia
- hyperinflation of affected side of chest
- hyperresonance of affected side of chest
- diminished or absent breath sounds
- cyanosis
- diaphoresis
- AMS
- JVD
- hypotension
- hypovolemia

Hemothorax

- chest trauma
- shock
- dyspnea
- dull percussive sounds over affected side

Tension Pneumothorax

- usually S/S of chest trauma

- dyspnea
- ventilation - perfusion mismatch
- hypoxemia
- hyperinflation of affected side of chest
- hyperresonance of affected side of chest
- diminished or absent breath sounds
- cyanosis
- diaphoresis
- AMS
- JVD
- hypotension
- hypovolemia

TREATMENT FOR PNEUMOTHORAX

- occlusive dressing
- if it's a tension pneumothorax ⇒ perform **Needle Decompression** →
  @ midclavicular line & 2nd intercostal space, over the 3rd rib on the affected side

CARDIOLOGY

ANATOMY

CONDUCTION SYSTEM BETWEEN THE ATRIA AND VENTRICLES

- **cardiac contractions** are coordinated by two types of specialized cardiac muscle cells that do not contract:
  - nodal cells
  - conducting cells
- **nodal cells** depolarize spontaneously, and their rate is established by pacemaker cells
- the nodal cells that are first to reach threshold
- the **pacemaker cells** are located in the SA (**sinoatrial**) **node** → a tissue mass in the posterior wall of the right atrium near the entrance of the superior vena cava
- the cells of the SA node are electrically connected to those of the larger AV (**atrioventricular**) **node** by conducting cells in the atrial walls
- the AV node spontaneously depolarizes at a slower rate than the SA node, so action potentials from the SA node usually stimulate it before it's able to self-stimulate
- however, should the AV node not receive enough action potential or none at all, it will become the pacemaker of the heart
- the AV node is located in the floor of the right atrium near the opening of the coronary sinus
- from there, the impulse travels to the AV bundle, also called the **bundle of His**, which runs along the interventricular septum
- the bundle of His then splits into left and **right bundle branches**, which radiate across the inner surfaces of
  the left and right ventricles
- then **Purkinje fibers** convey the impulses to the contractile cells of the ventricular myocardium

Here are the steps of **cardiac conduction**:

1) SA node fires, sending an impulse along conducting cells to the AV node
2) along the way, the impulse is also transmitted to atrial walls, which begin contraction (ventricle walls are electrically isolated from the atrium by the heart's fibrous skeleton)
3) the impulse pauses at the AV node, and then travels down the AV bundle, the bundle branches, and finally reaches the Purkinje fibers
4) the ventricular myocardium contracts as the impulse travels upward, squeezing blood towards the base of the heart

ABSOLUTE AND RELATIVE REFRACTORY PERIODS

- **absolute refractory period**
  - myocardial cells are completely depolarized and insensitive to any further excitation (beginning of Q wave to apex of T)
- **relative refractory period**

- threshold of excitation is higher than normal, but excitation is possible (from apex of T wave to isoelectric line)

Refractory period of the atria is much shorter than the ventricles → atria are much more prone to fibrillation

JUNCTIONAL ESCAPE RHYTHM

Originates in the AV junction

- often takes pacing duties when sinus arrest or a proximal AV nodal block exists Look for an absent or inverted P wave

PROPERTIES OF CARDIAC CELLS

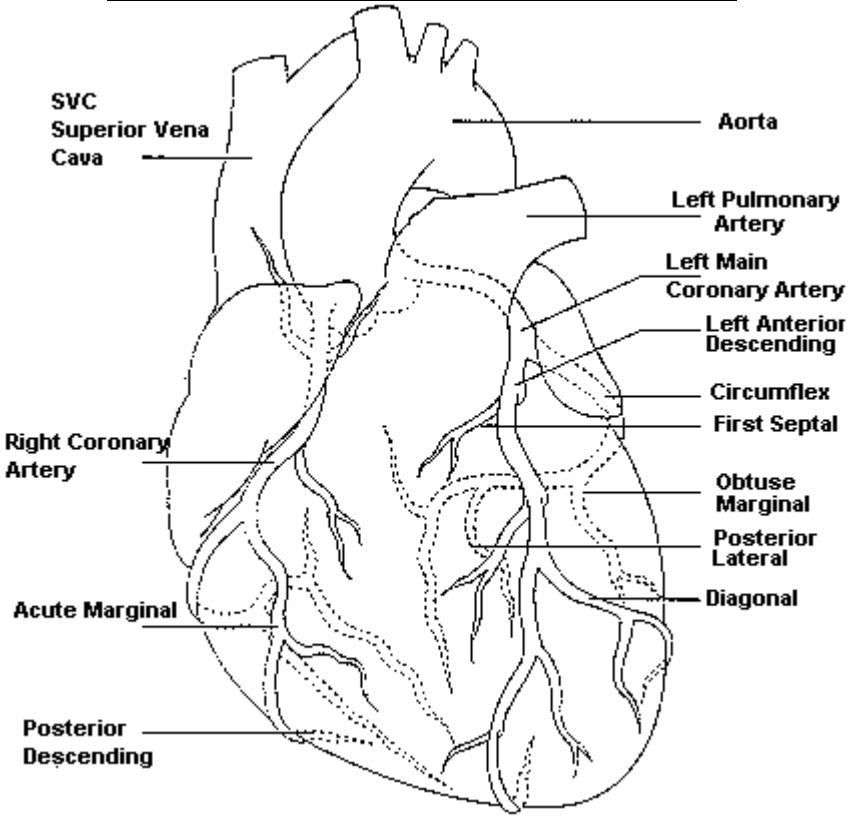
Cardiac conductive cells have four characteristics:

- **Excitability** → ability to respond to electrical stimulus
- **Conductivity** → ability to conduct electrical impulse
- **Automaticity** → each conductive cell can depolarize without outside impulse → self-excitation (the cell with the fastest rate becomes the pacemaker)
- **Contractility** → the ability to contract

Cardiac muscle cells (**cardiocytes**) are small and contain a single centrally located nucleus

- they have large T tubules that branch inside the cell, and a small sarcoplasmic reticulum ⇒ so they depend more on extra cellular fluid Ca
- they have many mitochondria and abundant myoglobin for oxygen storage
- they also maintain energy reserves in the form of glycogen and lipids
- each cardiocyte is connected to several others at intercalated discs
- tight junctions, desmosomes, and gap junctions at the intercalated discs give stability and communicability → because of this, action potentials are able to travel rapidly in these cells (Ca ions move easily through myocytes)
- also, myofibrils in adjacent cells are anchored together through the intercalated discs
- cardiac muscle cells 'pull together' because of this
- unlike skeletal muscle, cardiac muscle can undergo graded contractions
- the depolarization-repolarization process in cardiac muscle lasts longer than in skeletal muscle → cardiac muscle cells are limited to about 200 contractions a minute
- cardiac muscle's refractory period also lasts well into the relaxation phase, prohibiting tetany

ANATOMY OF THE CORONARY ARTERIES



Coronary Arteries

- originate in the aorta, just above the leaflets of the aortic valve
- receive blood during diastole ⇐
  aortic valve's leaflets cover the **ostia** (opening of the coronary artery) during systole
- there may be anatomical variants of the heart's blood supply in different people
  collateral circulation
  A protective mechanism that provides an alternative path for blood flow in case of a blockage somewhere in the system (the older the person is → the more collateral circulation there is)

Right Coronary Artery

- 2 main branches: **Posterior Descending Artery**
  Marginal Artery
- supplies:
  - part of the right ventricle
  - part of the right atrium
  - part of the conduction system
- empties directly into the right atrium via **small cardiac veins**

Left Coronary Artery

- 2 main branches: **Anterior Descending Artery**
  Circumflex Artery
- supplies:
  - left ventricle
  - part of the right ventricle
  - left atrium

- interventricular septum
- heart's conduction system

Anterior Great Cardiac Vein] → - drain blood from the left coronary system
Lateral Marginal Vein] - empty into the **Coronary Sinus**

CORONARY ARTERIES ARE PERFUSED

During diastole ⇐ during systole, the aortic semilunar valve blocks the entrance to the coronary arteries

FRANK-STARLING'S LAW

- the more the myocardial fibers stretch, the more the strength they contract with
- myocardial fibers contract more forcefully when stretched ⇒
  when the ventricles are filled with a large preload, they contract with more force
  "A full heart is a happy heart"
- as end-diastolic volume (preload) increases, so do stroke volume and blood pressure
- thus, preload and stroke volume are proportionate
  (i.e. as preload increases, stroke volume increases; and as preload decreases, stroke volume decreases)

CARDIAC OUTPUT AND STROKE VOLUME

Stroke Volume → the amount of blood ejected with each systolic contraction

- stroke volume depends on three factors:
  - preload = end diastolic volume (exerts stretch on atria)
  - cardiac contractility
  - afterload = vascular resistance against which the heart must pump

Cardiac Output = Stroke Volume x Heart Rate

- normal cardiac output: about 5 liters/min

CARDIOVASCULAR VARIABLES AFFECTING SYSTEMIC PERFUSION

BP ← systemic vascular resistance
← cardiac output ← heart rate
← stroke volume ← preload
← myocardial contractility
← afterload

PATHOPHYSIOLOGY

TYPES OF ANGINA

- **Angina Pectoris** means "pain in the chest"
- it is commonly associated with myocardial ischemia secondary to ASHD (Atherosclerotic Heart Disease)
- it may also be caused by spasming of the coronary arteries, called **Prinzmetal's Angina**
    - usually due to cocaine use

Angina is often classified as:

- Stable: angina in response to physical or emotional stress
- Unstable: angina occurring at rest

STABLE DYSRHYTHMIA

- the AHA recognizes the stable/unstable dysrhythmias as one that has no clear-cut boundary, and recommends that the "whole clinical picture" be considered rather than just BP and HR, for example
- Most criteria for a stable dysrhythmia is:
    - any adult patient having a dysrhythmia with no signs of hypotension
    - any pediatric patient having a dysrhythmia NOT associated with depressed mental status and absent peripheral pulses $^{and}/_{or}$ hypotension (decompensated shock)

JVD INDICATES

- **right sided heart failure** → blood backs up into systemic circulation, thus the jugular veins remain full and are unable to drain normally
- pericardial tamponade, PE, tension pneumothorax, or CHF

JVD is a measure of right atrial & venous pressure

- to measure it → when patient is sitting up in a 45° angle (semi-Fowler's position)

HEART FAILURE IN APE

The left ventricle is failing ⇒ left sided heart failure

- if the left ventricle is weakened (such as in an MI) or is pumping inefficiently (such as in a dysrhythmia) → it may not be able to pump out all of the blood delivered to it
- when this happens, blood backs up into the pulmonary circuit, causing pulmonary hypertension and plasma leakage into the lungs (APE)

ECTOPIC BEATS

Ectopic beats are produced when ectopic foci (heart cells other than the pacemaker cells) depolarize and produce aberrant beats (PACs and PVCs)

!!! PJCs are NOT ectopic, as they originate from pacemaker cells in the AV junction

HEART SOUNDS WITH CHF

An S_3 gallop " Ken-tuck-ey, Ken-tuck-ey"

VARICOSE VEINS

Dilated superficial veins, usually in the lower extremities

- contributing factors:
  - pregnancy
  - obesity
  - genetics

Legs & feet may also be swollen due to poor venous drainage

Not usually a significant health problem

SIGNS AND SYMPTOMS OF A AAA

Abdominal Aortic Aneurism

Signs & symptoms:

- severe, tearing chest pain, radiating to the back
- pulse difference between extremities
- harsh systolic murmur
- hypovolemia (may be initially hypertensive due to stretching of sympathetic nerve fibers in the abdomen)

COR PULMONALE

Congestive heart failure secondary to pulmonary hypertension

EFFECT OF CA CHANNEL BLOCKERS

Ca channel blockers (Verapamil, Cardizem) cause vascular dilation and slow conduction through the AV node

EKG

SPEED OF EKG PAPER

The standard speed is 25 mm/second

- 1 small box = 0.04 sec = 1 mm ⇒
  1 sec = 25 mm

LARGE AND SMALL SQUARES ON THE EKG PAPER

- **small square**
  - 0.04 seconds horizontally
  - 1 mm wide and 1 mm tall
- **large square**
  - 0.20 seconds
  - 5 mm wide and 5 mm tall

RULES FOR EVALUATING EKGs

- analyze the rate
- analyze the rhythm
- analyze the P-waves
- analyze the P-R Interval
- analyze the QRS Complex

POSITIVE ELECTRODE FOR EACH LEAD IN AN EKG

- Lead I — right arm to left arm (with left arm ⊕)
- Lead II — right arm to left leg (with leg ⊕)
- Lead III — left arm to left leg (with leg ⊕)
- aVF — left foot ⊕
- aVL — left arm ⊕
- aVR — right arm ⊕
- Chest leads — all electrodes ⊕ (they are unipolar)

V_1 AND V_6 ARE ALSO CALLED

Precordial chest leads, unipolar leads

DIFFERENCE BETWEEN POSITIVE AND NEGATIVE DEFLECTIONS IN AN EKG

- positive deflection indicates that the electrical impulse is moving toward the positive electrode
- negative deflection indicates that the impulse is moving away from the positive electrode

CAUSES OF ARTIFACT

Artifacts are any deflections recorded on the EKG produced by factors other than the heart's own electrical activity:

- shivering
- muscle tremors

- patient movement
- loose electrodes
- 60 cycle electrical interference
- machine malfunction

Most common cause: loose electrodes

QRS COMPLEX REPRESENTS

The QRS complex shows the depolarization of the ventricles

- the ventricles begin to contract just after the peak of the R wave

DURATION OF A NORMAL QRS COMPLEX

0.12 seconds or less (three little boxes on your EKG paper)

LONG PRI MEANS

- a PRI that is prolonged (> 0.20 seconds) and regular is diagnostic for a 1° heart block
- a PRI that cyclically transitions from shorter to longer indicates a 2° type I heart block (Wenckebach)
- a lengthened PRI with dropped QRS complexes indicates a 2° type II heart block
- PRI that is all over the place and P waves that "march through" QRS complexes is indicative of a 3° heart block

EKG WITH HYPOTHERMIA

- the primary change: **Osborn** or **'J 'wave** → a slow, positive deflection at the end of the QRS complex
- other changes, such as A-fib, T-wave inversion, bradycardia, PVC's may also occur *(but the Osborn wave is sure to be what they want on the exam)*

EKG IN WPW

In **Wolf-Parkinson-White Syndrome**

- an accessory AV conduction pathway ("**Bundle of Kent**") prematurely depolarizes a portion of the ventricle, showing up on the EKG as a short PRI and an elongated QRS, and produces a **delta wave** (concave deflection) in the QRS complex

12-LEAD FOR INFERIOR ISCHEMIA / INFARCTION

Elevation - Depression

Inferior (Right Coronary Artery) : II, III, aVF ---------- I, aVL, V_1 – V_4

!!! if there are signs of an inferior infarction, there is a 50% chance there is also a RVMI !!!

