PATHOLOGY SYNOPSIS

Abbreviations used at end of notes

Cell injury

PO₂: driving force for diffusion of O₂ into tissue
SaO₂: percent heme groups occupied by O₂
Cyanosis: decreased O₂ saturation (SaO₂)
O₂ content: 1.34 x Hb x SaO₂ + PAO₂
Oxygen: electron acceptor in oxidative pathway
Hypoxia: inadequate O₂ leads to ATP depletion
Ischemia: decreased arterial (or venous) blood flow
Respiratory acidosis: retention of CO₂ always decreases PAO₂
Ventilation defect: impaired delivery of O₂ to alveoli; intrapulmonary shunting of blood (e.g., RDS)
Perfusion defect: absent blood flow to alveoli; increased alveolar dead space (e.g., pulmonary embolus)
Diffusion defect: O₂ cannot cross alveolar-capillary interface; interstitial lung disease (e.g., sarcoidosis)
Methemoglobin: ↓ SaO₂; heme iron +3; oxidizing agents (sulfur/nitro drugs); Rx with IV methylene blue
Clinical methemoglobinemia: cyanosis not corrected by O₂; chocolate colored blood
Carbon monoxide: ↓ SaO₂; left-shift O₂ binding curve; inhibits cytochrome oxidase
Causes carbon monoxide poisoning: car exhaust, space heaters, smoke inhalation
S/S carbon monoxide poisoning: headache; cherry red color skin
Cyanide: inhibits cytochrome oxidase; systemic asphyxiants
Carbon monoxide + cyanide poisoning: house fires
Left-shifted O₂ curve: ↓ 2,3 BPG, carbon monoxide, alkalosis, HbF, methemoglobin, hypothermia
Right-shifted O₂ curve: ↑ 2,3 BPG, high altitude, acidosis, fever
High altitude: respiratory alkalosis enhances glycolysis; ↑ synthesis 2,3 BPG
Mitochondrial poisons: damages membrane and drums off protons; alcohol, salicylates
Uncoupling agents in mitochondria: drain off protons; dinitrophenol, thermogenin (brown fat)
Complication mitochondrial poisons/uncoupling agents: hyperthermia
Decreased ATP: impaired Na⁺/K⁺ ATPase pump (cellular swelling); reversible
Anaerobic glycolysis: ATP synthesis in hypoxia; lactate ↓ intracellular pH, denatures proteins
Irreversible injury hypoxia: membrane/mitochondrial damage
Mitochondrial damage: release cytochrome c activates apoptosis
Irreversible injury hypoxia: ↑ cytosolic Ca²⁺ activates phospholipase, proteases, endonuclease
Free radicals: unpaired electron in outer orbit; damage cell membranes and DNA
Free radicals: superoxide, hydroxyl, peroxide, drugs (acetaminophen)
Superoxide dismutase: neutralizes superoxide
Glutathione: neutralizes peroxide, drug FRs
Catalase: neutralizes peroxide
Lipofuscin: indigestible lipid of lipid peroxidation; brown pigment increased in atrophy and FR damage
Reperfusion injury in heart: superoxide FRs + calcium
Mitochondrial injury: cytochrome c in cytosol initiates apoptosis
SER hyperplasia: alcohol, barbiturates, phenytoin
Complications SER hyperplasia: increases drug metabolism (e.g., oral contraceptives); ↓ vitamin D
Chediak-Higashi: membrane protein defect in transferring lysosomal enzymes to phagocytic vacuoles
Chediak-Higashi: AR; giant lysosomes
I cell disease: absent enzyme marker in Golgi apparatus (mannose 6-phosphate); empty lysosomes
Rigor mortis: stiff muscles after death due to ATP depletion
Fatty change in liver: MCC alcohol (increase in NADH); DHAP → G3P → TG
Fatty change in liver: ↑ VLDL pushes nucleus to side
Causes fatty change: ↑ synthesis TG/FAs, ↓ β-oxid FAs/synthesis apoproteins/release VLDL
Fatty change in kwashiorkor: ↓ synthesis of apoproteins
Ferritin: primary iron storage protein; soluble in blood; serum level reflects marrow storage iron
Hemosiderin: insoluble ferritin degradation product visible with Prussian blue stain
Atrophy: reduction in cell/tissue mass by either loss or cell shrinkage
Brain atrophy: ischemia; Alzheimer’s
Exocrine gland atrophy in CF: duct obstruction by thick secretions
Labile cells: stem cells (skin, marrow, GI tract)
Stable cells: in Go phase (smooth muscle, hepatocytes); can enter cell cycle (growth factors, hormones)
Permanent cells: cannot replicate; cardiac/striated muscle; neurons
Hypertrophy: increase in cell size (structural components, DNA)
LVH: increased preload (valve regurgitation), increased afterload (hypertension, aortic stenosis)
RVH: pulmonary hypertension
Bladder smooth muscle hypertrophy: prostate hyperplasia constricts urethra
Removal of kidney: hypertrophy of remaining kidney
Hyperplasia: increase in number of cells
Endometrial hyperplasia: unopposed estrogen (obesity, taking estrogen)
RBC hyperplasia: increased EPO (blood loss, ectopic secretion, high altitude)
Prostate hyperplasia: increased dihydrotestosterone
Gynecomastia: hyperplasia male breast tissue; normal in newborn, adolescent, elderly
Metaplasia: one adult cell type replaces another cell type
Squamous metaplasia in bronchus: smoking
Intestinal metaplasia in stomach: Paneth cells, goblet cells; *H. pylori* chronic atrophic gastritis
Squamous metaplasia bladder: *Schistosoma hematobium* infection
Barrett’s esophagus: glandular metaplasia of distal esophagus; due to GERD
Dysplasia: atypical hyperplasia or metaplasia are precursors for cancer
Squamous dysplasia in cervix: human papilloma virus
Squamous dysplasia in bronchus: smoking
Necrosis: death of groups of cells
Coagulation necrosis: preservation of structural outline (due to ↑ lactic acid)
Infarction: pale (e.g., heart, kidney); hemorrhagic (e.g., lung, small bowel); dry gangrene
Liquefactive necrosis: brain infarct, bacterial infections; wet gangrene
Caseous necrosis: variant coagulation necrosis; granulomas due to TB/systemic fungi
Granulomas: activated macrophages (epithelioid cells); multinucleated giant cells; CD4 T cells
Epithelioid cells: γ-interferon released by CD4 T cells activates macrophages
Multinucleated giant cells: fusion of epithelioid cells
Granulomas: type IV hypersensitivity
Enzymatic fat necrosis: associated with pancreatitis; soap formation (Ca²⁺ + fatty acids)
Fibrinoid necrosis: necrosis of immune reactions (immune vasculitis/endocarditis)
Postmortem necrosis: autolysis; no inflammatory reaction
Dystrophic calcification: calcification of damaged tissue; normal serum calcium
Dystrophic calcification: pancreatitis; atherosclerotic plaque
Metastatic calcification: calcification of normal tissue; increased serum calcium or phosphorus
Nephrocalcinosis: metastatic calcification of collecting tubule basement membranes
S/S nephrocalcinosis: polyuria due to nephrogenic diabetes insipidus; renal failure
Apoptosis: gene regulated individual cell death
Signals activating apoptosis: Mullerian inhibitory factor, tumor necrosis factor, hormone withdrawal
Signal modulators of apoptosis: TP53 suppressor gene, BCL-2 genes
BCL-2 genes: anti-apoptosis gene; prevents cytochrome c from leaving mitochondria
Caspases: responsible for enzymatic cell death in apoptosis; proteases and endonucleases
Markers of apoptosis: eosinophilic cytoplasm, pyknotic (ink dot) nucleus
Apoptosis: loss Mullerian epithelium in male fetus; thymus involution; killing cancer cells

Inflammation and Repair

Histamine: key chemical in acute inflammation; mast cell; arteriole vasodilation; ↑ venular permeability
Ruber acute inflammation: redness; arteriolar vasodilation (histamine)
Calor acute inflammation: heat; arteriolar vasodilation (histamine)
Tumor acute inflammation: swelling; ↑ vessel permeability (histamine)
Dolor acute inflammation: pain; bradykinin, PGE
Acute inflammation: neutrophil dominant; ↑ IgM
Initial vessel events: transient vasoconstriction → arteriolar vasodilation → ↑ venular permeability
Neutrophil rolling acute inflammation: due to selectins
Integrins: neutrophil adhesion molecules; C5a and leukotriene B4 activate; neutrophil margination
CD11/CD18: markers for integrins
Endothelial cell adhesion molecules: activated by IL-1 and TNF
ICAM: intercellular adhesion molecule
VCAM: vascular cell adhesion molecule
Leukocyte adhesion molecule defect: failure of umbilical cord to separate; poor wound healing
↓ Activation neutrophil adhesion molecules: neutrophil leukocytosis; corticosteroids
↑ Activation neutrophil adhesion molecules: neutropenia; endotoxins
Chemotaxis: directed movement; C5a and LTβ4
Opsonizing agents: IgG, C3b; enhance phagocytosis
Neutrophils, monocytes, macrophages: receptors for IgG, C3b
O2-dependent MPO system: most potent microbicidal system; neutrophils, monocytes
Production of superoxide from O2: NADPH oxidase with NADPH cofactor; produces respiratory burst
Nitroblue tetrazolium (NBT): test for respiratory burst
Superoxide dismutase: converts superoxide to peroxide
Myeloperoxidase: lysosomal enzyme that combines peroxide + Cl to form bleach (HOCl)
Microbicidal defects: chronic granulomatous disease childhood (XR), myeloperoxidase deficiency (AR)
Chronic granulomatous disease: absent NADPH oxidase; no respiratory burst
Chronic granulomatous disease: Staphylococcus aureus not killed (catalase positive)
Chronic granulomatous disease: Streptococcus killed (catalase negative)
Myeloperoxidase deficiency: AR; respiratory burst present; no bleach produced
Opsonization defect: Bruton's agammaglobulinemia (XR, decreased IgG)
Phagocytosis defect: Chediak-Higsashi (see cell injury); also has defect in microtubule polymerization
COX inhibitors: non-steroidal (non-selective), selective COX-2 inhibitors
PGE2: vasodilation, fever
PGI2: vasodilator; prevent platelet aggregation
Nitric oxide: vasodilator; FR gas from conversion arginine to citrulline
IL-1 and TNF: fever, synthesis acute phase reactants in liver, leukocytosis
IL-6: stimulated by IL-1; stimulates synthesis of acute phase reactants
Acute phase reactants: fibrinogen, ferritin, C-reactive protein
Bradykinin: kinin produced in conversion of factor XII to factor XI
Bradykinin: pain, vasodilator, ↑ vessel permeability; cough/angioedema ACE inhibitors
Anaphylatoxins: C3a and C5a; directly stimulate mast cell release of histamine
Prostaglandin I2: synthesized by endothelial cells; vasodilator, inhibits platelet aggregation
Lipoxygenase: hydroxylation of arachidonic acid
Zileuton: inhibits lipoxygenase
Zafirlukast, montelukast: block lipoxygenase receptor
LTC₄, -D₄, -E₄: bronchoconstrictors
TXA₂: synthesized by platelets; platelet aggregation, vasoconstriction, bronchoconstriction
Dipyridamole: inhibits thromboxane synthase
Corticosteroids: inhibits phospholipase A₂, activation neutrophil adhesion molecules
Corticosteroids: neutrophilic leukocytosis, lymphopenia, eosinopenia
Fever: right shift OBC; hostile to bacterial/viral replication
Chronic inflammation: monocyte/macrophage; ↑ IgG; repair by fibrosis
Granuloma: cellular immunity; macrophages interact with T₄₁ class cells (memory cells)
Positive PPD: Langerhan's cells process PPD and interact with T₄₁ class cells
Suppurative inflammation: abscess; Staphylococcus aureus (coagulase)
Cellulitis: subcutaneous inflammation; Streptococcus pyogenes (hyaluronidase)
Pseudomembranous inflammation: toxins from Corynebacterium diphtheriae, Clostridium difficile
Cell cycle: key checkpoint G₁ to S phase
TP53 and RB suppressor genes: arrests cell in G₁ phase for DNA repair or apoptosis
BAX gene: stimulates apoptosis; activated by TP53 suppressor gene if too much DNA damage
Extracellular matrix: basement membrane, interstitial matrix
Complete restoration: cell must be capable of duplication, no damage to basement membrane
Scar tissue: end-product of repair by connective tissue
Collagen: triple helix of cross-linked α chains
Collagen: cross-links at points of hydroxylation (lysyl oxidase) increase tensile strength
Type I collagen: bones, tendons
Type III collagen: early wound repair
Type IV collagen: basement membrane
Type X collagen: epiphyseal plate
Laminin: key basement membrane glycoprotein
Fibronectin: key interstitial matrix glycoprotein
Angiogenesis in repair: basic fibroblast growth factor, vascular endothelial growth factor
Key event in wound repair: granulation tissue formation; fibronectin responsible
Granulation tissue: becomes scar tissue
Collagenases: zinc cofactor (metalloprotease); type III collagen replaced by type I collagen
Tensile strength of healed wound: 80% original strength
Inhibition wound healing: infection (MCC; S. aureus), zinc deficiency, DM
Ehlers-Danlos syndrome: defects in collagen synthesis and structure; hyperelasticity
Scurvy: ↓ collagen tensile strength by decreasing cross-links at points of hydroxylation
Keloid: excessive type III collagen; common in blacks
Pyogenic granuloma: exuberant granulation tissue; bleeds when touched
Healing primary intention: clean wound; appose wound margins with suture
Healing secondary intention: infected wound; leave wound open; myofibroblasts important
Liver injury: regenerative nodules; abnormal cytoarchitecture
Lung injury: type II pneumocyte repair cell
CNS injury: astrocyte and microglial cell repair cells; gliosis
WBC alterations acute inflammation: neutrophilic leukocytosis, left shift, toxic granulation
Erythrocyte sedimentation rate: increased fibrinogen enhances rouleau
C-reactive protein: indicator acute inflammation and inflammatory atheromatous plaque
Polyclonal gammopathy: diffuse elevation γ-globulins; ↑ IgG; chronic inflammation
Fluids and Hemodynamics