LOCATION		*ARTERY*	*LEADS*	*RECIPROCAL LEADS*
I	**I**nferior wall	RCA	II , III , AVF	I , AVL
Saw	**S**eptal	LAD	V_1 - V_2	
A	**A**nterior wall	LAD	V_3 - V_4	II , III , AVF
Lion's	**L**ateral wall	Circumflex	I , AVL , V_5 - V_6	II , III , AVF
Paw	**P**osterior wall	RCA	V_8 - V_9 R>S in V_1	ST ↓ in V_1 - V_4
	Right Ventricular Infarct	RCA	V_4R	

DIFFERENT TYPES OF PACEMAKERS

Artificial pacemakers are surgically inserted (or temporarily placed transvenously, esophageal or transcutaneously) when the heart's own pacemaker fails or becomes dysfunctional

- two major types of pacemaker that may be used:
  - **non-demand pacemaker** (asynchronous)
    - delivers a timed electrical impulse at a preselected rate, regardless of the patient's intrinsic pacemaker activity
    - these are less often used due to risk of firing at the wrong moment in the cardiac cycle (apex of T wave)
  - **demand pacemaker**
    - delivers electrical impulses when no intrinsic beats from the heart are detected

Pacemakers may be placed in either the atria or the ventricles, or both (**AV sequential pacemakers**)

INTERVENTIONS / TREATMENTS

PAD / PADDLE PLACEMENT

1st to the right of the upper sternum below the clavicle
2nd apex of heart → left of left nipple in anterior axillary line
- don't place pads/paddles over a pacemaker (place them at least 5 inches away from it)
- alternatively: PALS allows a "kid sandwich" →
  one pad/paddle to the left of the sternum and one on the back →
  this may be necessary in infants if only large pads are available

PACING, CARDIOVERSION, AND DEFIBRILLATION

- **defibrillation** is the process of passing a current through a fibrillating heart to depolarize the cells and allow them to repolarize uniformly
- **synchronized cardioversion** is a controlled form of defibrillation for patients with an organized dysrhythmia
- **transcutaneous external pacing** allows electrical pacing of the heart through the skin via specially designed thoracic electrodes

PART OF THE QRS THAT'S "AIMED" AT WHEN CARDIOVERTING

The highest point of the QRS complex (the peak of the R wave)
- this guarantees (hopefully) that the shock will be delivered during the absolute refractory period, lowering the possibility that the shock will cause an artificial "R-on-T" event

CANDIDATE RHYTHMS FOR TCP

- symptomatic bradycardias
- high-degree AV blocks
- A-fib with slow ventricular response
- asystole (witnessed)

CONTRAINDICATION TO CAROTID SINUS MASSAGE

- bradycardias or hypotension
- patients with carotid atherosclerosis → an embolus could be released and cause a CVA
- AHA recommends avoiding CSM in patients of late middle age and older, because there is a significant chance they'll have atherosclerosis

!!! *be sure to auscultate for bruits first* ***!!!***

TREATMENT FOR CHEST PAIN

Assuming we are talking about chest pain in a patient with no unstable dysrhythmias, and signs of an MI (or, at least, no signs of other things that might cause chest pain that treatment for an MI might exacerbate – like pericardial tamponade, respiratory problems, PE, trauma…)
- perform the appropriate assessment (12-Lead)
- Oxygen
- Nitroglycerine

- ASA
- Morphine

TREATMENT FOR CARDIOGENIC SHOCK

- O_2 @ 15 liters via NRB
- Dopamine 5µg/kg/min IV Drip
- If still hemodynamically unstable → titrate the drip to desired rate for a max of 20µg/kg/min

TREATMENT FOR SVT

- immediate cardioversion at 50-100 J ← ONLY IF UNSTABLE
- Adenosine if stable 6 – 12 - 12 mg rapid IVP, followed by rapid flush of 20 ml NS (2 syringe method)

STABLE SVT AND TREATMENT

According to AHA ACLS recommendations, a stable tachycardia is one unaccompanied by "serious signs or symptoms"

- treatment should be chosen according to the type of SVT - MAT, PSVT, or Junctional tachycardia
- all may be given Amiodarone or other anti-arrhythmics, but only PSVT should be cardioverted, as MAT and Junctional Tach will not respond to electricity → this is because in those two types of SVT, there is no reentry circuit

TREATMENT FOR BRADYCARDIA

If the bradycardia is symptomatic:

- first with Atropine Sulfate (0.5-1mg) IV bolus and TCP if the Atropine is not effective → further interventions (according to ACLS) should be performed as necessary in the following order:
  - Dopamine drip
  - Epinephrine drip
  - Isoproterenol drip

TREATMENT FOR V-FI B

- CPR / appropriate BLS measures
- defibrillate at 200, 300, and 360 J
- Epinephrine or Vasopressin
- shock, shock, shock
- consider anti-arrhythmics (Amiodarone, Lidocaine, Magnesium, Procainamide)
- shock shock shock, drug, shock shock shock, drug, shock etc...

TREATMENT FOR POLYMORPHIC V-TACH

Cardioversion $^{and}/_{or}$ anti-arrhythmics (Magnesium, Lidocaine, Amiodarone, Procainamide, β blockers)

- AHA also suggests overdrive pacing
- In the case of **Torsades de Pointes**: Magnesium Sulfate is the first line treatment

TREATMENT FOR ASYSTOLIC ARREST

- if the arrest was witnessed:
    - a precordial thump should be administered
    - CPR initiated
    - TCP attempted (only if asystole is present in 2 leads)
- if unwitnessed:
    - CPR should occur first

!!! *the AHA accepts but does not necessarily recommend the use of a precordial thump in witnessed arrest, and only when performed by health care professionals* ***!!!***

MEDICAL EMERGENCIES

GENERAL

Calcium levels affect

- bone growth / density / strength
- the clotting process (both intrinsic and extrinsic) and the production of thromboplastin
- the release of calcitonin and parathyroid hormone
- the permeability of cell membranes to Na^+
- the contractility of muscle tissue: Ca stored in the cisternae of each sarcoplasmic reticulum is released,
  binds to troponin, and initiates muscle contraction
- the release of neurotransmitters at the synaptic gap
- GI tract and kidneys, since Ca may be excreted through both routes

Too much Ca suppresses muscle activity - too little Ca causes irritability

Hypocalcemia may cause seizures, dysrhythmias with CHF-like findings, and a myriad of other symptoms

Hypercalcemia may cause nausea, vomiting, AMS, abdominal pain, constipation, weakness, polyuria, headache, and kidney stones

SHOCK

DIFFERENT TYPES OF SHOCK

There are two ways to classify shock: the new way and the more traditional way

- traditional way:
  - cardiogenic
  - hypovolemic
  - neurogenic
  - septic
  - anaphylactic
- new way:
  - cardiogenic
  - hypovolemic
  - obstructive
  - distributive

Cardiogenic Shock

Failure of the heart to pump enough blood to all parts of the body

- compensatory measures (such as vasoconstriction) make the heart work even harder and accelerate myocardial ischemia and infarction, and thus complete pump failure
- signs & symptoms:
  - pulmonary edema
  - diminished lung sounds, wheezes, rales
  - difficulty breathing
  - productive cough with white or pink sputum
  - AMS
  - heart rate may vary from bradycardic to tachycardic

Hypovolemic Shock

Loss of blood volume (and thus hypoperfusion) from

- hemorrhage
- dehydration
- sweating
- burns (burns cause plasma loss)
- diabetic ketoacidosis with osmotic diuresis

- signs & symptoms:

  The "classic" signs of shock:

  - cool, pale, diaphoretic skin
  - low to absent urine output
  - AMS
  - falling blood pressure
  - pulse that goes from normal to tachycardic to bradycardic and then disappears as the patient decompensates

Obstructive Shock

Caused by an obstruction to normal cardiovascular circulation, such as in

- PE
- cardiac tamponade
- tension pneumothorax

- signs & symptoms:

  The "classic" signs of shock *(see hypovolemic shock above)*, along with S/s of the causative obstruction (APE, tamponade, or tension pneumothorax)

Distributive Shock

Any shock caused by abnormal distribution and return of blood due either vessel permeability, vasodilation, or both

- septic shock
- neurogenic shock
- anaphylactic shock

Septic shock

Begins with an infection that is distributed throughout the body by the bloodstream → toxins released by the infecting organism overcome compensatory mechanisms → causing vasodilation and increased permeability of the vessels
(and thus, increased loss of intravascular fluid)

- signs & symptoms may vary

  patients in septic shock are often feverish, but may also present as hypothermic

  - flushed or pale skin
  - cyanotic
  - dyspnea
  - altered lung sounds

Neurogenic Shock

Results from CNS injury that interrupts nerve impulses to the arteries →
arteries lose muscle tone and dilate → no fluid has been lost, but the container has been enlarged

- signs & symptoms:
  - warm, flushed, dry skin below the injury site
  - low blood pressure and slow pulse from the early stages

Anaphylactic Shock

Shock caused by anaphylactic reaction to an allergen

- signs & symptoms

  Due to the nature of anaphylaxis, signs and symptoms may differ from patient to patient

  - flushed, itchy skin
  - cyanosis
  - hives

- dyspnea
- wheezing, stridor
- sneezing, coughing
- laryngospasm
- laryngeal edema
- vasodilation
- increased heart rate
- decreased blood pressure
- nausea & vomiting
- abdominal cramping
- diarrhea
- AMS
- dizziness
- headache
- seizures

PULMONOLOGY

CONCENTRATIONS OF DIFFERENT ATMOSPHERIC GASSES

Normal atmospheric pressure is 760 torr

- Nitrogen → 79%
- Oxygen → 21%
- Carbon Dioxide → 0.04%
- Water vapor → 0.50%

DIVISION BETWEEN THE UPPER & LOWER AIRWAY

in adults → larynx
in pediatrics → cricoid ring

STRUCTURES THAT MOISTEN THE AIR IN THE AIRWAY

The paranasal sinuses

TERMINAL UNIT OF THE RESPIRATORY TREE

The alveoli

SURFACTANT

A compound that regulates the surface tension of the fluid lining the alveoli, keeping them open for gas exchange

PART(S) OF THE BODY THAT SIGNAL THE BRAIN TO MODIFY THE RESPIRATORY RATE

- carotid and aortic baroreceptors detect BP and effect RR
- carotid and aortic chemoreceptors detect pH, PCO_2, and PO_2 and effect RR

MONITORING AND CONTROLING OF THE RESPIRATORY RATE

- the respiratory centers are three loosely organized pairs of nuclei in the pons and medulla
  → they regulate the respiratory muscles and control the rate and depth of breathing
- the inspiratory center functions in both quiet and forced respiration →
  it stimulates the inspiratory muscles for ~ 2 seconds, then is silent to allow for expiration
- in forced (voluntary) respiration, the expiratory center activates accessory muscles for both inspiration and expiration
- mechanoreceptor reflexes respond to changes in the volume of the lungs or to arterial blood pressure
- an "inflation reflex" prevents the lungs from over expanding
  stretch receptors are stimulated when the lungs expand, and sensory fibers transmit this info through the vagus nerve →
  as a result, the inspiratory center is inhibited and the expiratory center is stimulated
- the deflation reflex stimulates the inspiratory center and inhibits the expiratory center →
  the smaller the volume of the lungs, the greater the inhibition

- neither the inflation nor the deflation reflex are involved in quiet breathing ← together they are known as the **Hering-Breuer Reflexes**
- carotid and aortic baroreceptors are sensitive to changes in blood pressure → when BP falls, the RR increases; when BP rises, the RR decreases → this adjustment results from the stimulation or inhibition of inspiratory and expiratory centers in the glossopharyngeal (IX) and vagus (X) nerves
- chemoreceptors respond to chemical changes → chemoreceptors in the carotid bodies and the aortic bodies are sensitive to pH, pO_2, and pCO_2, and receptors in the medulla respond to levels of pH and pCO_2 2 in the CSF → these changes are relayed to the respiratory centers, which adjust RR and depth to compensate for pH changes

CONTROL OF RESPIRATIONS

Both voluntary and involuntary

- if you aren't telling your body to breathe, it will breathe on its own

CO_2 TRANSPORT IN THE BLOOD

See #3 below for the answer

After entering the bloodstream, CO_2 may be:

1) dissolved in the plasma (7%)
2) bound to globin in hemoglobin molecules in RBCs (23%)
3) converted to a molecule of carbonic acid (H_2CO_3), and then broken down into bicarbonate (HCO_3) and H^+ ions (70%) → this is why active tissue becomes acidic

GAS EXCHANGE

Gas exchange occurs across the respiratory membrane of the alveoli

SpO_2 LEVELS

- normal → 95 – 100 %
- mild hypoxia → 91 – 94 %
- moderate hypoxia → 86 – 90 %
- severe hypoxia → 85 % and lower ⇒ immediate intervention needed →

including administration of 100% O_2, ventilatory assistance, or both

The goal is to maintain SaO_2 at 95 – 100 %

PHASES OF THE RESPIRATORY CYCLE - PARTIAL PRESSURES DURING EACH PHASE

Inspiration and expiration

- as inspiration begins the diaphragm contracts & flattens and the intercostal muscles contract → expanding the chest wall → this produces a decrease in air pressure inside the chest cavity (1-2 mmHg below atmospheric pressure) causing air to be drawn into the lungs
- during expiration, both the chest wall and the diaphragm recoil to their normal resting state, which increases the pressure inside the chest to 1-2 mmHg above atmospheric pressure, driving air out of the lungs

- a single breath (one respiratory cycle) moves air into and out of the lungs
- each breath consists of an inhalation (inspiration) and an exhalation (expiration)
- breathing functions to maintain adequate alveolar ventilation, the movement of air into and out of the alveoli

Tidal volume (500 ml)
Total air moved into and out of the lungs during a single respiratory cycle

Expiratory reserve volume (1000 ml)
The amount of air that can be voluntarily expelled at the end of a tidal cycle

Inspiratory reserve volume (♂ 3300 ml - ♀ 1900 ml)
The amount of air that can be taken in over and above the tidal volume

Residual volume (1200 ml)
Air left in the respiratory passageways and alveoli after the expiratory reserve volume is expelled

Minimal volume
Air left in the lungs after lung collapse (⇐ surfactant coating prevents the alveoli from collapsing)

Vital capacity (3400 – 4800 ml)
Maximum amount of air that can be moved in and out of the respiratory system in a single respiratory cycle → the sum of inspiratory reserve volume, expiratory reserve volume and tidal volume

Dead space (150 ml)
The volume of air in the conducting passageways

DIFFERENT ADVENTITIOUS LUNG SOUNDS

Rales (also known as '**crackles**')
Light crackling, popping nonmusical sounds, usually heard on inspiration
- stem from air passing through moisture in the bronchoalveolar system or alveoli opening abruptly
- most often occur shortly after inspiration starts and end soon thereafter

Rhonchi
Continuous lower pitched sounds with a lower pitch and a snoring quality
- caused by secretions in the larger airways, usually occurs in early exhalation but may appear in early inspiration too

Wheezing
Smaller bronchial passages make a 'musical' wheezing sound when blocked
- usually originate in the smaller bronchioles and appear at the end of exhalation

Stridor
A high pitched sound upon inspiration
- indicates obstructed larynx or trachea

Friction Rub
Squeaking or grating sound of pleural linings rubbing together
- sounds like leather or sandpaper rubbing together
- happens when pleural membranes become inflamed $^{and}/_{or}$ lose their lubrication
- audible during entire respiratory cycle

Snoring
A loud rumbling caused by partial airway obstruction by the tongue or foreign body

NORMAL RESPIRATORY RATES

- adult → 12-20 breaths/min
- child → 12-40 breaths/min
- infant → 30-60 breaths/min

RESPIRATORY PATTERNS

Eupnea

Normal respiratory pattern

Kussmaul's Respirations

Deep, slow or rapid, gasping breathing; often seen with diabetic ketoacidosis

Cheyne-Stokes Respirations

Progressively deeper, faster breathing alternating gradually with shallow, slower breathing; associated with brain stem injury

Biot's Respirations (Ataxic Respirations)

Irregular pattern of rate and depth with sudden, periodic episodes of apnea; associated with increased intercranial pressure due to lesion in medullar respiratory center

Central Neurogenic Hyperventilation

Deep, rapid respirations; associated with increased intracranial pressure due to stroke or brain injury

Agonal Respirations

Shallow, slow, infrequent respirations; indicates brain anoxia

Apneustic Respirations

Slowed breathing

DIFFERENCE BETWEEN EMPHYSEMA AND ASTHMA

Asthma

A reactive airway disease characterized by acute constriction of the bronchi in response to external or internal stimuli, causing dyspnea & hypoxia

- following this first stage of acute constriction, a secondary inflammatory reaction may occur
- asthma does not destroy lung tissue

Emphysema

A chronic pulmonary disease resulting from the permanent destruction of alveolar tissue, resulting in lost respiratory exchange surface and loss of lung elasticity