**Total body water:** ECF (plasma, interstitial fluid), ICF (cytosol)
**Osmosis:** $H_2O$ shift between ECF and ICF; controlled by serum Na$^+$ and glucose
**Edema:** increased fluid in interstitial space or body cavities; transudate, eduate, lymph
**Transudate:** protein and cell-poor fluid in interstitial space/body cavity; alteration Starling's forces
**Starling's forces:** oncotic pressure (albumin) keeps fluid in vessels, hydrostatic pressure pushes fluid out
**Pitting edema:** decreased oncotic pressure and/or increased hydrostatic pressure

$\uparrow$ **Hydrostatic pressure:** pulmonary edema in LHF; pitting edema of legs in RHF; portal hypertension

**Renal retention sodium and water:** $\uparrow$ hydrostatic pressure and $\downarrow$ oncotic pressure

**Causes renal retention sodium/water:** $\downarrow$ cardiac output (activation RAA system), primary renal disease

$\downarrow$ **Oncotic pressure (hypoalbuminemia):** kwashiorkor; nephrotic syndrome; cirrhosis

**Ascites in cirrhosis:** $\downarrow$ oncotic pressure, $\uparrow$ hydrostatic pressure

**Exudate:** protein and cell rich (pus); acute inflammation with $\uparrow$ vessel permeability

**Lymphedema:** radical mastectomy; filariasis; inflammatory carcinoma (lymphatics plugged by tumor)

**Thrombus:** endothelial injury, stasis, hypercoagulability

**Venous thrombus:** fibrin clot with entrapped RBCs, WBCs, platelets; deep veins below knee (stasis)

**Heparin/warfarin:** anticoagulants that prevent venous clot formation

**Arterial thrombus:** endothelial injury; platelets held together by fibrin

**Aspirin:** prevents platelet thrombus in arteries

**Pulmonary thromboembolism:** femoral vein site of origin

**Systemic thromboembolism:** majority from left heart

**Fat embolus:** long bone fractures; delayed symptoms (48 hrs); thrombocytopenia, hypoxemia

**Ammiotic fluid embolism:** DIC; lanugo hair in maternal pulmonary arteries

**Diving:** 1 atmosphere pressure increase with 33 foot descent into water; $N_2$ gas dissolved in tissue

**Decompression sickness:** release of $N_2$ gas from tissue with rapid ascent; ischemic damage

**Dyspnea, chest pain underwater:** pulmonary embolus

**Dyspnea, chest pain rising to surface:** spontaneous pneumothorax

**Hypovolemic shock (blood loss):** $\downarrow$ CO and LVEDP; $\uparrow$ PVR

**Cardiogenic shock:** $\downarrow$ CO; $\uparrow$ LVEDP and PVR

**Septic shock:** $\uparrow$ CO ($\uparrow$ venous return); $\downarrow$ PVR (vasodilation)

**Kidneys:** most susceptible organ in shock; straight portion proximal tubule most susceptible

**Shock complications:** ischemic ATN, multiorgan failure, $\uparrow$ AG metabolic acidosis

Neoplasia

**Tumors:** parenchyma neoplastic component

**Benign tumors:** epithelial (e.g., adenoma) or connective tissue (e.g., lipoma, leiomyoma)

**Carcinoma:** epithelial origin; squamous cell carcinoma, adenocarcinoma, transitional cell carcinoma

**Basal cell carcinoma:** invades but does not metastasize

**Squamous cell carcinoma:** lower lip, oral pharynx, larynx, lung, esophagus, skin, cervix

**Adenocarcinoma:** distal esophagus $\rightarrow$ colon, kidney, liver, pancreas, prostate, breast, lung, endometrium

**Transitional cell carcinoma:** renal pelvis, ureter, bladder

**Sarcoma:** malignancy of connective tissue origin; e.g., osteogenic sarcoma (bone)

**Liposarcoma:** MC sarcoma in adults

**Embryonal rhabdomyosarcoma:** MC sarcoma in children

**Teratoma:** ectoderm, endoderm, mesoderm derivatives; bone/teeth visible on x-ray

**Hamartoma:** normal tissue, normal size; bronchial hamartoma, Peutz Jeghers polypl

**Choristoma:** normal tissue aberrant tissue location; pancreatic tissue stomach wall

**Mixed tumor:** different morphologic patterns, same germ cell layer; pleomorphic adenoma parotid
Leukemia: malignancy of stem cells in bone marrow
Lymphoma: malignancy of lymph nodes
Extranodal lymphoma sites: stomach (MC), Peyer’s patches
Malignant tumors: invade and metastasize; benign tumors do not
Upregulate telomerase: increases telomere length; found in all neoplastic cells
Monoclonality: key finding in neoplastic vs normal cells
E-Cadherin: intercellular adhesion; lose adhesion in malignant cells
Malignant cells: receptors for laminin (basement membrane), fibronectin (ECM)
Invasion enzyme: type IV collagenase (basement membrane)
Angiogenesis: basic fibroblast growth factor, vascular endothelium growth factor
Metastasis: lymphatic, hematogenous, seeding; often more common than primary cancer
Carcinoma: lymph node→ hematogenous
Vessel invading carcinomas: renal cell carcinoma (renal vein, vena cava), hepatocellular carcinoma
Sarcoma: hematogenous
Seeding: ovarian cancer, periphery lung, CNS via spinal fluid
Sites where metastasis more common primary cancer: lung, bone, brain, liver, adrenal
Sites where primary cancer more common than metastasis: GI tract, kidney, urogenital
Bone metastasis: osteoblastic (radiodense); osteolytic (radiolucent)
Bone sites metastasis: vertebra MC (Batson venous plexus)
Osteoblastic metastasis: prostate cancer; increased serum AP, hypercalcemia
EM neurosecretory granules: carcinoid tumors, small cell carcinoma, neuroblastoma
EM thin and thick myofilaments: rhabdomyosarcoma
EM Birbeck granules: histocytic neoplasms (Langerhan’s histiocytosis)
Primary prevention: stop smoking; sun screen; high fiber diet
Cancers in children: leukemia (MC), CNS tumors, Burkitt’s, Ewing’s, neuroblastoma
Cancer vaccine: hepatitis B vaccine; prevents hepatocellular carcinoma
Cancer incidence men: prostate → lung → colorectal
Cancer incidence women: breast → lung → colorectal
Cancer mortality men: lung → prostate → colorectal
Cancer mortality women: lung → prostate → colorectal
Gynecologic cancers: endometrium→ ovary → cervix
Cervical Pap smear: decreased incidence of cervical cancer; detects cervical dysplasia
Malignant melanoma: fastest increasing in world
Southeast China: nasopharyngeal carcinoma (EBV)
Southeast Asia: hepatocellular carcinoma (HBV + aflatoxin)
Japan: stomach cancer
Africa: Burkitt’s lymphoma, Kaposi sarcoma (HHV-8)
Squamous dysplasia oropharynx, larynx, bronchus, cervix: risk for squamous cell carcinoma (SCC)
Chronic irritation sinus orifices, third degree burn scars: risk for SCC
Actinic (solar) keratosis: risk factor for SCC
Glandular metaplasia of esophagus (Barrett’s): risk factor for adenocarcinoma
Endometrial hyperplasia: risk factor for adenocarcinoma
Glandular (intestinal) metaplasia of stomach (Helicobacter): risk factor for adenocarcinoma
Chronic ulcerative colitis: risk factor for adenocarcinoma
Villous adenoma of rectum: risk factor for adenocarcinoma