PHYSIOLOGICAL CHANGES WITH EMPHYSEMA

Emphysema results from destruction of the alveolar walls

- increased residual volume while vital capacity remains relatively normal
- hyperresonance with percussion
- **polycythemia [** an excess of red blood cells resulting in an abnormally high hematocrit and pink/red skin **]**
- clubbing of the fingers
- barrel chest
- hypoxic drive
- hypertrophy of accessory respiratory muscles

- thin body

TROUBLE SLEEPING WHEN LAYING DOWN

This is called **orthopnea**

- patients with severe CHF or COPD often find it takes less effort to breath when in a sitting position rather than laying down
- this is why the question "how many pillows do you sleep with" is often asked

CAUSES AND SIGNS & SYMPTOMS OF A PULMONARY EMBOLISM

Caused by a particle lodging in a pulmonary artery, blocking pulmonary circulation, leading to hypoxemia

- emboli can come from:
  - different injuries
  - surgeries
  - medicines
  - invasive procedures
  - childbirth
  - various disease states (sickle cell disease, cancer…)
- forms of emboli:
  - bloods clots
  - plaques
  - masses of bacteria
  - cancer cells
  - amniotic fluid and particles
  - fat from the marrow of broken bones
  - air bubbles
- signs & symptoms
  - sudden unexplained dyspnea
  - possible pleuritic chest pain
  - non-productive cough (occasionally with hemoptysis)
  - labored breathing
  - tachypnea
  - tachycardia
  - possible signs of right sided heart failure (JVD, falling BP)
  - usually no abnormal $^{L}/_{S}$ (sometimes crackles or friction rub)

CARPOPEDAL SPASM

Cramping of the muscles of the hands and feet, resulting from hypocalcemia, and are often associated with respiratory alkalosis due to hyperventilation syndrome

ASTHMA ATTACK TREATMENT IN PHASE 1 AND IN PHASE 2

Phase One

- Albuterol or Metaproterenol

Phase Two

- steroid therapy
- aggressive airway management due to the muscle fatigue and air trapping

Because phase two is characterized by an inflammatory response refractory to bronchodilators
(Albuterol, Metaproterenol, Epinephrine) steroids are the definitive treatment

MANAGEMENT OF A PATIENT WHO IS HYPERVENTILATING

NEVER assume hyperventilation is just a result of anxiety

- always assume there may be an underlying medical problem causing hypoxia

!!! oxygen will not hurt your patient if given during a short ambulance ride, even if they really are hyperventilating due to anxiety ***!!!***

Respiratory Emergencies

Extremely common: two categories, acute and chronic, both can present as life threatening.

Respiratory System: filters, warming. Humidifying and exchanging more than 10,000L of air per day (adult).
Upper: mouth, pharynx (nasal ands oral) larynx and vocal cords. Lower: trachea, bronchi, bronchioles and alveoli

Respiration= inspiring O2 and exhaling CO2 Ventilation = exchanging CO2
Diffusion= crossing the capillary/alveolar junction Perfusion = oxygenated blood pumped out to the tissues

Pathophysiology: problems that affect gas exchange (ventilation)
Upper airway obstruction (trauma, epiglottitis, tonsillitis, choking)
Lower airway obstruction (trauma, obstructive lung disease, mucus, brochospasm airway edema)
Impaired chest movement (trauma, hemothorax, pneumothorax, empyema (pus)
Neurological control problems, depressed CNS function, stroke, disease
Diffusion-Related problems:
Low O2 in air
Alveolar pathology (COPD, blebs)
Interstitial space pathology, high water pressure, edema
Perfusion-Related Problems
Inadequate blood volume or hemoglobin levels
Impaired circulation
Chest wall trauma

Assessment Findings: Major focus is recognizing life threats
Altered mental status
Severe cyanosis
Absent breath sounds
Stridor

ï 1 -2 word dyspnea
Tachycardia >120/min
Pallor, diaphoresis
Use of accessory muscles

Focused History

Ever had this before, known pulmonary problems, ever been intubated,
Medications, changes in medications
Possible toxic exposures

General Impression, evaluate the following
Position- tripod position = moderately severe respiratory distress
Mentation
Ability to speak
Respiratory Effort
Skin color and appearance

Vital Signs: obtain baseline vitals, Pulse, BP, Respiratory rate/patterns
Head and Neck: pursed lips breathing, JVD, sputum suggests infection Chest: symmetry, trauma, barrel chest (COPD), retractions
Extremities: carpopedal spasm = low CO2 levels
Diagnostic testing: Pulse Ox, Peak flow, Capnometry (end of ET tube)

Obstructive Airway Diseases are Asthma (4-5%) and COPD: sometimes divided into emphysema and chronic bronchitis (20% of adult males). Contributing factors:

Stress Infection Exercise
Tobacco smoke can cause asthma and COPD Allergens: food, animal dander, dust, mold, pollen
Drugs: reactions to beta blockers
Occupational hazards: latex allergy

Pathophysiology of obstructive lung disease:

Smooth muscle spasm/bronchospasm: beta receptors respond to sympathetic stimulation > bronchodilation. Beta blockers are bronchoconstrictors

- Aminophylline
- Theodur
- Somophylline, Elixophylline, Brethine
- Proventil, Ventolin, Alupent, Albuterol Mucus: cilia moves mucus out
- Inflammation

Asthma: 8.9 million people have this acute airflow obstructive disease of the lower airway. Hypersensitive bronchial airways that are easily irritated>bronchospasm> limits movement of air>increased mucus> swelling and edema> inflammatory cell proliferation

Most common onset in children and young adults. 1/3 develop it before age 5, 1/3 of children outgrow it, adult onset asthma is usually persistent. ¼ diagnosed after age 50.

Extrinsic asthma: some specific outside substance causes bronchioles to narrow, more common in children

Intrinsic asthma: no substance identified as causing narrowing. More commonly adult onset

Triggers to Asthma Attack:

Respiratory infections

NEUROLOGY

Central Nervous System (CNS) = brain and spinal cord, involved in the serious neurological problems. Affects:

Cognitive Systems: responsible for alertness, awareness, normal wakeful state Cerebral Homeostasis: balance, maintaining brain perfusion and oxygenation using cerebral autoregulation.

Motor Control: affects tics to seizures, weakness to paralysis

Sensation: alterations in sensory systems accompany weakness > paralysis

PARTS OF THE BRAIN

- 6 major parts:
  - forebrain
    - cerebrum
    - diencephalon
      - thalamus
      - hypothalamus
  - hindbrain
    - mesencephalon (midbrain)
    - pons
    - medulla oblongata
    - cerebellum

- areas of specialization:

speech	→	temporal lobe of cerebrum
vision	→	occipital cortex of cerebrum
personality	→	frontal lobes of cerebrum
sensory function	→	parietal lobes of cerebrum
balance & coordination	→	cerebellum
reticular activating system	→	lateral portion of midbrain, medulla and pons

1) Cerebrum

- in the anterior and middle area of the cranium
- contains two hemispheres → joined by the **corpus callosum**
- functions:
  - conscious thought process
  - intellectual functions (intelligence, language)
  - memory storage and processing (learning, analysis)
  - involuntary regulation of somatic motor patterns

cerebral cortex

- outermost layer of the cerebrum

2) Diencephalon (interbrain)

- covered by the cerebrum
- major role in regulating the autonomic NS
- provides switching and relay centers that integrate the conscious and unconscious sensory and motor pathways

Thalamus

- relay and processing centers for sensory information

Hypothalamus

- centers for controlling emotions
  - autonomic functions (temperature regulation, sleep)
  - hormone production (water balance, stress response)
- connected to the pituitary gland

Limbic System

- functional grouping rather than an anatomical one
- establishes emotional states and behavioral drives
- linking the consciousness, intellectual functions of the cerebral cortex with the unconscious, autonomic functions of the brain stem
- long-term memory storage and retrieval

3) Mesencephalon (midbrain)

- located between the diencephalon and pons
- functions:
  - processing of visual and auditory data
  - eye movement
  - generation of involuntary somatic motor responses
  - maintenance of consciousness

Reticular Activating System (RAS)

- diffuse system of interlacing nerve cells responsible for maintaining consciousness and the ability to respond to stimuli
- sends impulses to and receives impulses from the cerebral cortex

4) Pons

- between the midbrain and medulla oblongata
- connection between the brain and the spinal cord
- functions:
  - relays sensory information to cerebellum and thalamus
  - involuntary somatic and visceral motor centers

5) Medulla Oblongata

- between the pons and the spinal cord
- function:
  - relays sensory information to the thalamus
  - autonomic centers for regulation of visceral functions (respiration, cardiovascular functions, digestive system functions)

6) Cerebellum

- in the posterior fossa of the cranial cavity
- consists of 2 hemispheres
- closely related to the brainstem and higher centers
- functions:
  - involuntary control of complex somatic motor patterns
  - fine motor movements
  - posture, equilibrium, muscle tone
  - memory storage of learned motor patterns
  - adjusts output of other somatic motor centers in brain and spinal cord

CRANIAL NERVES

A = Afferent fiber of nerve - Sensory (to brain)
E = Efferent fiber of nerve - Motor (from brain)

I. Olfactory Nerve
Smell

II. Optic Nerve
Vision - **A**

III. Oculomotor Nerve
Ocular movement - **E**
Pupil contraction - **E**
Muscular sensibility - **A**

IV. Trochlear Nerve
Ocular movement - **E**
Muscular sensibility - **A**

V. Trigeminal Nerve
General sensibility of the face - **A**
Muscular sensibility - **A**
Mastication - **E**

VI. Abducens Nerve
Ocular movement - **E**
Muscular sensibility - **A**

VII. Facial Nerve
Cutaneous sensibility - **A**
Facial expression - **E**
Visceral sensibility - **A**
Taste - **A**
Glandular secretion - **E**

VIII. Acoustic Nerve
Hearing - **A**
Sense of equilibrium - **A**

IX. Glossopharyngeal Nerve
Swallowing - **E**
Taste - **A**
Visceral sensibility - **A**
Glandular secretion - **E**

X. Vagus Nerve
Involuntary muscle control - **E**
Taste - **A**
Swallowing and speech - **E**
Cutaneous sensibility - **A**
Visceral sensitivity - **A**

XI. Spinal Accessory Nerve
Swalloing and speech - **E**
Movement of the head and shoulders - **E**

XII. Hypoglossal Nerve
Movement of the tongue - **E**

SYMPATHETIC AND PARASYMPATHETIC NERVOUS SYSTEMS

The ANS has two divisions: the sympathetic nervous system and the parasympathetic nervous system

- the sympathetic nervous system helps the body deal with stress ⇒ " fight-or-flight "
- the parasympathetic nervous system controls vegetative and reparative functions ⇒ " feed-or-breed "'

Sympathetic nervous system

- arises from the thoracic and lumbar region of the spinal cord
- preganglionic nerves exit the spine and end in sympathetic ganglia
- two types of sympathetic ganglia:
  - **sympathetic chain ganglia**
    - sympathetic chain ganglia are the starting point of postganglionic neurons →have several targets and effects:
      - sweat secretion
      - constriction of blood vessels in the skin
      - increase in blood flow to skeletal muscle
      - increase in heart rate and force of cardiac contraction
      - bronchodilation
      - stimulation of energy production

  - **sympathetic collateral ganglia**
    - sympathetic collateral ganglia are the starting point of postganglionic nerves that synapse at organs in the abdomen:
      - reduction of blood flow to abdominal organs
      - decreased digestive activity
      - relaxation of smooth muscle in the wall of the bladder
      - release of glucose stores from the liver
      - stimulation of the adrenal medulla → releases epinephrine and norepinephrine (as hormones traveling in the blood, not as neurotransmitters) → these hormones prolong sympathetic

effects and stimulates tissues not innervated by sympathetic nerves
    - postganglionic neurons synapse at receptors on target tissue
- **adrenergic receptor** → responsive to epinephrine and norepinephrine
    - four types of adrenergic receptor: α_1, α_2, β_1, and β_2

α_1 receptors
- peripheral vasoconstriction
- increased contractile force (⊕ inotropic)
- decreased heart rate (⊖ chronotropic)
- mild bronchoconstriction
- stimulation of metabolism

α_2 receptors
- peripheral vasoconstriction (by inhibition of norepinephrine release in the synapse)

B_1 receptors
- increased heart rate (⊕ chronotropic)
- increased contractile force (⊕ inotropic)
- increased automaticity and conduction (⊕ dromotropic

B_2 receptors
- peripheral vasodilation
- bronchodilation
- uterine relaxation
- gastrointestinal relaxation

Parasympathetic nervous system
- the parasympathetic nervous system arises from the brain stem and the sacral spine
- parasympathetic preganglionic nerves are much longer than sympathetic, and tend to terminate in ganglia close to the target tissues
- parasympathetic nerve fibers that leave the brain stem travel within four of the cranial nerves:
    - Oculomotor (III)
    - Facial (VII)
    - Glossopharyngeal (IX)
    - Vagus (X)
- stimulation of the parasympathetic nervous system results in:
    - pupillary constriction
    - digestive secretion
    - increased digestive activity
    - bronchoconstriction
    - reduction in heart rate (⊖ chronotropic)
    - reduction in cardiac contractile force (⊖ inotropic)
    - **acetylcholine** is the neurotransmitter of the parasympathetic nervous system
        - it is also the neurotransmitter for the somatic nervous system and muscle contraction

- very short-lived → within a fraction of a second after its release, it is deactivated by acetylcholinesterase

ACETYLCHOLINE

ACh is a neurotransmitter used in the ANS

- the sympathetic nervous system uses ACh in preganglionic synapses, and the parasympathetic nervous system uses it exclusively
- because of this, a parasympathetic response is often called a "cholinergic" response and parasympatholitics are labeled "anticholinergic"
- deactivated by AchE = Acetylcholinesterase

α AND β EFFECTS

Adrenergic receptors are generally divided into four types: **α_1**, **α_2**, **β_1**, and **β_2**

α_1 receptors

- peripheral vasoconstriction
- increased contractile force (⊕ inotropic)
- decreased heart rate (⊖ chronotropic)
- mild bronchoconstriction
- stimulation of metabolism

α_2 receptors

- peripheral vasoconstriction (by inhibition of norepinephrine release in the synapse)

β_1 receptors

- increased heart rate (⊕ chronotropic)
- increased contractile force (⊕ inotropic)
- increased automaticity and conduction (⊕ dromotropic)

β_2 receptors

- peripheral vasodilation
- bronchodilation
- uterine relaxation
- gastrointestinal relaxation

Types of CNS Disorders: **V I N D I C A T E**

1. **V**ascular: involving circulation problems to the brain and spinal cord

Infections of the Brain, Spinal Cord and Meninges

2. Meningitis: viral is more common, milder, can't treat. Bacterial is less common, more severe and can be treated with antibiotics
3. Encephalitis: infection of the brain tissue, usually viral
4. Brain Abscess: localized collection of pus and debris in the brain. One kind is from bacterial endocarditis - heart valve infection

Neoplastic: tumor metastasizing to the brain. Brain tumor is responsible for 1 out of 5 new-onset seizures in people over 21.

Degenerative: progressive deterioration of the CNS

5. Alzheimer's
6. Multiple Sclerosis
7. Parkinson's

Inflammatory - types of inflammation without infection

8. Rheumatoid arthritis
9. Systemic lupus erythematosus

Congenital: rupture of a congenital aneurysm is the most common cause of spontaneous intracerebral hemorrhage in a young person
Allergic and autoimmune: lupus cerebritus is an autoimmune inflammatory condition. Severe allergic reactions can cause cerebral hypoperfusion and brain damage
Trauma: head trauma can obviously cause neurological problems
Endocrine and metabolic: glandular, electrolyte, hormonal imbalances may result in neurological symptoms. Hypoglycemia and hypoxia and common and easily cared for.

Assessment:

1. General Appearance: first impression of how sick they appear
2. Level of consciousness: give them a challenging task, memorization
3. Speech: determine if there has been any recent changes
4. Skin: splotchy, bruised looking rash could be sign of meningitis
5. Posture and Gait: determine if there has been any recent changes
6. Vital signs:
7. Head and neck: Ketones on breath can smell like alcohol
8. Thorax and lungs: look for hypoventilation, CO2 retention and hypoxia
9. Cardiovascular: ECG changes can mimic AMI
10. Nervous system: look for symmetry. Marked differences in the two sides of the body are probably abnormal

Management: Ongoing assessment. ABCs. Assess blood glucose level, treat hypoglycemia. What is normal blood sugar again? 70-100? Start an IV with normal saline or LR

Seizures and Epilepsy

Seizure: sudden abnormal brain cell activity. Seizures reoccurring over a span of years is called epilepsy. 3/4ths of people with epilepsy have their first seizures before age 20. Four types of seizures:

PHASES OF A SEIZURE

- aura → hallucinations preceding a seizure
- LOC → lost consciousness
- tonic → continuous muscle contraction
- hypertonic → extreme muscular rigidity
- clonic → rhythmic muscle spasms
- post seizure → patient remains in a coma
- postictal → awake, fatigued, other neurological deficits

ABSENCE SEIZURE

Brief loss of consciousness / awareness due to seizure activity in the brain

TREATMENT FOR EXTRAPYRAMIDAL SYMPTOMS

EPS (**Extra Pyramidal Symptoms**) :

- parkinsonian-like tremors and muscle twitching, a common side effect of neuroleptics (antipsychotics) like Haldol
- treat with Benadryl

1. Generalized major motor seizures: tonic-clonic, muscles rapidly contract and relax. Also called Grand mal, last 2-5 minutes

Focal motor seizures or simple partial seizures. 1-2 minutes or may read to body and become generalized.

2. Behavioral Seizure: brief absence, could be temporal lobe epilepsy, also called complex-partial seizure, or in children called petit mal seizure
3. Status Epilepticus: series of seizures without a period of wakefulness between them.

Secondary Causes of Seizures: they are not a disease, they are a symptom.

Infection (meningitis, brain abscess, encephalitis)
Fever
Trauma
Stroke
Tumor
Failure to take anti-seizure meds
Metabolic abnormalities
Drug overdose or alcohol i.e. TCAs
Hypertensive emergency
Liver or kidney failure

Patient Assessment:

F A C T S

F- Focus, focal motor or generalized body involvement
A - Activity; what movements took place
C - Color, did they turn cyanotic T - Time, how long did it last
S - Secondary info like OPQRST for pain, get a SAMPLE history

Postictal state: decreased LOC lasting about 30 minutes. Watch for violent behavior.

Management:

1. give hi flow O2
2. Don't put anything in their mouth
3. Assist ventilation as nec.
4. Be prepared for suction
5. Do not restrain, use padding to protect them
6. Start an IV line
7. Cardiac monitor
8. Check O2 saturations

9. Transport in recovery position

Anti-seizure Drugs: diazepam (Valium), lorazepam (Ativan)

Coma and Altered LOC

Causes of coma AIEOU, TIPS

Acidosis, Alcohol Epilepsy, endocrine Infection
Overdose
Uremia
Trauma
Insulin
Psychosis
Shock, stroke

Assessment:

1. When was the patient last well? What was the onset?
2. How did the symptoms progress? Pinpoint when things started to change.
3. What symptoms preceded the onset of coma?
4. Clues to drug use
5. Abnormal breathing
6. Evidence of trauma
7. Abnormal pupil response
8. Always check blood sugar

Management:

Establish and maintain the airway
Hi-flow O2
If spinal injury is likely, then immobilize
Monitor vital signs
Transport supine or in coma position
Prepare for vomiting
Start IV line for normal saline or LR
Monitor cardiac rhythm
Reassure the patient, even the unresponsive ones

SYNCOPE

Sudden, temporary loss of consciousness due to insufficient blood supply to the brain

- return to consciousness occurs soon after hitting the ground

!!! If a patient doesn't regain consciousness within a few minutes ⇒ it's not a syncope ***!!!***

- there are three general causal categories of syncope:
  - cardiovascular
    - any dysrhythmia or other cardiac condition that causes sufficient anoxia in the brain
  - non-cardiovascular

- metabolic conditions
- neurological conditions
- psychiatric conditions (hypoglycemia, anxiety attacks…)

- idiopathic
  - any unknown cause

Headache: serious causes are tumors, bleeding, hypertension, meningitis, poisoning.
Brain tissue has no nerves to feel pain, so all pain is from stretching or irritation of nearby structures:

Vascular: involves cerebrovascular circulation, constriction or dilation of cerebral vessels. Rapid onset of severe headache could be intracranial bleeding
Non vascular: infection, tumor, muscle spasm

Assessment: In addition to pain, there may be blurred vision, nausea and vomiting, vertigo, stiff neck. Bradycardia, hemiplegia, hypertension, unequal or pinpoint pupils, photophobia.

Management:

1. Monitor ABCs
2. Prepare for vomiting
3. Reduce bright lights
4. Ice pack on painful area
5. O2 10-15L via NRB

DIFFERENCE BETWEEN A CVA AND A TIA

- CVA → injury, hemorrhage / ischemia to brain tissue due to hypoxia
- TIA → symptoms of cerebral ischemia that resolve within 24 hours

Stroke (CVA) results from interruption of circulation to the brain causing ischemia and damage to brain tissue. Neurological symptoms persist longer than 24 hours. Recovery takes place in weeks to months. Two types:
Occlusive: 3 out of 4 strokes, caused by blockage in a blood vessel
Hemorrhagic: caused by bleeding in the brain. Symptom abrupt and severe

Clot Busters: Occlusive strokes only! Must be within 3 hours. Most wake up in the A.M when it is too late.
Ischemic penumbra: area of tissue potentially viable surrounding the infarct zone.
Cocaine is becoming the most common cause of stroke in young people

Assessment (Stroke): Most common finding is paralysis. Usually hemiplegia, damage on one side of brain affects opposite side of the body. Most have elevated BP. Also seizures, dizziness, loss of consciousness, stiff neck, headache, altered LOC, airway problems, hypoventilation, cardiac dysrhythmias. My favorite: vomiting. Pupillary abnormalities.

Cincinnati Prehospital Stroke Scale:

1. Facial Droop: show teeth or smile
2. Arm Drift: close eyes and hold arms out
3. Speech: you can't teach an old dog new tricks

Assessment:

1. When was the patient last well? What was the onset?
2. How did the symptoms progress? Pinpoint when things started to change.
3. What symptoms preceded the onset of coma?
4. Clues to drug use
5. Abnormal breathing
6. Evidence of trauma
7. Abnormal pupil response
8. Always check blood sugar

Management:

Establish and maintain the airway Hi-flow O2
If spinal injury is likely, then immobilize Monitor vital signs
Transport supine or in coma position Prepare for vomit
Start IV line for normal saline or LR Monitor cardiac rhythm
Reassure the patient, even the unresponsive ones.

Management:

Establish and maintain the airway, provide hi-flow O2 by mask. Consider intubation if necessary
Nothing by mouth, prepare for vomit Reassure patients
Start an IV Cardiac monitor
Measure blood glucose

TIAs: mini-strokes: stroke-like neurological deficits that resolve within minutes to hours. They still should be evaluated at the hospital, because they are at risk for stroke.

WINDOW FOR TPA ADMINISTRATION

Three hours

CUSHIN'G REFLEX

Associated with increased intracranial pressure

- hypertension
- elevated temperature
- decreased pulse
- decreased respirations with irregular respiratory pattern

ENDOCRINOLOGY

ENDOCRINE GLANDS AND TISSUES

1) hypothalamus
2) pituitary gland
    a) posterior pituitary gland
    b) anterior pituitary gland
3) thyroid gland
4) parathyroid gland
5) thymus
6) pancreas
    a) α cells
    b) β cells
    c) δ cells
7) adrenal glands
    a) adrenal medulla
    b) adrenal cortex
8) gonads
    a) ovaries
    b) testes
9) pineal gland
10) tissues with endocrine functions
    a) placenta
    b) parts of the digestive tract
    c) heart
    d) kidneys

SIGNS AND SYMPTOMS OF HYPO- AND HYPERTHYROIDISM

Hyperthyroidism

An excess of thyroid hormones in the blood

- thyrotoxicosis is prolonged organ overexposure to thyroid hormones
- **Thyrotoxic Crisis (Thyroid Storm)**
    - usually associated with severe physiologic stress (trauma or infection)
    - can be fatal within 48 hours
    - signs & symptoms
        - high fever (106 or higher)
        - irritability
        - tachycardia
        - HTN
        - vomiting
        - diarrhea
        - delirium or coma
- **Grave's Disease**
    - represents 95 % of cases of thyrotoxicosis

- strongly hereditary disorder
- six times more common in women than men
- onset usually in the 20s and 30s
- it is stimulated by autoantibodies that stimulate an excess production of thyroid hormone
- signs & symptoms:
    - agitation, emotional changeability
    - insomnia
    - poor heat tolerance
    - weight loss with increased appetite
    - weakness
    - dyspnea
    - tachycardia
    - A-fib with no cardiac Hx
    - exophthalmos [bulging eyeballs]
    - goiter

Hypothyroidism

Inadequate thyroid hormones in the blood

- hypothyroidism and Myxedema can be congenital or acquired
- low levels of thyroid hormones create a low metabolic state
- signs & symptoms:
    - fatigue
    - slowed mental function
    - lethargy
    - cold intolerance
    - constipation
    - decreased mental function
    - decreased appetite / increased weight
    - unemotional
    - puffy face
    - thinned hair
    - enlarged tongue
    - pale & cool skin that feels like dough
    - **Myxedema Coma**

      A hypothermic, stuporous state in which respiratory depression may occur
        - triggers include infection, trauma, cold, or CNS depressants
    - hypothermia
    - low amplitude bradycardia
    - CO_2 retention
- **Myxedema**

  Long-term underexposure to thyroid hormones
    - causes a thickening of connective tissue in the skin and other tissues, including the heart

ANATOMY OF THE PANCREAS

- the majority of the pancreas is exocrine, and produces digestive enzymes and buffers
- the endocrine pancreas produces somatostatin, glucagon and insulin
- lies between the stomach and duodenum
- connected to the duodenum via the main pancreatic duct (**duct of Wirsung**) and the smaller accessory duct (**duct of Santorini**)
- the endocrine cells of the pancreas form only 1% of its total mass, and they are clustered in groups known as **Islets of Langerhans**
- **α cells** produce **glucagon**
  β cells produce **insulin**
  δ cells produce **somatostatin** (**GHIH** - growth hormone inhibiting hormone)

GLYCOGEN

- Glycogen is a starch, a long chain of glucose molecules, and is a form the body stores energy in
- Glycogen is stored in the liver

INSULIN

Produced by the β cells of the pancreas

- insulin is released in response to high levels of blood glucose
- it stimulates the absorption of glucose into target cells, fat and glycogen production for energy storage
- insulin release is inhibited by lowered levels of blood glucose

GLUCAGON

Glucagon is released from the pancreas in response to lower levels of blood glucose

- it stimulates the breakdown of glycogen, fatty acids, and proteins to form glucose
- its release is inhibited by elevated levels of blood glucose

KETONES

Byproduct of lipid and protein catabolism, which are both increased in diabetics who are unable to process glucose

EFFECTS OF EXTREMILY LOW INSULIN LEVELS

The body is unable to process an adequate amount of glucose and instead relies more heavily on lipid and protein catabolism, which produces ketone bodies, causing ketoacidosis

HYPERGLYCEMIC PATIENT'S BREATH

It may have a sweet & fruity smell due to ketoacidosis

DIFFERENCE BETWEEN HYPOGLYCEMIA, DKA AND HHNK

Hypoglycemia

Low blood glucose and high insulin

- may be caused by:
  - taking too much insulin
  - improper usage of prescribed diabetic meds

    - poor intake
    - overexertion
- signs & symptoms:
    - AMS
    - weak, rapid pulse
    - headache
    - cold & clammy skin
    - drooling
    - tremors

Diabetic Keto-Acidosis (DKA)

A complication of Type I DM

- profound insulin deficiency and increased glucagon activity raises level of blood glucose
- the body switches to fat catabolism because it's unable to use the available glucose (no insulin)
- this produces ketoacidosis, and the high levels of glucose diurese the patient into dehydration
- signs & symptoms
    - **polyuria [** excessive urination **]**
    - **polydipsia [** excessive thirst **]**
    - **polyphagia [** excessive hunger **]**
    - dry mucous membranes
    - Kussmaul's respirations
    - tachycardia
    - sweet & fruity breath
    - restlessness
    - unconsciousness
    - abdominal Pain
    - dimmed vision
    - NO headache, NO tremors

Hyperglycemic Hyperosmolar Nonketotic Acidosis (HHNK)

Osmotic diuresis and associated dehydration caused by sustained hyperglycemia

- insulin activity is not high enough to combat hyperglycemia, but is high enough to prevent ketosis
- usually seen in Type II DM
- signs & symptoms:
    - polyuria
    - polydipsia
    - polyphagia
    - dry mucous membranes
    - tachycardia
    - lethargy / unconsciousness
    - NO breath odor, NO headache, NO tremors

CUSHING'S SYNDROME

Hyperadrenalism

- signs & symptoms
    - changed body habitus
    - hypertension
    - vulnerability to infections

ADDISON'S DISEASES

Adrenal insufficiency

- signs & symptoms
    - weakness
    - fatigue
    - weight loss
    - hyperpigmentation of the skin and mucous membranes

Addisonian Crisis

Form of shock associated with adrenocortical insufficiency and characterized by profound hypotension and electrolyte imbalances

ALLERGIES / ANAPHYLAXIS

Allergic Reaction: result from exposure to any substance to which an individual is sensitive

Anaphylaxis: Specific type of allergic reaction caused by the interaction of an allergen (called an antigen) and one antibody (IgE)

Allergen: Generic term for any substance to which a person is sensitive
Antigen: an Allergen

Antibody: Antibodies respond to antigens. There are five types of antibodies, part of the immune system that recognizes antigens and stimulates an immune system response

Diphenhydramine: Benedryl. An antihistamine that blocks the effects of histamine
Epinephrine: Adrenaline. Stimulates alpha and beta blockers
Histamine: Cellular substance released into the body during anaphylactic shock, causes bronchospasm, vasodilation and leakage of fluid from vessels

IgE: Ig=immunoglobins. IgE is the only antibody involved in anaphylaxis

Pathology of Anaphylaxis:

Antibodies attack antigens. The severity of the symptoms range from progressive hives to cardiac arrest. Histamine release occurs first

- Bronchospasm
- Vasodilation
- Leaking of fluid

Histamine stimulates the release of other mediators

- Unpredictable spiral of events

Biphasic (early and late) anaphylactic response is 1 out of 5 people

- Reoccurrence 4-5 hours later > may lead to shock

Presentation, Signs and Symptoms

Upper Airway: hoarse, stridor, edema, runny nose
Lower Airway: bronchospasm, mucus, wheezing, decreased breath sounds
Cardiovascular system: tachycardia, hypotension, dysrythmia, chest tightness
GI: nausea, vomiting, cramps, diarrhea
Neurological system: anxiety, dizziness, syncope, weakness, headache, seizure, coma
Cutaneous: angioedema, uticaria, pruritus, erythema, edema, tearing of the eyes

MOST COMMON: hives, wheezing, abdominal pain

Methods of Entry into the Body:

Inhalation
Absorption
Injection
Ingestion

Assessment:

Get a good history ask about recent changes in foods, drugs, detergents, cosmetics etc.

Signs and Symptoms of Anaphylactic Shock

Sense of agitation, confusion, decreased LOC
Swelling of soft tissues like hands tongue and pharynx
Wheezing, rales, rhonchi
Tingling, burning, itching skin
Abdominal pain
Tachycardia
Weak, thready pulse
Profound hypotension (late sign)
Weakness
Diaphoresis
Cyanosis
Peripheral edema

Mild Reactions:

Treatment: Benadryl 10-50 mg slow IV push or IM if vital signs are normal, no respiratory symptoms, itching rash/swelling on outside of body.