Tubular adenoma of colon: risk factor for adenocarcinoma
Scal tissue in lung: risk factor for adenocarcinoma
Regenerative nodules in cirrhosis: risk factor for hepatocellular carcinoma
Complete hydatidiform mole: risk factor for choriocarcinoma
Dysplastic mole: MC risk factor for malignant melanoma
UVB light: MC risk factor for BCC, SCC, melanoma
HHV-8: MC risk factor for Kaposi's sarcoma
EBV: MC risk factor for nasopharyngeal carcinoma
Polycyclic hydrocarbons: MC risk factor for larynx (SCC), lung cancers
Asbestos: MC risk factor for mesothelioma
Polycyclic hydrocarbons: MC risk factor for oral cavity, mid-esophagus SCC
Barrett's esophagus: MC risk factor for distal esophagus adenocarcinoma
H. pylori: MC risk factor for stomach adenocarcinoma and lymphoma
Tubular adenoma, villous adenoma: MC risk factor for colon adenocarcinoma
HBV and HCV: MC risk factors for hepatocellular carcinoma
Vinyl chloride: MC risk factor for liver angiosarcoma
Gallstones, porcelain gallbladder: MC risk factor for gallbladder adenocarcinoma
Polycyclic hydrocarbons: MC risk factor for pancreas adenocarcinoma
Polycyclic hydrocarbons: MC risk factor for renal cell carcinoma
Polycyclic hydrocarbons: MC risk factor for urinary bladder
HPV + lack of circumcision: MC risk factor for penis SCC
Age: MC risk factor for prostate adenocarcinoma
Cryptorchid testis: MC risk factor for seminoma
Age > 50 with excess estrogen exposure: MC risk factor for breast and endometrial carcinoma
HPV 16/18: MC risk factor for vulva, vagina, cervix SCC
DES: MC risk factor for vagina/cervix clear cell carcinoma
Nulliparity: MC risk factor for surface derived ovarian cancer
Complete mole: MC risk factor for choriocarcinoma
Turner syndrome (XO): MC risk factor for dysgerminoma of ovary
Turner syndrome (XO/XY): gonadoblastoma of ovary
Ionizing radiation: MC risk factor for papillary cancer of thyroid
Family history (MEN Ia/Ib): MC risk factor for medullary carcinoma thyroid
Hashimoto's thyroiditis: MC risk factor for malignant lymphoma thyroid
Ionizing radiation: MC risk factor for osteogenic sarcoma
EBV: MC risk factor for primary CNS lymphoma in AIDS and Burkitt's lymphoma
Ionizing radiation: MC risk factor for acute/chronic myelogenous leukemia
EBV: MC risk factor for Burkitt's lymphoma
HTLV-1: MC risk factor for T cell leukemia/lymphoma
Bacterial causes cancer: H. pylori (stomach adenocarcinoma and lymphoma)
Parasitic causes cancer: S. hematobium (SCC bladder), C. sinensis (cholangiocarcinoma)
Carcinogenesis: mutations involving regulatory genes
Regulatory genes: protooncogenes, suppressor genes, anti-apoptosis genes
Types mutations: point mutation MC, translocation, amplification (↑ copies), overexpression (↑ activity)
Translocations: Burkitt's: t(8;14); CML t(9;22); follicular lymphoma: t(14;18); APL leukemia t(15;17)
Key cancer genes: TP53 suppressor gene, RAS protooncogene
Point mutation: inactivates suppressor genes (e.g., TP53), activates protooncogenes (e.g., RAS)
Amplification: activates ERB-B2
Overexpression: enhances activity of BCL-2
SIS POC: function— growth factor synthesis; mutation— overexpression
ERB-B2 POC: function— growth factor receptor; activation bad prognostic sign for breast carcinoma
RAS POC: function— GTP signal transduction; point mutation; 30% of all human cancer
ABL POC: function— non-receptor tyrosine kinase activity; translocation (9;22) causing CML
MYC POC: function— nuclear transcription; translocation (8;14) causing Burkitt's lymphoma
Inactivation suppressor genes: majority are point mutations; loss of suppression
Sporadic retinoblastoma: two hit theory; two separate point mutations of RB suppressor gene on #13
AD retinoblastoma: one hit theory; one already inactivated in germ cells
TP53 suppressor gene functions: G1-S phase inhibition, DNA repair, activation BAX apoptosis gene
Inactivation TP 53 suppressor gene: inactivation causes majority of human cancers
RB suppressor gene function: G1-S phase inhibition
Inactivation RB suppressor gene: retinoblastoma, osteogenic sarcoma
APC suppressor gene function: prevents nuclear transcription by catenin
Inactivation APC suppressor gene: familial polyposis
BRCA1-2 suppressor genes function: DNA repair
Inactivation BRCA 1/2 suppressor genes: breast, ovarian cancers
BCL-2 function: anti apoptosis gene (keeps cytochrome c in mitochondria)
BCL-2 gene: t(14;18) translocation of heavy chain causes overexpression; follicular B cell lymphoma
Xeroderma pigmentosum: AR; defect in DNA repair enzymes; ↑ risk for UVB light cancers
Hereditary non-polyposis syndrome: AD; inactivation DNA mismatch genes; colorectal cancer
Chromosome instability syndromes: AR; susceptibility to DNA damage; leukemias, lymphomas
Examples chromosome instability: Bloom syndrome, ataxia telangiectasia, Wiskott-Aldrich syndrome
Carcinogens: chemicals (MC), viruses, radiation, H. pylori, physical (squamous cancer in burn scar)
Polycyclic hydrocarbons: key chemical carcinogen (cigarette smoke)
Aflatoxins: produced from Aspergillus; hepatocellular carcinoma
Asbestos: lung cancer, mesothelioma
Thorium dioxide: hepatocellular carcinoma, cholangiocarcinoma
Aniline dyes: transitional cell carcinoma
Vinyl chloride: angiosarcoma of liver
Benzene: leukemia
Cyclophosphamide: transitional cell carcinoma of bladder
EBV: Burkitt's; CNS lymphoma (AIDS); Hodgkin's mixed cellularity; nasopharyngeal carcinoma
HBV and HCV: hepatocellular carcinoma
HPV: cervical, penis, and anorectal squamous cancers
HHV-8: Kaposi sarcoma
UVB-cancers: basal cell carcinoma, squamous cell carcinoma, malignant melanoma
Key host defense: cytotoxic CD8 T cells (type IV hypersensitivity)
Cachexia: due to tumor necrosis factor-α
Most common anemia: anemia chronic disease
Most common coagulopathy: hypercoagulability
Most common COD in cancer: gram negative infection
Acanthosis nigricans, seborrheic keratoses: possible markers for gastric adenocarcinoma
Clubbing: possible marker for lung cancer
Non-bacterial thrombotic endocarditis mitral valve: possible marker for pancreatic cancer
TNM staging: metastasis more important than nodal involvement
AFP: hepatocellular carcinoma, yolk sac tumors
PSA: prostate cancer
CEA: recurrence colorectal cancer
BJ protein: multiple myeloma
β-Human chorionic gonadotropin: choriocarcinoma
Calcitonin: medullary carcinoma thyroid; hypocalcemia
Small cell carcinoma lung: ADH (hypotremia), ACTH (ectopic Cushing's)
Renal cell carcinoma: EPO (polycythemia), PTH-related peptide (hypercalcemia)
Hepatocellular carcinoma: EPO (polycythemia), insulin-like factor (hypoglycemia)
Medullary carcinoma of thyroid: calcitonin (hypocalcemia), ACTH (ectopic Cushing's)
Squamous cell carcinoma of lung: PTH-related peptide (hypercalcemia)

Hematology

Erythropoietin: synthesized in peritubular capillaries
Reticulocyte count: measure of effective erythropoiesis; correct for degree of anemia
Extramedullary hematopoiesis: hematopoiesis outside bone marrow (e.g., spleen)
Newborn physiologic anemia: drop in Hb due to replacement of HbF RBCs with HbA
Pregnancy: Hb and Hct decreased; greater increase in plasma volume than RBC mass
Anemia: normal O₂ saturation and arterial PO₂
MCV: average volume of RBCs; useful for anemia classification
MCHC: average Hb concentration in RBCs
MCHC: ↓ in microcytic anemias; ↑ in spherocytosis
Thalassemias: ↓ MCV, ↑ RBC count
RDW: RBC size variation; ↑ iron deficiency; normal in other microcytic anemias
Mature RBC: anaerobic glycolysis; no mitochondria or HLA antigens
Total iron binding capacity: ↑ iron deficiency; ↓ anemia chronic disease, sideroblastic anemia
% Saturation: ↓ iron deficiency, anemia chronic disease; ↑ sideroblastic anemia
Serum ferritin: ↓ iron deficiency; ↑ anemia chronic disease, sideroblastic anemia, normal thalassemia
Microcytic anemias: iron deficiency MC, anemic chronic disease, thalassemia, sideroblastic anemia
Iron deficiency child: MCC Meckel's diverticulum
Iron deficiency woman < 50: MCC menorrhagia
Iron deficiency man < 50: MCC peptic ulcer disease
Iron deficiency men/woman > 50: MCC colon cancer
Stages iron deficiency: ↓ ferritin; ↓ Fe and % saturation, ↑ TIBC; normocytic then microcytic anemia
Anemia chronic disease: MC anemia in malignancy and alcoholics
α-Thalassemia trait: AR; two α-globin gene deletions; normal Hb electrophoresis
HbH disease: three α-globin gene deletions; hemolytic anemia; four β-globin chains
Hb Bart's disease: four α-globin gene deletions; four γ-globin chains
β-Thalassemia minor: AR; DNA splicing defect; ↑ HbA₂ and F; ↓ HbA
β-Thalassemia major: nonsense mutation with stop codon; hemolytic anemia; ↑↑Hbf, ↑ HbA₂
Sideroblastic anemia: defect in mitochondrial heme synthesis producing ringed sideroblasts
Causes sideroblastic anemia: alcohol, pyridoxine deficiency (isoniazid Rx of TB), Pb poisoning
Pb poisoning: inhibition ferrochelatase, δ-aminolevulinic acid dehydrase, ribonuclease
S/S Pb poisoning children: growth retardation; Pb in epiphyses; abdominal colic; encephalopathy
S/S Pb poisoning adult: peripheral neuropathy; proximal renal tubule damage (Fanconi's syndrome)
Lab Pb poisoning: coarse basophilic stippling RBCs; ↓ MCV; ↑ blood Pb; ↑ δ-aminolevulinic acid
Vitamin B₁₂: animal products; requires intrinsic factor for reabsorption in terminal ileum
Vitamin B₁₂: transfers methyl group to homocysteine
R factor: binds with B₁₂ in mouth, removed by pancreatic enzymes in small intestine
Vitamin B₁₂: involved in propionate metabolism; end-product succinyl CoA
Causes B₁₂ deficiency: vegan, PA MC, fish tapeworm, pancreatitis, bacterial overgrowth, Crohn's disease
PA: autoimmune destruction parietal cells; chronic gastritis body/fundus; achlorhydria; ↑ gastrin
Causes folate deficiency: alcohol MCC, poor diet, drugs, malabsorption, pregnancy, goat milk
Drugs and folate deficiency: alcohol, OC, phenytoin, methotrexate, trimethoprim, 5-fluorouracil
Intestinal conjugate in folate metabolism: inhibited by phenytoin
Jejunal uptake of monoglutamate form of folate: inhibited by alcohol and OC
Dihydrofolate reductase: inhibited by methotrexate, trimethoprim
Thymidylate synthase: inhibited by 5-fluorouracil
Folate deficiency: MCC of increased serum homocysteine
Lab in B12/folate deficiency: pancytopenia; hypersegmented neutrophils; ↑ homocysteine
Lab findings unique to B12 deficiency: ↑ gastrin (PA), ↑ methylmalonic acid
B12 reabsorbed absorbed after administration of intrinsic factor: PA
B12 reabsorbed absorbed after administration of antibiotics: bacterial overgrowth
B12 reabsorbed absorbed after administration of pancreatic extract: chronic pancreatitis
Acute blood loss: initially normal Hb and Hct; 0.9% saline uncovers RBC deficit
Aplastic anemia: drugs (e.g., phenylbutazone); infection (e.g., parvovirus); benzene
Lab findings aplastic anemia: pancytopenia; hypocellular bone marrow
Anemia in renal disease: normocytic; decreased EPO
Extravascular hemolysis: macrophage phagocytosis of RBCs; ↑ unconjugated bilirubin and urine UBG
Intravascular hemolysis: ↓ serum haptoglobin; hemoglobinuria; hemosiderinuria
Congenital spherocytosis: AD; defect in spectrin; extravascular hemolysis; splenomegaly
Blood findings in spherocytosis: normocytic anemia; dense RBCs, ↑ MCHC, ↑ osmotic fragility
PNH: missing decay accelerating factor; complement destruction RBCs, neutrophils, platelets
S/S PNH: pancytopenia; hemoglobinuria; positive sugar water test and acidified serum test
HbSS: AR; missense mutation (valine for glutamic acid 6th positive β-globin chain)
Causes of sickling: ↑ deoxyhemoglobin (hypoxemia, acidosis); HbS > 60%
HbF: inhibits sickling; hydroxyurea ↑ HbF
Pathophysiology HbSS: vasoocclusive crises, hemolytic anemia (extravascular)
HbSS children: dactylitis (6–9 mths); Streptococcus pneumoniae sepsis (dysfunctional spleen)
HbSS osteomyelitis: Salmonella paratyphi
HbSS complications: aplastic crisis (parvovirus), acute chest syndrome, autosplenectomy, calcium bilirubinate gallstones, priapism, aseptic necrosis
HbAS: microhematuria from sickling in renal medulla; renal papillary necrosis
Hb electrophoresis: HbAS—HbA 55–60%, HbS 40–45%; HbSS—HbS 90–95%, HbF 5–10%
Blood findings in HbSS: sickle cells; target cells; Howell-Jolly bodies (nuclear remnants)
G6PD deficiency: XR; oxidant damage (peroxide) to Hb (e.g., primaquine; dapsone; fava beans)
Blood findings G6PD deficiency: Heinz bodies (denatured Hb; special stain); bite cells