Moderate and Severe Reactions:

Aggressive airway management
Ventilatory support
Oxygen therapy
Circulatory support
Epinephrine .3-.5 mL subcutaneous if:

- Wheezing or stridor
- Edema of the pharynx, tongue or soft palate
- Vascular compromise (hypotension, weak thready pulse, confusion, tachycardia)

Anaphylactic shock:

Provide reassurance, keep them calm
Ensure an adequate airway
Intubate if the patient can't maintain an airway
Apply EKG pads to monitor
High flow O2 by non-rebreather
Start an IV, large bore cannula, normal saline or lactated Ringers, macro drip, BP <90? run it wide open
Administer epinephrine .3-.5 mg SQ, or IM with an Epi-Pen
Bronchodilators may be used for stridor or wheezing
Transport priority patients

GASTROENTEROLOGY

Solid	**RUQ**	**LUQ**	**Hollow**
Liver	Liver	Stomach	Stomach
Spleen	Gall Bladder	Spleen	Intestines
Pancreas	Kidney	Pancreas	Gall Bladder
Kidneys	Large Intestine	Kidney	Urinary Bladder
Ovaries	Small Intestine	Large Intestine	Uterus
		Small Intestine	Ureter
Main problem	**RLQ**	**LLQ**	**Main Problem**
Injury =Bleeding	Colon	Large Intestine	Injury=Peritonitis
	Appendix	Small Intestine	
	Large Intestine	Ovary	
	Small Intestine	Ureter	
	Ureter	Urinary Bladder	
	Urinary Bladder	Uterus	
	Uterus		

INFLAMMATION AT THE JUNCTION OF THE LARGE AND SMALL INTESTINE

This junction is called the appendix ⇒ **appendicitis**

PERITONITIS

Inflammation of the **peritoneum** **[** lining of the abdominal cavity **]**

VISCERAL PAIN

Dull, poorly localized pain that originates in the walls of hollow organs

SOMATIC PAIN

Sharp, localized pain that originates in walls of the body, such as skeletal muscles

CULLEN'S SIGN

Ecchymosis in the periumbilical area

GREY-TURNER'S SIGN

Ecchymosis in the flank

ZOLLINGER-ELLISON SYNDROME

Condition that causes the stomach to secrete excessive amounts of hydrochloric acid and pepsin

BRIGHT RED BLOODY STOOL

Bright red bloody stool is called **hematochezia**

- it is most likely caused by a bleed near the end of the colon → often rectal or hemorrhoidal
- treatment should include:
    - BLS
    - resuscitation as necessary
    - EKG monitoring (precaution in case of electrolyte imbalance from longer term bleed or other causes of dysrhythmia)
    - IV fluids

CAUSES OF GASTROINTESTINAL BLEEDING

Upper GI Bleed

- Esophageal Varices
  Swollen veins of the esophagus
- Acute Gastroenteritis
  Acute inflammation of the stomach and intestines
- Chronic Gastroenteritis
  Chronic inflammation of the stomach and intestines
- Peptic Ulcer
  Erosion caused by gastric acid

Lower GI Bleed

- Ulcerative Colitis
    - Pancolitis
      Ulcerative colitis spread throughout the entire colon
    - Proctitis
      Ulcerative colitis limited to the rectum
- Chron's disease
  Idiopathic inflammatory bowel disorder associated with the small intestine
- Diverticulitis
  Inflammation of the diverticula
- Hemorrhoids
  Small mass of swollen veins in the anus or rectum
- Bowel obstruction

TREATMENT FOR A GI BLEED

Mainly supportive

- stabilize ABCs
- provide O_2
- keep patient warm
- position for shock
- fluid replacement via large bore IVs

UROLOGY/ NEPHROLOGY

TYPES OF DIURETICS

- diuretics increase urine output
- all diuretics affect the reabsorption of sodium and chloride and produce an osmotic gradient decreasing the reabsorption of water
- in general, the earlier in the nephron the diuretic works, the more sodium and water will be excreted in the urine
- there are four types of diuretics, which differ in the area of the nephron they affect:
    - **Loop diuretics** (high ceiling diuretics)
        - profoundly affect circulating blood volume
        - blocks sodium reabsorption in the ascending loop of henle, thus decreasing fluid volume by decreasing fluid pull from the tubule ⇒
        - it decreases preload at the heart, lowering blood pressure
            - Furosemide (Lasix)
    - **Thiazides**
        - affect the early portion of the distal convoluted tubule and thus cannot block as much sodium from reabsorption as loop diuretics
            - Hydrochlorothiazide (HydroDiuril)
    - **Potassium sparing diuretics**
        - inhibit the effects of aldosterone on the distal tubules or the specific sodium-potassium exchange mechanism
        - they are not very potent because they act late in the nephron, but they are used because they increase potassium reabsorption
    - **Osmotic diuretics**
        - alter the reabsorption of water in the proximal convoluted tubule by using a large sugar molecule that is filtered through the glomerulus and pulls water with it

ANURIA AND OLIGURIA

Oliguria → low urine production
Anuria → lack of urine production

SIGNS AND SYMPTOMS OF CHRONIC RENAL FAILURE

- edema
- acidosis
- ascites
- pulmonary edema
- CHF
- headache
- muscle twitching
- anorexia
- nausea
- vomiting

- GI bleed
- pale
- uremic frost
- ecchymosis
- sepsis

TOXICOLOGY/POISONING

Poisoning: exposure to substance that is generally harmful, with no beneficial effects Overdose: excessive exposure to a substance that has normal treatment uses. Nearly ½ involve prescription drugs.

Types of toxicological emergencies:
- Unintentional Poisonings
  - Dosage Errors: accidental by nurses, Drs, family members or self
  - Idiosyncratic reactions: unpredictable side effects
- Childhood poisoning: inattentive care/childhood curiosity. These are the most frequent calls to the poison control centers
- Environmental exposures
- Occupational exposures
- Neglect and abuse: fine line between

Drug and Alcohol Abuse/Substance Abuse: millions of $$ of injuries and illness each year
- Intentional Poisonings or Overdose
- Chemical warfare: terrorism, war, WMD
  - Assault or homicide: using poison to commit murder
  - Suicide attempts: deliberate exposure to a known poison or overdose of a therapeutic drug

Scene size-up comes first.
Assure your safety and that of your team first.

Routes of absorption:
- Ingestion: poison enters the body through the mouth and absorbed by the digestive tract. Mushrooms, sleeping pills. Preferred method of care is activated charcoal and/or gastric lavage
- Inhalation: toxic fumes or gas inhaled into the lungs. Carbon Monoxide. Move patient to fresh air, provide hi-flow O_2
- Absorption: substances may pass through the skin to the blood stream. Pesticides, ag chemicals. Brush off, flush with H2O, Remove clothing, Protect yourself Injection: toxic material injected by needles or stingers, deal with the symptoms.

Epi for bee/wasp as necessary, some snakebites have antivenom, Narcan for opiates.

Geographically Specific Types:

- Venomous Snakes: coral snakes in FL
- Spiders
- Marine animals: jelly fish, lion fish

Manufacturing industries: chemical plants, oil refineries Transportation industries: railroad routes, interstate highways

Toxidromes: groups of drugs that present with the same patterns of toxicity

Management: protect and maintain ABCs. Antidotes may be available, but attention to the basics is most important.

Assessment: Ask:
What was taken?
How much was ingested?
When the poisoning occurred?
What has been done for the patient so far?

Signs and Symptoms vary:
Burning, tearing of eyes Respiratory distress Cyanosis
Nausea, vomiting, diarrhea Diaphoresis, salivation
Weakness, dizziness, headache, seizure Altered level of consciousness

Physical Findings:
Pulse: tachycardia - stimulants, bradycardia - heart meds, pesticides
Respiratory Rate: increased in children may mean aspirin, depressed resps from narcotics, sedatives and CO poisoning
Temperature: elevated = aspirin and stimulants, lowered = alcohol, sedatives, narcotics, pesticides
Blood Pressure: decreased by depressants or narcotics, elevated by cocaine, stimulants

Focused Physical Exam
Respiratory System: can cause resp depression, airway obstruction, distress and wheezing
Cardiovascular System: irregular heart rhythms, chest pain, shock and cardiac arrest
Neurological System: pupil size, narcotics constrict (myosis), stimulants dilate

Care of the Poisoned Patient:
Airway, breathing, circulation
Follow vital signs, pulse Ox
Put on cardiac monitor
Position patient to prevent aspiration
High flow O2 by mask, cannula or consider intubation
Restrain violent/suicidal patient as per local protocols
Notify receiving hospital: bring pills, bottles, containers, samples, snakes (dead), spiders (dead)

Activated Charcoal: 1 gram per kg. 30-100g for an adult, 15-30g for a child up to 12

Cholinergics: stimulate the parasympathetic nervous system, block the breakdown of acetylcholine. Pesticides like organophosphates and nerve gas agents like sarin, or soman.

Severe symptoms are called:

SLUDGEM - salivation, lacrimation, urination, defecation, GI cramping, emesis, miosis

Bradycardia
Wheezing
Myosis
Coma
Convulsions

Management: Own safety! HazMat only. Atropine, Pralidoxime (2-pam chloride), Diazepam, Activated Charcoal if oral ingestion

Anticholinergics: block the parasympathetic nervous system, also called vagolytic agents. Atropine, ipratropium, antihistamines, antispasmodics, tricyclic antidepressants

Severe symptoms will be hot, red, dry and mad Tachycardia, tachypnea

Temporary psychosis

Management: Maintain ABCs. Counter-drugs are rarely given, they are more dangerous than the anticholenergics themselves. Treat the symptoms. Activated charcoal may help.

Narcotics/Opiates: CNS and respiratory depressants. Heroin, morphine, codeine, meperidine, propoxyphene, fentanyl, hydrocodone.

Euphoria Hypotension
Respiratory depression/arrest Nausea
Pinpoint pupils Seizures Coma

Management: Maintain ABCs. Naloxone (Narcan) antagonizes narcotics (and the users). IV administration may wear off too fast, and wake them up too much. IM dose lasts longer and they awake more slowly.

Toxic Gas inhalation:

Inert gases: displaces O2 and injury/death is due to asphyxiation. CO2, methane, exane, propane acetylene. Mental, seizures, cardiac dysrhythmias

Irritant gases: irritate tissues. Highly water soluble irritate upper airways. Less water soluble pass through to the lungs and cause sever tissue damage

1. Immediate reactions: 1-2 hours, red mucous membranes, eye andnasal irritation, cough, sore throat, bronchospastic
2. Delayed: 6-24, laryngeal edema, hoarseness, stridor, non-cardio PE
3. Chronic: recurrent pneumonia and lung disease

Systemic Toxins: gases that poison the cells. CO, cyanide, hydrogen interfere with O2 transport and delivery. Other agents can damage the liver and kidneys

Sources of Toxic Gases: accidents and fires are the most common. Leaking tanks, truck rollovers, by-products from fires, chemical reactions

Pathophysiology: determines the effects of gas inhalation:

Water solubility
Depth and rate of breathing
Smell: if it smells, we can detect and avoid it Concentration of gas
Length of exposure

Differences in host: some people are more sensitive Smokers:

lower resistance to toxic gas
COPDer will have a worse time as well

Management: Protect yourself. Treat the symptoms. Protect ABCs. Hi-flow O_2, intubate if necessary, IV, nebulized bronchodilators may help, prompt transport

Carbon Monoxide Poisoning: colorless, flavorless, odorless, non-irritating gas. Gas heaters are among the most common sources of domestic CO exposure. CO binds with hemoglobin 250x more readily and so O_2 can't, suffocating the patient on a cellular level. Assessment: suspect CO in any fire, smoke or closed space. Pulse ox won't detect.

Signs and symptoms:

Malaise, weakness, headache
Confusion, dizziness Nausea,
shortness of breath
Drowsiness Unconsciousness
Chest pain, may develop AMI or PE
Cherry red skin - late sign
Rales, rhonchi
Seizures,
blisters

Management: Protect yourself. Fresh air, Protect ABCs. Hi-flow O2, ventilate/intubate if necessary, IV, prompt transport

Tricyclic Antidepressants: common are amitriptyline (Elavil), amoxapine (Asendin), clomapramin (Anafranil), doxepin (Sinequan, Adepin), imipramine (Tofranil) and nortriptyline (Aventyl, Pamelor).

Block the reuptake of norepinephrine and seratonin in the brain. Some have anticholinergic and cardiac membrane actions.

Heat exhaustion and heat stroke. V-Tac dysrythmias. Very dangerous in an overdose because it only takes a few pills. A typical one-month prescription is more than enough to be fatal.

Signs and symptoms vary on the drug, dose and time since ingestion:

Dry mouth
Confusion
Hallucinations
Delirium

TOLERANCE, HABITUATION AND ADDICTION

Tolerance

The need to progressively increase the dose of the drug to produce the effect achieved by smaller doses

Habituation

The act of becoming accustomed to anything from frequent use or exposure

Addiction

Compulsive and overwhelming dependence on a drug (may be physical or psychological)

TOXIN ANTIDOTES

- Opiates → Naloxone
- Cocaine → benzodiazepines (for seizures)
- Amphetamines → Benzodiazepines (for seizures)
- Hallucinogens → Benzodiazepines (for seizures)
- MAOI's → Benzodiazepines (for seizures)
- Benzodiazepine's → Flumazenil (Romazicon)
- Barbiturates → Sodium Bicarbonate
- TCA's → Sodium Bicarbonate
- Lithium → Sodium Bicarbonate
- Organophosphates → Atropine
- Theophylline → Activated charcoal
- Salicylates → Activated charcoal / Sodium Bicarbonate
- Acetaminophen → N-acetylcysteine
- NSAIDS → Support ABCs
- Beta blockers → Glucagon / TCP
- Digoxin → Digibind
- Ca channel blockers → Calcium chloride / Calcium Gluconate
- Iron → Deferoxamine
- Lead and Mercury → Chelating agents

RELATIONSHIP BETWEEN ALCOHOLISM AND ESOPHAGEAL VARICES

Alcoholism leads to a cirrhotic liver → obstructing blood flow and contributing to portal HTN

- normally, as blood flows through the liver it encounters almost no resistance
- but cirrhotic liver damage obstructs blood-flow, causing blood to back up under increased pressure to the esophageal veins
- these veins are not strong enough to handle the increased pressure, and they balloon out, weakening and becoming susceptible to rupture
- over time with constant portal HTN the esophageal varices will rupture

HEMATOLOGY

CELLS THAT PRODUCE ANTIBODIES

B Lymphocytes → they release antibodies after they differentiate into plasma cells

DISEASES OF THE BLOOD

Diseases of the Red Blood Cells

Anemia

An inadequate number of red blood cells or inadequate hemoglobin within the red blood cells

Sickle Cell Disease

An inherited disorder of red blood cell production;
the red blood cells become sickle-shaped when oxygen levels are low

Polycythemia

An excess of red blood cells;
an abnormally high hematocrit

Diseases of the White Blood Cells

Leukopenia / Neutropenia

Too few white blood cells

Leukocytosis

Too many white blood cells

Leukemias

A cancer of the hematopoietic cells

- **A**cute **L**ymphocytic **L**eukemia
- **C**hronic **L**ymphocytic **L**eukemia
- **A**cute **M**yelogenous **L**eukemia
- **C**hronic **M**yelgenous **L**eukemia

Lymphomas

A cancer of the lymphatic system

Platelet Diseases

Thrombocytosis

An abnormal increase in the number of platelets

Thrombocytopenia

An abnormal decrease in the number of platelets

Hempophylia

A blood disorder in which one of the proteins necessary for blood clotting is missing or defective

VonWillebrand's Disease

Condition in which the vWF component of factor VIII is deficient

Disseminated Intravascular Coagulation (DIC)

A disorder of coagulation caused by systemic activation of the coagulation cascade