Pyruvate kinase deficiency: ↓ ATP; RBCs dehydrated; ↑ 2,3-BPG (right-shifted OBC)
Warm type AIHA: IgG; extravascular hemolysis; e.g., SLE, drugs
Cold type AIHA: IgM intravascular hemolysis; e.g., CLL, Mycoplasma
Penicillin: IgG antibody against penicillin attached to RBC (type II hypersensitivity)
Methyldopa: drug alters Rh antigens; IgG antibody against Rh antigens (type II hypersensitivity)
Quinidine: drug–IgM IC; intravascular hemolysis; type III hypersensitivity
Lab findings AIHA: positive direct Coombs'; spherocytes
Micro-macroangiopathic hemolysis: mechanical damage causing intravascular hemolysis
Causes of micro/macro hemolysis: aortic stenosis (MCC), DIC, TTP, HUS
Peripheral blood findings micro/macro hemolysis: schistocytes; iron deficiency from hemoglobinuria
Malaria: intravascular hemolysis correlates with fever; falciparum—ring forms and gametocytes
Leukemoid reaction: exaggerated WBC response to infection; usually due to infection
Leukoerythroblastic reaction: marrow infiltrative disease peripheralizes myeloblasts/nucleated RBCs
Causes of leukoerythroblastic reaction: bone metastasis MCC, myelofibrosis
Eosinophilia: type I hypersensitivity (e.g., penicillin reaction); invasive helminthic infection
Helminths not producing eosinophilia: pinworms, adult worms in ascariasis
Atypical lymphocytes: mononucleosis; CMV; toxoplasmosis; viral hepatitis; phenytoin
Mononucleosis: due to EBV; EBV attaches to CD21 receptors on B cells
Clinical findings mono: exudative tonsillitis, generalized lymphadenopathy, hepatosplenomegaly
Lab findings mono: atypical lymphocytosis; IgM heterophile antibodies against horse RBCs
Lymphopenia: T cell deficiencies (HIV); combined B/T deficiency (adenine deaminase deficiency)
Lymphocytosis: viral infections, whooping cough
Corticosteroids: lymphopenia, eosinopenia, neutrophilia
Chronic MPD: neoplastic stem cell disorder; splenomegaly; marrow fibrosis; risk for leukemia
Examples of MPD: polycythemia vera, myelofibrosis and myeloid metaplasia
Relative polycythemia: ↓ plasma volume; ↑ RBC count; normal RBC mass
Absolute polycythemia: ↑ RBC count and RBC mass
Appropriate polycythemia: hypoxic stimulus for EPO to generate RBCs
Causes of appropriate absolute polycythemia: lung disease; cyanotic heart disease, high altitude
Appropriate absolute polycythemia: normal plasma volume; ↑ RBC mass; ↓ SaO₂; ↑ EPO
Inappropriate absolute polycythemia: no hypoxic stimulus for EPO
Causes of inappropriate polycythemia: ectopic secretion EPO, polycythemia vera
Polycythemia vera: ↑ plasma volume and RBC mass; normal SaO₂; ↓ EPO
Ectopic EPO (renal cell carcinoma): normal plasma volume; ↑ RBC mass; normal SaO₂; ↑ EPO
Myelofibrosis myeloid metaplasia: marrow fibrosis; extramedullary hematopoiesis; splenomegaly
Lab findings in myelofibrosis: tear drop RBCs; dry bone marrow aspirate (marrow fibrosis)
Essential thrombocythemia: MPD with increase in abnormal appearing platelets
Myelodysplastic syndrome: severe anemia in elderly; 30% develop leukemia; ringed sideroblasts
Benzene: aplastic anemia; acute leukemia
Leukemia by age: ALL: newborn~14; AML: 15~60; CML: 40~60; CLL: > 60
Acute vs chronic leukemia: acute: blasts > 30% in bone marrow; chronic: blasts < 10% in bone marrow
AML: Auer rods in myeloblasts
Acute promyelocytic leukemia: t(15;17); defect in retinoic acid; Rx retinoic acid (↑ maturation); DIC
Acute monocytic leukemia: gum infiltration
CML: t(9;22) of ABL POC; Philadelphia chromosome 22; leukocyte alkaline phosphatase score
ALL: early pre-B (80%); CALLA (CD10) and TdT positive; CNS and testicle involvement
ALL: t(12;21) offers good prognosis
CLL: B cell neoplasm; ↓ γ-globulins; MCC generalized lymphadenopathy patients > 60-yrs-old
Adult T cell leukemia: HTLV-1; CD₄ T cells; skin infiltration; lytic bone lesions with hypercalcemia
Hairy cell leukemia: positive TRAP; splenomegaly; Rx with purine nucleosides
Nodal sites: germinal follicles: B cells; paracortex: T cells; sinuses: histiocytes
Testicular cancer: metastasizes to para-aortic nodes
Stomach cancer: metastasizes to left supraclavicular nodes (Virchow node)
Phenyltoin: atypical lymphocytosis
Cat scratch disease: Bartonella henselae; granulomatous microabscesses
Follicular B-cell lymphoma: t(14;18); overexpression of BCL-2 anti-apoptosis gene
Burkitt lymphoma: t(8;14); EBV association; common childhood NHL; "starry sky" appearance
Extranodal lymphomas: risk factors— H. pylori (stomach); Sjogren's syndrome
Mycosis fungoides: CD₄ T neoplasm; skin lesions with Pautrier's microabscesses
Sezary syndrome: leukemic phase of mycosis fungoides
Polyclonal gammopathy: sign of chronic inflammation
Monoclonal gammopathy: M component (spike); sign of plasma cell disorder
Confirmatory tests: serum and urine immunoelctrophoresis; bone marrow aspirate
Bence Jones protein: light chains in urine; predictive of a malignant plasma cell disorder
Multiple myeloma: M spike; lytic bone lesions; pathologic fractures; hypercalcemia; renal failure
MGUS: MC monoclonal gammopathy; may progress to myeloma
Findings in MGUS: elderly patient; no BJ protein; no malignant plasma cells
Waldenstrom's macroglobulinemia: lymphoplasmacytic lymphoma; IgM M spike; hyperviscosity
Hodgkin's lymphoma: neoplastic component Reed Sternberg (RS) cell; CD15 CD30 positive
Lymphocyte predominant Hodgkin's: infrequent classic RS cells
Nodular sclerosing Hodgkin's: female dominant; supraclavicular nodes + anterior mediastinal nodes
Mixed cellularity Hodgkin's: male dominant; numerous RS cells; EBV association
Hodgkin's prognosis: stage of disease and type of Hodgkin's most important factors

Alkylating agents in Rx of Hodgkins: ↑ risk for second malignancies (leukemia; NHL)

Langerhan's histiocytes: CD1 positive; Birbeck granules

Letterer-Siwe disease: malignant histiocytosis < 2-yr-s-old; diffuse eczematous rash; organ involvement

Hand-Christian disease: malignant; lytic skull lesions, diabetes insipidus, exophthalmos

Eosinophilic granuloma: benign histiocytosis; lytic bone lesions with pathologic fractures

Mast cells: release histamine (pruritus; swelling); metachromatic granules positive with toluidine blue

Urticaria pigmentosum: localized mastocytosis; skin lesions swell and itch with scratching

Amyloid: twisted β-sheet; apple green birefringence

Primary amyloidosis: AL amyloid derived from light chains; plasma cell disorders

Secondary amyloidosis: AA amyloid derived from serum-associated amyloid; chronic infections

Alzheimer's disease: amyloid precursor protein gene product chromosome 21; amyloid-β

Gaucher's disease: macrophages have fibrillary appearance; deficiency glucocerebrosidase

Niemann-Pick disease: macrophages have soap bubble appearance; deficiency sphingomyelinase

Hypersplenism: splenomegaly; peripheral blood cytopenias; portal hypertension MCC

Spleenic dysfunction: Howell Jolly bodies; susceptible to Streptococcus pneumoniae sepsis

Anticoagulants: tissue plasminogen activator, heparin, PGI2, ATIII, protein C/S

Heparin: enhances ATIII activity (neutralizes all factors except V, VIII, fibrinogen)

Protein C/S: neutralize V and VIII

Procoagulants: coagulation factors, thromboxane A2 (platelet aggregation, vasoconstrictor)

Protein C and S: inactivate factors V and VIII; enhance fibrinolysis

Von Willebrand factor: complexes with factor VIII to enhance VIII:C activity; platelet adhesion

Platelets: receptors for von Willebrand factor and fibrinogen; synthesize thromboxane A2

GpIb: platelet receptor for von Willebrands factor

GpIIb:IIIa: platelet receptor for fibrinogen

Extrinsic system factor: VII

Intrinsic system factors: XII, XI, IX, VIII

Final common pathway factors: X, V, prothrombin (II), fibrinogen (I)

Factor XIII: cross-links insoluble fibrin; strengthens fibrin clots

Vitamin K-dependent factors: prothrombin, VII, IX, X, protein C and S

Factors consumed in a clot: fibrinogen, prothrombin, V, VIII; fluid is called serum

Plasmin: cleaves fibrinogen and insoluble fibrin into degradation products

Bleeding time: evaluates platelet function (adhesion, release reaction, aggregation)

Aspirin: MCC of a prolonged bleeding time

Tests for vWF: ristocetin cofactor assay; vWF antigen assay; agar electrophoresis

PT: evaluates extrinsic pathway to fibrin clot

PTT: evaluates intrinsic pathway to stable fibrin clot

Fibrinolysis tests: fibrinogen degradation products; D-dimers (cross-linked insoluble fibrin)

S/S platelet dysfunction: cannot form temporary plug; epistaxis; petechiae; bleeding from scratches

Idiopathic thrombocytopenic purpura (ITP): children; antibodies against GpIib:IIIa; no splenomegaly

Chronic autoimmune thrombocytopenic purpura: SLE; antibodies against GpIib:IIIa receptors

Heparin: thrombocytopenia due to IgG antibody against heparin attached to PF4 on platelets

PF3: heparin neutralizing factor

HIV: thrombocytopenia MC hematologic abnormality; similar to ITP

TTP: platelet thrombi develop in areas of endothelial damage in small vessels; consumption of platelets

S/S: fever, thrombocytopenia, renal failure, hemolytic anemia with schistocytes, CNS deficits

Lab findings TTP: thrombocytopenia, prolonged bleeding time, normal PT and PTT

HUS: similar to TTP; endothelial injury from Shiga-like toxin of 0157:H7 E. coli in undercooked beef

S/S factor deficiency: no stable fibrin clot—late rebleeding; menorrhagia; GI bleeding; hemorrhages