Multiple Myeloma

A cancerous disorder of plasma cells

HEMOPHILIA

Hemophilia is a blood disorder in which one or more of the proteins responsible for clotting is missing ⇒ bleeding is more likely to start and harder to stop in hemophiliac patients

- males are much more likely to be hemophiliacs ⇐ the missing clotting factor is due to a faulty X chromosome → men only have one X chromosome, so if it's faulty, they will have hemophilia
- but if a female has the faulty X and any other (non-faulty) X ⇒
  the non faulty X is dominant and suppresses the faulty X ⇒ she won't be a hemophiliac

ENVIRONMENTAL

Medical condition caused or exacerbated by weather, terrain, atmospheric pressure or other local factors. Risk factors that make it more likely:
Old or young age
General health
Fatigue
Existing medical conditions (diabetes etc.)
Medications
Systemic: hypothermia, heat exhaustion and heat stroke
Localized: frostbite, sunburn

FORMS OF HEAT DISSIPATION

- **conduction**
  Direct contact of the body's surface with another
- **convection**
  Heat loss via air currents passing over the body
- **radiation**
  Transfer of energy through space or matter
  - you will lose 60% of your body heat this way if not dressed properly (same principle as a radiator)
- **evaporation**
  Change of liquid to vapor
  Sweating and evaporation of fluids from the lungs are the main route of evaporative heat loss
- **respiration**
  Combines mechanisms of convection, radiation, and evaporation
  (this accounts for a large proportion of the body's heat loss)

HEAT EXHAUSTION / HEAT STROKE / HEAT CRAMPS

- **heat cramps**
  Muscle cramps caused by overexertion and dehydration
  - signs & symptoms:
    - cramps
    - weakness
    - faint feeling
    - warm, moist skin
    - stable $^{V}/_{S}$

  Care: move to cool, sips of cools water, IV of normal saline, 15L/min O2, transport

- **heat exhaustion**
  Mild heat illness due to excessive heat exposure and dehydration
  - signs & symptoms:
    - elevated temp (100ºF or more)
    - cool, clammy skin

- heavy perspiration
- headache
- anxiety
- paresthesia
- impaired judgment
- psychosis

Care: move to cool, sips of cools water, IV of normal saline, 15L/min O2, monitor ECG, transport

- **heat stroke**

Most serious true environmental emergency that occurs when the body's hypothalamic temperature regulation is lost → this can cause massive cell death

- signs & symptoms:
  - high core temp → temperature of at least 105ºF
  - sweating stops
  - hot skin that is dry or drying
  - deep respirations that becomes shallow, rapid at first but may later slow
  - hypotension
  - confusion, disorientation or unconsciousness
  - seizure

Care: immediate cooling: ice packs at neck, armpits, wrists, groin. Immersion, fanning, IV of normal saline or LR, 15L/min O2, monitor ECG, transport

DROWNING IN COLD VS. WARM WATER

Cold water drowning is better

- Cold water greatly slows the metabolic rate, decreasing the demand for O_2, allowing tissue to survive for great periods of time

Near Drowning: drowning is death by asphyxiation during an immersion episode, so near drowning is when the process is interrupted and reversed. Drugs and alcohol are involved in 35-75% of drownings. Lakes, ponds and backyard pools. Males 5-8x more likely, also older, younger and African American are higher risks.
Assessment:

Signs and symptoms:
Progressive dyspnea Wheezing
Tachycardia Cyanosis Chest pain
Mental confusion
Coma, resp. or cardiac arrest Treatment:
Mouth to mouth can begin in the water

Stabilize neck if nec. ECG monitoring
IV of normal saline or LR at TKO

Three types of drowning:
- Dry drowning: 10-20% laryngeal spasm cuts off the air
- Wet drowning: 80-90% fluid fills the lungs
- Secondary drowning: reoccurrence of fluid in lungs (PE or Asp. Pneu) after successful recovery, few minutes up to four days.

Seawater causes an influx of hypotonic serum. Blood can't exchange O_2 and CO_2 Freshwater causes a washout of surfactant and lung loses elasticity.

FEVER

Above 37°C (98.6°F)

HYPOTHERMIA

Below 35°C (95°F)

Cold Disorders:
- Mild: CBT > 32.2 C or 90 F
- Severe: CBT < 32.2 C or 90 F
- Compensated: presence of signs and symptoms but with normal CBT Hypothermia victims stop shivering at 90 degrees

Three primary causes:

Cold water immersion - principle cause of death in boating accidents. Any water less than 98.6. Acute onset, without rescue, chances are low

Cold weather exposure - close 2nd in occurrence, over minutes to hours Urban hypothermia - debilitated, aged, intoxicated, or all three at once, lack proper thermoregulation, also babies.
Chronic onset = hours to days

Signs and Symptoms:
- Diminished coordination and psychomotor function
- Altered mentation
- Cardiac irritability - A-FIB most common, brady down. V-Fib more common in rewarming
- They're not dead until they're warm and dea

Treatment:
- Remove from cold
- Dry off and provide barriers/blankets, insulate
- Handle gently, check pulse for 30-45 seconds, begin chest compressions/ ventilation/AED as necessary. Cold hearts are resistant to shock (under 86)
- Hi-flow O_2, can be warm, moist
- Warm fluids if conscious
- IV of warm LR
- Dress and care for frostbite
- NEVER allow to refreeze

Hot packs over carotids, head, lateral thorax and groin
Warm the core first, not extremities - there could be cold acidotic blood and waste in the extremities that will rush in "after drop phenomenon"

FROST BITE

Environmentally induced freezing of body tissues causing destruction of cells

TRENCH FOOT (IMMERSION FOOT)

A painful foot disorder resembling frostbite and resulting from exposure to cold and wet, which can eventually result in tissue sloughing or gangrene

Treatment: rule out other significant injuries, raise core body temp before extremities, transport asap, protect the site and handle gently, do not break blisters, no smoking, no rubbing. Do not allow to refreeze.

Diving Accidents:
Pressure increases about 1 pound per square inch (PSI) with each 2 feet in depth. Divers must take pressurized air in scuba gear so the lungs will not collapse

Air Embolism: Divers must exhale on the way up or the volume of gas "trapped" in the lungs will expand. Also it is easier to hold your breath underwater, because the O2 is under pressure and more gets to the cells. But never hold your breath under water, or upon ascent, the drop in pressure ceases to feed the tissues at the same rate and you could black out.

Signs and Symptoms: frothy pink sputum, shortness of breath, vertigo, seizures.

Treatment: High-flow O2, watch for tension pneumothorax, Trendelenburg, left side lateral trap air in heart. Recompression in hyperbaric chamber

Nitrogen Narcosis: apathetic, slightly euphoric state

BAROTRAUMA

Injuries caused by changes in pressure;
occurs from increasing pressure during a diving descent (" **the Squeeze** ")

DECOMPRESSION ILLNESS

Decompression Sickness: the "bends". Nitrogen dissolves into the tissues under high pressure and is released into the bloodstream in the form of bubbles upon a too-rapid ascent. Most cases due to repetitive diving (more than 1 in a 12-hour period).

Signs and Symptoms: blotchy red rash, pain in joints, dizziness, paralysis, shortness of breath.

Treatment: High-flow O2, IV normal saline TKO, Trendelenburg, left side lateral trap air in heart. Recompression in hyperbaric chamber

Squeeze Symptoms: severe pain in the ears, sinuses, lungs, airways, teeth, other air spaces, gut, Gradual ascent watch the eardrums.

Assessment for all diving emergencies:

Did you breathe compressed air underwater? Number of dives, bottom time
Type of equipment Diver's activities
Type of water, environmental factors, water entry Companion Gas mix

INFECTIOUS DISEASES

TYPES OF HEPATITIS

Hepatitis means inflammation of the liver, which can happen in many ways
The most prevalent and contagious types are viral: A, B, C, D & E

- **Hepatitis-A** → fecal / oral
  - mild and rarely serious
  - resolves by itself in 2-3 weeks
- **Hepatitis-B** → body fluids
  - more contagious than HIV
  - most patients are asymptomatic
- **Hepatitis-C** → body fluids
  - chronic
  - causes cirrhosis
- **Hepatitis-D** → occurs only in conjunction with Hepatitis-B
- **Hepatitis-E** → fecal / oral
  - not common in the U.S.

PROPER CONTAC PRECAUTIONS FOR HEPATITIS

The various types of hepatitis are spread via fecal-oral and bloodborne routes

- gloves
- hand washing
- full protection (eye shields, gowns …) if blood or feces might splatter or be flung

Disease	***Mode of Transmission***	***Incubation Period***
AIDS	AIDS or HIV infected blood via IV drug use; semen and vaginal fluid; blood transfusion; needle sticks (rarely); mother to fetus	Several months or years
Hepatitis B, C	blood, stool, other body fluids; contaminated objects	Weeks or months
Tuberculosis	respiratory secretions – airborne or on contaminated objects	2 – 6 weeks
Meningitis (bacterial)	oral and nasal secretions	2 – 10 weeks
Pneumonia (bacterial, viral)	oral and nasal droplets and secretions	Several days
Influenza	airborne droplets; direct contact with body fluids	1 – 3 days
Staphylococcal Skin Infections	contact with open wounds, sores, contaminated objects	Several days
Chicken Pox (Varicella)	airborne droplets; contact with open sores	11 -21 days

German Measles (Rubella)	airborne droplets; mother to fetus	10 – 12 days
Whooping Cough (Pertussis)	respiratory secretions; airborne droplets	6 – 10 days

PSYCHIATRIC / BEHAVIORAL

Behavior = how a person acts
Abnormal behavior = deviates from society's norms and expectations
Maladaptive behavior = unable to properly adapt to challenging circumstances
Behavioral Emergency = disorders characterized by abnormal and maladaptive behavior that family/social group can't tolerate

Causes grouped in three categories:
Biological/Organic: diseases, drugs, toxins, biochemical psychiatric disorders
Psychosocial: childhood trauma, bad parents, dysfunctional family
Sociocultural: life events war, death of loved one, economic problems

Management: first and foremost scene and personal safety

10 Useful Interview Skills for Behavioral Emergencies:

1. Listen, use eye contact and empathy
2. Elicit feelings and facts
3. Respond to feelings, validate them
4. Correct misconceptions
5. Provide info on follow up care
6. Offer honest support
7. Ask effective questions
8. Don't lead the "testimony"
9. Structure the interview chronologically
10. Conclude by asking about other events or feelings

DIFFERENCE BETWEEN SCHIZOPHRENIA / ANXIETY / PSYCHOSIS / DELIRIUM / DEPRESSION

Psychosis

Extreme response to stress characterized by impaired ability to deal with reality, maladaptive behavior that involves distortion of reality

Anxiety

Anxiety disorders are characterized by a dominating sensation of apprehension and fear

- anxiety itself is roughly defined as a state of uneasiness, discomfort, apprehension, and restlessness
- The DSM divides anxiety disorders into three categories
  - panic disorder
  - phobia
  - post-traumatic stress disorder

Delirium

Acute, rapid onset of disorganized thought, confusion, memory loss, and even hallucination

- related to **dementia** → which is different because it is chronic and more likely to be permanent

Schizophrenia

Change in behavior including delusions, hallucinations, disorganized speech, catatonia, flat affect

Depression

Profound sadness or melancholy

Suicidal Patients: suicide gesture is a cry for help. Suicide attempt shows true desire to die. Ask directly "Were you trying to kill yourself?"

Legal Issues: know specific regulations for handling these individuals

SIGNS AND SYMPTOMS OF ANXIETY

Categories of anxiety attacks:

1) ***Panic attack***

Extreme period of anxiety resulting in great emotional distress

- signs & symptoms : presentation may resemble a cardiac or respiratory condition, hyperventilation ⇒ paresthesia

  - palpitations, pounding heart or tachycardia
  - sweating
  - trembling or shaking
  - sensation of SOB or smothering
  - feeling of choking
  - chest pain or discomfort
  - nausea or abdominal distress
  - feeling dizzy, unsteady, lightheaded or faint
  - derealization **[** feeling of unreality **]** or depersonalization **[** being detached from oneself **]**
  - fear of losing control or going crazy
  - fear of dying
  - paresthesia **[** numbness, tingling sensation **]**
  - chills or hot flashes

2) ***Phobias***

Excessive intense, irrational fear that interferes with functioning (i.e., Agoraphobia = fear of crowds)

3) ***Posttraumatic Stress Syndrome***

Reaction to an extreme, usually life-threatening stressor

- signs & symptoms :
  - desire to avoid similar situations
  - recurrent intrusive thoughts
  - depression
  - sleep disturbances

- nightmares
- persistent symptoms of increased arousal
- feeling of guilt for having survived the incident
- substance abuse

DIFFERENCE BETWEEN MUNCHAUSEN'S SYNDROME AND HYPOCHONDRIA

Hypochondriasis

Exaggerated interpretation of physical symptoms as a serious illness

Munchausen's syndrome

Intentional production of physical or psychological symptoms without external incentives for the behavior (economic, avoiding police, avoiding work…)

- a factitious disorder in which the patient feigns illness in order to assume the sick role
- patients will sometimes undergo multiple surgical operations and other painful procedures

JUSTIFIED RESTRAINTS

- restrain, only if necessary, using soft restraints to protect the patient and others from harm
- restraints should only be used if the patient presents a danger to themselves or others
- restraints must be utilized in accordance with New York State Mental Health Law
- police or Peace Officer should be present at the scene prior to the application of restraints

DELIRIUM TREMENS

Disorder found in habitual and excessive alcohol users after cessation of drinking for 48-72 hours

- causes visual, tactile and auditory disturbances
- in severe cases may lead to death

WERNICKE'S SYNDROME

Condition characterized by loss of memory and disorientation, associated with chronic alcohol use and
a diet deficient in thiamine

KORSAKOFF'S PSYCHOSIS

Psychosis characterized by disorientation, muttering delirium, insomnia, delusions and hallucinations

- signs & symptoms
  - painful extremities
  - bilateral foot drop
  - bilateral wrist drop (rarely)
  - pain on pressure over the long nerves

Substance abuse:
Alcohol abuse = medical, behavioral or social problems related to excessive alcohol consumption

Alcoholism = chronic dependence on alcohol and a pattern of abnormal behaviors.

Severe intoxication can result in cardiac dysrhythmias, shock and death. Conditions that may mimic alcohol intoxication: drug abuse, brain tumor, hypoglycemia, meningitis, head injury, stroke, postictal state, DKA, hypoxia

Emergency care: ABCs, hi-flow O2, check blood sugar, transport severely intoxicated patients

Drugs: taken by mouth, injected, placed on skin to treat or prevent a disease or condition.

Ethical: manufactured by legitimate pharmaceutical company to treat specific diseases or conditions

Illicit: manufactured illegally for the purpose of abuse

Drug misuse: intentional or accidental use of a drug not as intended Drug abuse: use of a drug for a non-therapeutic effect - to get high etc.

Drug addiction: overwhelming desire to continue taking a drug to get a desired effect
True addiction is both psychological and physical. Drug dependence is just psychological.

Drug withdrawal: signs and symptoms resulting from abrupt cessation of use

Five classes of abused drugs:

Stimulants - uppers. Cocaine, meth, speed, caffeine hyperactivity, euphoria, tachycardia, sleeplessness, seizures

Depressants - downers. Marijuana, barbiturates, sleeping pills, antidepressants, tranquilizers. Sluggishness, slurred speech, decreased respiration and resp. arrest.

Hallucinogens - LSD, mescaline, psilocybin and PCP. Unpredictable behavior, hallucinations, tachypnea, nausea, dilated pupils, tachycardia, hypertension Narcotics - heroin, morphine, methadone… drowsiness, impaired coordination, sweating, resp. depression, constricted pupils, shock, convulsions and coma

Volatile Chemicals - aerosols, glue, gasoline, freon. Altered LOC, swollen mucus membranes of mouth and nose, hypertension, tachycardia, resp. distress, nausea

Assessment: Expect the history to be unreliable, ask “were you trying to hurt yourself?” Expect a mixture of drugs and alcohol, violent behavior is common

Management:

1. Maintain the airway, assist as necessary
2. Monitor patient for deterioration in respirations
3. O2 by nasal cannula or non-rebreather
4. Watch for vomiting of course
5. Prepare to suction
6. Notify Law Enforcement/Poison Control

7. Measure blood sugar
8. Monitor ECG
9. Place an IV
10. Monitor for shock
11. Restrain patient as necessary
12. Do not be judgmental

OB / GYN

ANATOMY OF THE UTERUS

The uterus consists of two regions:

body
- largest division of the uterus
- fundus → the rounded portion of the body superior to the attachment of the uterine tubes
- the body ends at the constriction known as the **isthmus**

cervix
- the inferior portion of the uterus

Ovaries: produce eggs, estrogen and progesterone
Fallopian tubes: passageway between ovaries and uterus
Uterus: hollow pear-shaped muscular organ where the fetus develops
Cervix: inferior narrow neck of the uterus
Vagina: birth canal
Perineum: between urethra and anus
Placenta: exchanges O_2 and nourishment from the mother for CO_2 and wastes from the fetus
Umbilical cord: attaches fetus and placenta has two arteries and one vein
Amniotic sac contains 500-100 mL of amniotic fluid, should be clear
Fetus: unborn child

PAINFUL MENSTRUATION

Dysmenorrhea

FUNCTION OF THE FALLOPIAN TUBES

- conduct ova from the ovaries to the uterus
- serve as the site of fertilization (usually in the upper $^1/_3$)

FEMALE OF CHILDBEARING AGE WITH ANY ABDOMINAL SYMPTOMS

Suspect ectopic pregnancy until proven otherwise

Implantation of the fertilized egg outside of the uterus

- signs
  - missed menstrual period
  - acute lower abdominal pain
  - possible vaginal bleed
  - syncope
  - shock

FUNCTIONS OF THE PLACENTA

- develops in the third month of pregnancy, from endometrium of mother and chorion of embryo
- allows oxygen and nutrients to diffuse from mother to fetus while CO_2 and wastes diffuse in opposite direction
- protects against microorganisms but not viruses
- functions:
    - transport of gases
    - transport of nutrients
    - excretion of wastes
    - hormone production
    - formation of a barrier

PHYSICAL CHANGES IN A PREGNANT WOMAN

- Full term - 280 days or 40 weeks
  LMP = last menstrual period
- altered hormonal output
- progesterone causes a decrease in airway resistance
- cessation of menses
- enlarging uterus ⇒ pushes up on the abdominal organs and diaphragm
- formation of mucous plug in the cervix
- vaginal mucosa increase in thickness
- vaginal secretions increase
- vulva develops violet color from increased vascularity
- urinary frequency due to compressed bladder
- increased urine production and glucosuria
- enlarged, tender breasts and increase in number of mammary glands
- nipples become larger, deeply pigmented, and more erectile
- loosened pelvic joints and postural changes with associated low back pain
- increased blood and lymphatic flow to abdominal and pelvic area
- abdominal organ displacement
- increase in blood volume and relative increase in plasma (40-50%)
- increased plasma volume, leukocytes, fibrinogen levels
- decreased hemoglobin & hematocrit concentrations
- heart displaced left and up
- cardiac output increases
- HR increases by 10-20 BPM
- BP decreases by 10-15 mmHg
- heart murmurs develop
- enlarged uterus interferes with venous return from legs
- risk of supine hypotension
- increased respiratory rate, tidal volume, decreased PCO_2
- increased metabolism
- DM may develop
- GI irritability
- hemorrhoids, edema of ankles, and varicose veins may be present
- weight gain

Three trimesters, each about 13 weeks
First trimester: most common time for miscarriages o
Second trimester
Third trimester

GPA = Gravida, Para and Miscarriages/Abortions

ECTOPIC PREGNANCY, ECLAMPSIA, PLACENTA PREVIA, ABRUPTIO PLACENTAE - TRIMESTERS

- Ectopic pregnancy → first trimester
- Abruptio placentae → usually third trimester
- Placenta previa → usually third trimester
- Eclampsia → third trimester
  during labor
  after labor

COMPLICATIONS DURING PREGNANCY AND CHILDBIRTH

- **Ectopic pregnancy**
  An implantation of a developing fetus outside of the uterus, often in the Fallopian tubes
- **Placenta previa**
  Abnormal implantation of the placenta on the lower half of the uterine wall, resulting in partial or complete coverage of the cervical opening
- **Abruptio placentae**
  A condition in which the placenta separates from the uterine wall
- **Abortion**
  Termination of the pregnancy before the 20th week of gestation
- **Spontaneous abortion**: miscarriage
- **Supine hypotensive syndrome** (vena caval syndrome)
  Occurs when the gravid uterus compresses the inferior vena cava when the mother lies supine → decreases the venous return to the right atrium (→ pregnant women should be transported on their left side)
- **Gestational diabetes**
  Diabetogenic effect of the pregnancy, usually subsiding after the pregnancy
- **Braxton-Hicks contractions**
  As early as the 13th week of gestation, the uterus contracts intermittently to condition itself to the birth process
- **Pre-eclampsia**
  A progressive hypertensive disorder defined as an increase in systolic blood pressure by 30 mmHg $^{and}/_{or}$ a diastolic increase of 15 mmHg over the baseline on at least 2 occasions at least 6 hours apart

Hypertension and fluid retention. Mild BP 140/90. Puffiness, excessive weight gain, protein in urine

Severe Pre-eclampsia →
- SBP of 160 mmHg or higher
- DBP of 110 mmHg or higher

and/or

- severe headaches
- visual disturbances
- acute pulmonary edema
- upper abdominal tenderness

- **Eclampsia**
  The most serious manifestation of pregnancy-induced hypertension and is characterized by grand-mal seizures
- **Preterm labor**
  True labor that begins before the 38th week of gestation
- **Prolapsed cord**
  When the umbilical cord precedes the fetal presenting part
- **Breech presentation**
  When the buttocks or both feet present first
- **Limb presentation**
  If the baby is in a transverse lie in the uterus, an arm or a leg is the presenting part
- **Occiput posterior presentation**
  Baby descends facing forward, the presenting part is the face or the brows
- **Cephalopelvic disproportion**
  Occurs when the infant's head is too big to pass through the mother's pelvis easily
- **Shoulder dystocia**
  Occurs when the infant's shoulders are larger than it's head
- **Meconium staining**
  When the fetus passes feces into the amniotic fluid
- **Postpartum hemorrhage**
  The loss of more than 500 ml of blood immediately following delivery
- **Uterine rupture**
  The actual tearing or rupture of the uterus, usually occurring with the onset of labor or from blunt abdominal trauma during pregnancy
- **Uterine inversion**
  When the uterus turns inside out after delivery and extends through the cervix
- **Pulmonary embolism**
  Caused by a blood cloth or amniotic fluid and particles

Trauma During Pregnancy:

Due to increased HR and lowered BP, vital signs are challenging to make sense of. During trauma, the body will preserve the mom first.

Miscarriage= spontaneous demise of a pregnancy. Collect any tissue/clots to take to hospital

Placenta Previa: abnormal positioning of the placenta over the cervix opening.
Profuse, painless bright red bleeding

1- Risk factors: multiple pregnancies, rapid succession of pregnancies, over 35 y/o, previous history of Placenta Previa
   Abruptio Placenta: premature detachment of a normally situated placenta. Severe, constant low pain and dark red bleeding
2- Risk factors: history of preeclampsia, chronic hypertension, multiple pregnancies, previous history of Abruptio Placenta, MVA, cocaine use

Uterine Rupture: occurs most commonly after onset of labor

POSITIONS AN INFANT MAY BE BORN IN

- **Vertex position [**headfirst and face down**]**
- Breech presentation - 3-4% of deliveries, preterm 20-30%. If the head does not deliver within 3 minutes of the torso, or tries to breathe, form a V with your fingers to try and make a tunnel of air to the newborn's face. If the baby's head does not deliver, transport mom with buttocks elevated or in knees to chest position
- Limb presentation - Transport asap, requires C-section
- Occiput posterior presentation
- Multiple Births. Twins are 1 in 90 live births. 40% are premature. There may be a shared placenta or two placentas
- Prolapsed Cord: cord presents first and may get compressed between the newborn and the mother's pelvis, cutting off fetal circulation before delivery. Insert a gloved finger and try to keep the head from mashing the cord. Pulsations in the cord indicate a viable newborn. Transport with mom in Trendelenburg or knee to chest. Cover the cord with warm moist gauze.

THREE STAGES OF LABOR

- **Dilation**
  - time from onset of labor to complete dilation of the cervix (~10 cm)
  - lasts 6-12 hours, with rupture of amniotic sac
- **Expulsion**
  - from complete cervical dilation to delivery
  - may last 10 min to several hours
    10cm cervix to delivery of newborn. If birth is imminent, do not transport. Place patient in a semi-reclining position on the firm, comfortable surface.

  Signs:
  Frequent contractions less than 2 min apart Intense urge to push
- **Placental phase**
  - after delivery when the placenta is delivered
  - powerful contractions help to constrict blood vessels torn during delivery
  - 5-30 minutes after delivery
  - Place in clean plastic bag or other container for inspection in hospital
  - Postpartum care: breastfeeding helps uterus contract> constricting blood flow, massaging uterus will help stop bleeding.
  - Hemorrhage of more than 500mL immediately after delivery is cause for concern.

Assessment

History of Present Situation:
In addition to SAMPLE information;
Pertinent medical conditions/history
Current health of mother
Recent injuries, illness, fever Prenatal care
Drug use (baby may need extra resuscitation)
Regarding the current pregnancy
First day of LMP
Delivery date
Previous pregnancies/deliveries? Any complications? Previous C-Section?
When did the contractions start, how far apart? Any other pain/bleeding

Physical Examination
Look for crowning

Management:
O2 IV
Position on left side to avoid supine hypotensive syndrome

General GYN Assessment PEARLS

Questions need to be broad enough to get information about the whole area:
Is there pain or cramping
OPQRST
Bleeding or discharge
Nausea, vomiting change in appetite Fever, diaphoresis, sweating
Change in normal bowel habits, constipation/diarrhea Urination, pain with urination, hematuria
Preexisting or chronic medical problems, surgeries
Dysmenorrhea: pain with menses Dyspareunia: pain with intercourse

Gravida: total number of pregnancies
Para: total number of live births (G5P2 = five pregnancies, 2 live births)

General Examination

Vital Signs= BP: hypotension could be internal hemorrhage or infection. Pulse: tachycardia due to dehydration, anemia, infection, pain, sepsis. Respiratory rate: could be increased
Skin = cyanosis could indicate anemia or resp. problems
Genitourinary exam: note presence of blood indirectly. No exams
Abdomen = palpate for masses or tenderness. Rebound tenderness is a sign of significant intra abdominal inflammation

Management: O_2, tachycardia, hypotension, severe pain i.e. if BP is below 90 start 2 IVs

Specific Emergencies Include:

Pelvic Inflammatory Disease (PID): caused by bacteria. Signs and symptoms: fever, lower ab pain, discharge, dyspareunia, guarding. Can lead to sepsis, and infertility
Ruptured Ovarian Cyst: follicles stimulated by hormones enlarge and can rupture> significant hemorrhage > hypotensive
Ectopic Pregnancy: implantation of a fertilized egg outside of the uterus. 1 in 200.
Consider this first for any female age 12-50.
Tubal rupture > massive bleeding > shock.
Straddle injuries: trauma to perineum due to a fall
Blunt trauma: MVA, physical assault, falls
Foreign bodies: don't try and remove, transport asap
Vaginal Bleeding
Miscarriage= spontaneous demise of a pregnancy. Collect any tissue/clots to take to hospital
Placenta Previa: abnormal positioning of the placenta over the cervix opening.
Profuse, painless bright red bleeding
Abruptio Placenta: premature detachment of a normally situated placenta. Severe, constant low pain and dark red bleeding

Sexual Assault: be professional, empathetic, show respect, help them cope, be an advocate for the patient and provide a comforting environment. Preserve evidence, collect clothing, do not wash or urinate

NEONATOLOGY

Newborn
A baby in the 1st few hours of it's life

Neonate
Infants in the first 28 days of life (from the time of birth to 1 month of age)

Premature
Infants born before the 38th week of gestation

Infant > 28 days < 1 year
About 6% of deliveries require some type of life support. Complications increase as birth weight goes down. 20x more likely to die.

Full term 38-42 weeks
Postmature after 42 weeks
Mortality
Live birth: neonate that has any sign of breathing, heartbeat or any voluntary movement
Fetal death: after 20 weeks gestation, before delivery, no signs of life after birth
Early Neonatal death: first week, Neonatal death is first 28 days
Perinatal mortality: total # of fetal and early neonatal deaths per 1000 live births
Postnatal death: 28 days to 1 year

NORMAL NEWBRON PARAMETERS

V/s **Resp** 30 – 60 brpm
HR 100 – 180 bpm
BP 60 -90 mmHg (systolic)
Temperature 36.7 – 37.8°C (98 – 100°F)
Respiratory effort
- rate & depth should increase immediately with tactile stimulation

Skin color
- newborns with peripheral cyanosis usually don't need supplemental O_2 unless cyanosis is prolonged

APGAR SCORING

- determine it at 1 and 5 minutes after delivery

7 - 10 active and vigorous newborn ⇒ requires only routine care
4 - 6 moderately distressed newborn ⇒ requires oxygenation and stimulation
0 - 3 severely distressed newborn ⇒ requires immediate resuscitation

	0	*1*	*2*
Heart Rate	Absent	Below 100	Over 100
Respiration (effort)	Absent	Slow and Irregular	Normal; Crying
Muscle Tone	Limp	Some flexion of extremities	Active; Good motion in extremities
Irritability	No response	Crying; Some motion	Vigorously crying
Skin Color	Bluish or pale	Pink or typical newborn color; Hands and feet are blue	Pink or typical newborn color of the entire body

CARE OF THE NEW BORN

- **suction** with a bulb syringe
  - **1st** nose
  - **2nd** mouth → so there's nothing in the infant's mouth to aspirate if it gasps when the nose is suctioned (suctioning the nose stimulates the breathing)
  - if meconium noted ⇒
    - avoid stimulating the infant
    - prepare intubation equipment and meconium aspirator ⇒
- direct suctioning of an ET tube
  - ET Intubation
  - direct suctioning of the ET tube via meconium aspirator while slowly withdrawing the ET tube as suction is applied (suction @ 100 cm/H_2O for a maximum of 10 seconds)
  - repeat until ET tube is clear of meconium (switch tubes if possible)
  - don't reinsert the ET tube unless the newborn has to be intubated

- apply umbilical clamps within 30-45 seconds after birth
  - **1st clamp**: ~10 cm (4 inches) away from the newborn
  - **2nd clamp**: ~ 5 cm (2 inches) farther away than the 1st

LIFE OUTSIDE:

Respiratory System: breathing is the most critical and immediate change required. Stimuli are thermal (cold outside the womb) and chemical (low O_2, high CO_2 and low pH). These factors stimulate the medulla.

Circulatory System: changes are more gradual and are a response to pressure changes. Fetal shunts close: the foramen ovale and the ductus arteriosus.

Thermoregulation: Large surface areas, thin layer of fat and can't shiver, so wrap them up quick and cover their heads

Hemopoietic System: Full term newborn has 80-85 mL of blood/kg of body weight. Most have about 300 mL at birth

Care of Newborn in Distress:

Airway: as the head is delivered, suction the mouth first then the nose. Keep the head down a bit from the body to allow fluids to drain

Breathing: Rub soles of feet and back to stimulate. Newborns are sensitive to hypoxia => brain damage. Primary apnea is reversed with stimulation. Secondary apnea requires ventilation

- Use a rolled towel under shoulders. Sniffing position, don't hyperextend the trachea
- If breathing is absent or irregular, BVM at 40-60 breaths per minute

Circulation/Heart Rate: Cardiac arrest is secondary to respiratory failure. If HR is below 100 beats per minute, ventilate with 100% O_2. If HR is below 60 initiate CPR

Color: If central cyanosis persists after stimulation and they are breathing, give O_2. Acrocyanosis or peripheral cyanosis (blue hands and feet) can persist for up to 48 hours after birth.

If an IV is needed: arms, feet and scalp are the most common spots. Fluid therapy is *10 mL/kg of body weight over 5-10 min*. Normal saline or Lactated Ringers.

Meconium: thick greenish black stools that usually pass after birth. Stress can cause it earlier. Neonate can aspirate and this is an emergency ==> respiratory distress. Vigorous suctioning of the hypopharynx before delivery of the shoulders.

Preterm infants:
Less Surfactant: reduces surface tensions of fluids in the lungs. Makes diffusion of O2 and CO2 more efficient. Without it, newborns are unable to keep their lungs inflated.
Less fat, translucent skin, cartilage soft, reflexes absent, can't cough, suck, swallow or gag.
Apnea of prematurity, more prone to SIDS
Sepsis: generalized bacterial infection. 4x greater chance of developing it

CONGENITAL ABNORMALITIES

Diaphragmatic Hernia

Protrusion of abdominal contents into the thoracic cavity through an opening in the diaphragm

Meningomyelocele

Herniation of the spinal cord and membranes through a defect in the spinal column

Omphalocele

Congenital hernia of the umbilicus

Choanal Atresia

Congenital closure of the passage between the nasal cavity and the pharynx by a bony or membranous structure

Cleft Palate

Congenital fissure in the roof of the mouth → forms a passageway between the oral & the nasal cavity

Cleft Lip

Congenital vertical fissure in the upper lip

Peirre-Robin Syndrome

Unusually small jaw, combined with a cleft palate, downward displacement of a large tongue and an absent gag reflex

PEDIATRICS

ANATOMICAL DIFFERENCES IN THE PEDIATRIC AIRWAY FROM THE ADULT AIRWAY

- narrower at all levels
- obligate nose breathers
- tongue proportionally larger
- epiglottis is larger and floppier
- trachea softer and more flexible
- larynx is higher
- cricoid ring is narrowest part

USE OF UNCUFFED ENDOTRACHEAL TUBE IN PEDIATRIC PATIENTS

Because the pediatric airway is funnel-shaped and provides a natural 'cuff' by the cricoid ring (cricoid ring → narrowest part of pediatric airway)

NORMAL SALINE AMOUNT TO BE MIXED WITH PEDIATRIC ETT MEDICATIONS

mix so that total volume is 3-5 ml

BASIC MANEUVER THAT CAN BE EMPLOYED TO TREAT VOMITING IN A PEDIATRIC PATIENT

Suctioning

ABSENCE SEIZURES IN A CHILD MAY BE MISTAKEN FOR

Daydreaming or inattentiveness

Croup (Laryngotracheobronchitis)

A common viral infection of young children 6 months – 4 years old;
resulting in edema of the sub-glottic tissues;
characterized by barking cough and inspiratory stridor

Epiglottitis

A bacterial infection of the epiglottis, usually in children 3 – 7 years old;
characterized by high fever, brassy cough, inspiratory stridor and drooling

Bronchiolitis

Viral infection of the medium-sized airways;
occurring most frequently in the 1st year of life

SPECIAL CONSIDERATIONS

ELDERLY

Common Problems due to Falling: Reduced mobility and independence
Poor nutrition due do difficulty preparing food and eating it Difficulty with elimination
Skin abrasions, injuries and circulatory compromise Injuries/trauma from falling
Decreased medical compliance

History of Falls, investigate:
CNS disorders
Weakness
Impaired vision
Dizziness
Cerebral vascular accidents
Medications

Changes in Normal Sensation:

Vision: cataracts are opacities in the lens, Glaucoma is high ocular pressure that can lead to vision loss

Hearing loss: can cause a barrier to proper treatment Speech: physical and metal changes can impair speech Pain perception: things just don't hurt as much

Continence and Elimination: can be embarrassing and unsanitary

General Assessment: you may be the only person who has seen them in a long time. Take the time to assess their ability to care for themselves and assess their activities of daily living.

Physical Exam: do a full head to toe, like a trauma exam if possible because they may not be able to tell you what's going on with them.

General Management:

Airway: watch for dentures and other airway obstructions
Circulation: Don't give too much IV fluids to CHFers

Transport: ask them to move and you help them, so as not to injure fragile bones Specific Systems: Ask them "What has Changed?"

Respiratory complaints - watch for: Pneumonia, PE, CPOD, Cardiovascular watch for: CHF, what medications, take orthostatics

Nervous system: watch for Stroke, and determine when the current issue started.

Cincinnati Stroke Scale: Facial droop (smile), Arm Drift, Speech

Thrombolytics must be administered within 3 hours to help

Endocrine: watch for diabetes 20% of the geriatric population has it. Many times geriatric diabetics have COPD too.

GI: these symptoms can be secondary to some other medical problem

Nausea, Hiatal Hernia, GI bleed, Bowel obstruction

Central Nervous System:

Stroke
TIAs
Delirium: quick onset, caused by infection, electrolyte imbalance, fever, medications etc. and reversible
Dementia: progressive loss of intellectual function, irreversible
Alzheimer's: progressive loss of cognitive function
Parkinson's" degeneration of the basal ganglia causes tremor at rest, sluggish movement and muscle rigidity

Other Special Considerations:

Toxicology: average 4-5 prescriptions routinely => drug interactions => non- compliance => side effects

Substance Abuse: stress, depression, confusion, falls

Environmental Emergencies: sensitive to changes in temperature

Trauma: osteoporosis makes it easy to fracture long bones, pelvis and hip

Cardiac: function and output are already reduced. Shock and blood loss can have a profound effect on perfusion

Head injuries: the brain shrinks, leaving more room to bounce around

Burns: significant cause of mortality. They don't heal as fast, infections abound and stress can cause AMI

Immobilization on a long board may be impossible or traumatic. Watch their backs and necks.

Neglect/Geriatric abuse: frequent calls to EMS, multiple injuries in different stages of healing, lack of food, clothing, shelter, lack of proper medications, hygiene.

KYPHOSIS

Exaggeration of the normal posterior curvature of the spine

MARFAN'S SYNDROME

A hereditary condition of the connective tissue, bones, muscles, ligaments, and skeletal structures characterized by

- unsteady gait
- tall, lean body
- long extremities

- flat feet
- stooped shoulders
- these patients often have a weakened aorta and should be monitored for signs of AAA

STOKES-ADAMS SYNDROME

A series of syndrome (most commonly syncope) resulting from heart block;
the symptoms result from decreased blood flow to the brain caused by sudden decrease in cardiac output

SICK SINUS SYNDROME

A group of disorders characterized by dysfunction of the sinoatrial node in the heart

ALZHEIMER'S DISEASE

A progressive, degenerative disease that attacks the brain;
results in impaired memory, thinking and behavior

PARKINSON'S DISEASE

Chronic, degenerative nervous disease;
characterized by tremors, muscular weakness and rigidity, and a loss of postural reflexes

SHY-DAGGER SYNDROME

Chronic orthostatic hypotension caused by a primary autonomic nervous system deficiency

***HERPES ZOSTER INFECTION* (*SHINGLES*)**

An acute eruption caused by a reactivation of latent varicella virus (chicken pox) in the dorsal root ganglia

OSTEOARTHRITIS

A degenerative joint disease;
characterized by a loss of articular cartilage and hypertrophy of the bone

OSTEOPOROSIS

Softening of bone tissue due to the loss of essential minerals, principally calcium

DYSPHORIA

An exaggerated feeling of depression or unrest;
characterized by a mood of general dissatisfaction, restlessness, discomfort and unhappiness

PRESBYCUSIS

Progressive hearing loss that occurs with aging

OPERATIONS

TIERED RESPONSE SYSTEM

System that allows multiple vehicles to arrive at an EMS call at different times, often providing different level of care

BEST SITE FOR DEPLOYING RESOURCES IN A HAZMAT SITUATION

Upwind and uphill

WEAPONS OF MASS DESTRUCTION

- pediatric patients older than 8 $^{Y}/_{O}$ should be treated under as adults
- max total dose of 2 PAM: 1.8 g (3 auto-injectors)

Salivation
Lacrimation
Urination
Defecation
Gastrointestinal problems (pain, cramping, gas …)
Emesis
Muscle tremors

TREATMENT FOR ORGANOPHOSPHATE POISONING

Atropine

- prevents bronchospasm

SMELL OF ALMONDS AT A HAZMAT SCENE

Indicates the possibility of Cyanide contamination

INTRAVENOUS THERAPY

IV Therapy

Important tool for cardiac disease, hypoglycemia, seizures and shock also:

- Routes for meds
- Precautionary measure

IVs come in four types

- Crystalloids - dissolving crystals (salts and sugars) in water. Ions cross the cell membrane quickly so for every L of blood lost, give 3L *(3:1 ratio)*
- Colloids - Expensive, need refrigerated, not given in field. Large molecules like proteins which do not readily pass through the cell membrane, they stay in the intravascular space longer and the pressure pulls fluid from other spaces. So they are called Volume Expanders.
- Blood - expensive, needs typed, needs refrigerated, needs a special filter, given in hospital
- O_2 Carrying fluids

Administrative Set: 70-110" long 5 Components

Piercing spike - sharp, pointy with protective cap
Drip chamber - Micro (60 drops per mL) Macro (10, 15 or 20 drops per mL)
Flow Clamp - roller clamp controls amount of fluid
Drug Admin port - y-shaped inlet, clean with alcohol before using
Connector End - connects to the hub of the catheter, also has protective cap

Blood Tubing: larger internal diameter and a special blood filter, usually drip factor of 10 drops/mL.

Two types:

1. Y tubing - more flexibility for administering fluids (swapping etc.)
2. Straight tubing

Volume Control: Burette Set. Chamber with measuring lines, when specified amounts need to be administered usually 100-150 mL.

Needle/Catheter
Catheter remains in the vein
Needle facilitates the passage into the vein 3 types:

- Plastic over hollow needle, needle is pulled out after insertion in vein leaving the catheter in place, gauge measurements 14-26.
- Plastic catheter through a hollow needle
- Hollow needle (butterfly)

Gauge Measurements
Gauge measurements 14-26. The smaller the number, the larger the bore.

14-16 gauge for patients in shock, cardiac arrest.

NEEDLE SIZES

Intradermal
25 - 27 gauge, 3/8 – 1" long (Tuberculin syringe)
Insert in 10 - 15° angle

Subcutaneous
24 – 26 gauge, 3/8 - 1" long (Hypodermic needle)
Insert in 45° angle

Intramuscular
21 – 23 gauge, 3/8 - 1" long
Insert in 90° angle

Intravenous
18 – 22 gauge
Insert 10 - 20° angle

Intraosseous
45mm, 25mm or 15mm IO needle

Intermittent Infusion Device (Hep Lock/Saline Lock) - short tubing and a clamp, med port and connector useful for a patient who requires venous access but not continuous infusion. Supplies and equipment:

- IV cannula
- One or two 3 mL syringes with heparin or saline
- Intermittent infusion device
- Tape/securing device
- Venous blood drawing equipment
- Antiseptic swab

Procedure Summary

Prime the lock with heparin or saline
Cannulate the vein
Connect the intermittent device to the hub of the IV catheter
Inject 305 mL of dilute heparin or saline

Structure of Veins: Three Layers:

Tunica Intima - endothelial lining, flat cellsto let blood flow. Valves in this layer
Tunica Media - muscular and elastic tissue, vasoconstrictor/dilators and nerve fibers inthis layer
Tunica Externa - connective tissue surrounding and supporting the vessel

IV Site Locations: never try distal to a failed spot, you may have blown the vein above it

Digital veins: use when other sites aren't available
Metacarpal: between the knuckles Cephalic: very common IV site
Median antebrachial: last resort
Basilic: ulnar border of hand and forearm

Antecubital: probably the most common IV site
Great saphenous: internal malleolus, inner thigh
Dorsal venous network: infants and toddlers
External Jugular: may be more important to manage the airway
Veins of leg: use as last resort, thrombus formation

Performing IV Cannulation:

Other notes:
- Explain the procedure to the patient
- Check the IV fluid to be used
- Prepare the Administration Set and the IV bag
- 14-16 gauge for trauma, volume replacement, cardiac arrest
- 18-20 gauge for medical conditions
- Never leave a tourniquet in place for more than 2 minutes
- Avoid areas of veins where valves are located
- Stabilize the vein by anchoring it with the thumb and stretching the skin downward
- Bevel of needle should be facing up when entering ski
- Never insert the needle/catheter in so that less than half the catheter is outside the skin
- Hold the needle stable and use the other hand to slide the catheter off the needle into the vein
- Press with middle finger over the skin where the catheter is sitting
- Remove needle carefully, leave catheter in place
- Needle goes immediately into the sharps container
- Connect IV tubing to the catheter hub
- Hang bag 30-36 inches above insertion site
- Open control valve briefly to check line patency
- Cover IV site with ointment, place a sterile dressing on, tape catheter in place
- Adjust flow rate for patient's condition
- Continue checking drip rate, IV site and patient vital signs periodically, especially for - Critical patients, pediatric/geriatric patients, those whose condition can be worsened by fluid overload, giving a type of fluid/drug that can cause tissue damage

Calculating Flow Rates
Volume in mL x Drip = Flow rate (drops per minute) Time of infusion

Factors that cause the flow rate to vary:
- Vein spasm
- Vein pressure changes
- Patient movement
- Manipulations of the clamp
- Bent or kinked tubing
- IV Fluid viscosity
- Height of the infusion bag
- Type of administration set

- Type and position of the venous access device

IV FLUSH

- 20 ml flush from IV bag if giving an IV bolus through an existing line
- 10 – 20 ml flush of NS if administering medications through a saline lock

Documentation

- **Date and time of venipuncture**, **type of device, length/gauge**, site, number of attempts
- Type and amount of solution, IV flow rate
- Any adverse reactions
- **Name and ID of person** initiating the infusion
- Unsuccessful attempts
- Write on tape that in **Bold** above

Troubleshooting: if the IV solution flow is slow or non-existent ask yourself: Is the tourniquet loose?

Complications:

- Pain
- Catheter shear - NEVER draw the catheter back over or through the needle once it has been advanced. Always pull the needle out first!
- Circulatory overload - S&S headache, flushed skin, tachycardia, hypertension, rales, dyspnea, tachypnea, JVD
- Cannulation of an artery - bright red blood that pushes the plunger up, pulse
- Hematoma or infiltration - injury to the blood vessel, puncture or dislodged cannula. S&S edema, blanched skin, discomfort, cool site, slow flow, no blood flashback
- Local infection - bacteria introduced into IV site S&S swelling tenderness several DAYS after initial treatment
- Air embolism - air allowed in the vein from IV tubing, IV set dislodged S&S hypotension, cyanosis, tachycardia, increased venous pressure. Loss of responsiveness
- Pyrogenic reaction - foreign proteins capable of causing fever come in from the IV solution or the administration set. Within 30 minutes of initial treatment. S&S fever, chills, backache, nausea, vomiting (of course, my favorite), flushed face, sudden pulse change. Cardiovascular collapse can result.

Drawing Blood: the most common reason to draw blood in the field is for blood glucose levels. Use at least a 19 gauge needle to prevent the blood cells from breaking up.

Changing an IV bag: sterile procedures must be used. Do not contaminate the IV spike, after spiking the new bag, make sure the drip chamber fills appropriately. If air becomes trapped in the tubing, clean the med port below the air and aspirate it with a needle and syringe.

Discontinuing the IV Line: Get gloves, sterile gauze and adhesive bandage. Close IV flow control valve. Un-tape and remove dressing. Hold gauze above site to stabilize and pull the catheter straight back. Apply direct pressure, then tape a sterile dressing in place.

*** The End ***

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