Hemophilia A: XR; hemorrhages; prolonged PTT, ↓ factor VIII activity, normal VIII antigen
Von Willebrand's disease: AD; platelet adhesion defect + factor VIII deficiency
Lab findings in VWD: ↓ vWF, VIII antigen, and VIII:C; prolonged bleeding time
Desmopressin acetate: Rx of choice for mild von Willebrand's disease and hemophilia A
Circulating anticoagulants: antibodies destroy coagulation factors
Lab finding in circulating anticoagulant: prolonged PT and/or PTT corrected with mixing studies
Vitamin K deficiency: ↓ epoxide reductase activity (↓ function vitamin K); hemorrhagic diathesis; ↑ PT
Causes vitamin K deficiency: antibiotics MC, newborn, malabsorption, warfarin
DIC: activation coagulation system from release of tissue thromboplastin and/or endothelial cell damage
DIC: consumption coagulation factors by fibrin clots; patient also anticoagulated
Causes: septic shock MCC, rattlesnake bite, massive trauma, amniotic fluid
S/S: bleeding from all scratches, holes, needle sites
Lab findings DIC: thrombocytopenia, ↑ PT and PTT, D-dimers (best test), anemia
Antiphospholipid antibodies: lupus anticoagulant and anticardiolipin antibodies; vessel thrombosis
Warfarin: inhibits epoxide reductase; PT best test but PTT also prolonged
Warfarin: full anticoagulation in 3 days when γ-carboxylated prothrombin disappears
Warfarin: ingredient in rat poison; danger to children in households with grandparents on warfarin
Rx warfarin overanticoagulation: intramuscular vitamin K (6-8 hrs), fresh frozen plasma (immediate)
Heparin: enhances ATIII; PTT best test but PT also prolonged
OC: estrogen ↑ coagulation factor synthesis and ↓ ATIII; predisposes to thrombosis
Factor V Leiden: MC hereditary thrombosis; resistant to degradation by protein C/S
ATIII deficiency: no prolongation of PTT with administration of heparin
Hemorrhagic skin necrosis: post-warfarin therapy in patient with heterozygote protein C deficiency
M cells: specialized cells that transfer foreign antigens to lymphocytes in Peyer's patches
Blood group O: some patient have anti-AB-IgG antibodies; increased incidence duodenal ulcers
Blood group A: increased incidence of gastric carcinoma
Newborns: do not have natural blood group antibodies at birth (e.g., anti-A-IgM)
Elderly: may lose natural blood group antibodies; no hemolytic reaction to mismatched blood
Rh antigens: inherited in autosomal codominant fashion; Rh antigens include D, C, c, E, e
Atypical antibodies: antibodies against Rh or non-Rh blood group antigens (e.g., anti-D)
Duffy antigen: receptor for Plasmodium vivax; blacks often lack Duffy antigen
Antibody screen: indirect Coomb's test; detects atypical antibodies in serum
Cytomegalovirus: MC infection transmitted by blood transfusion; MC antibody
Hepatitis C: MCC of post-transfusion hepatitis
Major crossmatch: patient serum reacted against donor RBCs; does not guarantee RBC survival
Universal donor: blood group O; no antigens on the surface of RBCs
Universal recipient: blood group AB; no natural blood group antibodies in serum
Packed RBC transfusion: raises Hb by 1 gm/dL and Hct by 3%
Cryoprecipitate: fibrinogen and factor VIII
Fresh frozen plasma: replacement for multiple factor deficiencies (e.g., cirrhosis, DIC)
Allergic transfusion reaction: type I IgE-mediated hypersensitivity reaction
Febrile transfusion reaction: recipient anti-HLA antibodies react against donor leukocytes
Intravascular HTR: transfusion of ABO incompatible blood (e.g., A person receives B blood)
Extravascular HTR: antibody attaches to donor RBCs; macrophage phagocytosis and hemolysis
Positive direct Coomb's test: present in both types of hemolytic transfusion reactions
S/S: jaundice, no increase in Hb, hemoglobinuria
ABO HDN: mother O and baby A or B; transplacental passage of maternal anti-AB-IgG
ABO HDN: positive direct Coomb's test; spherocytes; MCC unconjugated hyperbilirubinemia first 24-hrs
Rh HDN: mother Rh (D antigen) negative and fetus Rh (D antigen) positive
Rh HDN: no hemolysis in first Rh incompatible pregnancy
Rh HDN: maternal anti-D crosses placenta; potential for hydrops fetalis; high risk for kernicterus
Rh immune globulin: anti-D; coats D antigen site on fetal RBCs in maternal circulation
Rh HDN lab: positive direct Coomb's; severe anemia and hyperbilirubinemia
ABO HDN: protects mother from Rh sensitization (development of anti-D antibodies)
O Rh negative mother with A Rh positive baby: A+ cells destroyed by mothers anti A-IgM
Blue fluorescent light: converts unconjugated bilirubin in skin into harmless water soluble dipyrrole

Cardiovascular

MV auscultation: apex
TV auscultation: left parasternal border
AV auscultation: right 2nd intercostal space
PV auscultation: left 2nd intercostal space
S1: closure MV and TV
S2: closure AV and PV
Inspiration: split in A2 and P2; due to increased blood in right side of heart
S3: abnormal; due to blood entering volume overloaded ventricle in early diastole
Causes S3: valve regurgitation; congestive heart failure
S4: abnormal; due to blood entering non-compliant ventricle with atrial contraction in late diastole
Causes S4: volume overloaded ventricle, hypertrophy
Murmurs: stretching valve ring or damage to valve
Inspiration: increases right sided abnormal heart sounds and murmurs
Expiration: increases left sided abnormal heart sounds and murmurs
Stenosis murmurs: problem in opening valve
Regurgitation murmurs: problem in closing valve
Valves opening in systole: AV and PV
Valves opening in diastole: MV and TV
Valves closing in systole: MV and TV
Valves closing in diastole: AV and PV
LDL: primary vehicle for carrying cholesterol
VLDL: primary vehicle for carrying liver-synthesized triglyceride
Familial hypercholesterolemia (type II): AD; deficiency of LDL receptors; ↑ LDL
Type III hyperlipoproteinemia: deficiency apo E; ↑ remnants (chylomicron, intermediate density)
Type IV hyperlipoproteinemia: ↑ VLDL; alcoholics
Apo B deficiency: deficiency apo B48 (chylomicrons) and B100 (VLDL); ↓ CH and TG
Clinical findings in apo B deficiency: malabsorption; hemolytic anemia
Atherosclerosis: reaction to injury of endothelial cells
Risk factors: smoking, ↑ LDL, ↑ homocysteine, Chlamydia pneumoniae infection
Cells involved: platelets, macrophages, smooth muscle cells, T cells with cytokine release
Fibrous plaque: pathognomonic lesion of atherosclerosis
C-reactive protein: marker of an inflammatory atheromatous plaque
Inflammatory atheromatous plaque: predisposes to platelet thrombosis
Increased plasma homocysteine: ↑ vessel thrombosis; folate (MC)/vitamin B12 deficiency
Hyaline arteriolosclerosis: small vessel disease of DM and hypertension; excess protein in vessel wall
Mechanisms hyaline arteriolosclerosis in DM: non-enzymatic glycosylation
Non-enzymatic glycosylation: glucose attaches to amino acids in BM; causes ↑ permeability to protein
Mechanisms hyaline arteriolosclerosis in hypertension: pressure pushes proteins into vessel wall
Abdominal aortic aneurysm rupture: due to atherosclerosis; flank pain, hypotension, pulsatile mass
Syphilitic aneurysm: vasculitis of vasa vasorum of aortic arch; aortic regurgitation
Aortic dissection: due to hypertension and collagen tissue disorders (e.g., Marfan)
Cystic medial degeneration: elastic tissue degeneration creates spaces filled with mucopolysaccharides
Intimal tear in aorta: due to wall stress from hypertension and structural weakness
Types of dissection: proximal (MC); distal or combination of both
S/S proximal aortic dissection: chest pain radiating to back, lack of pulse; cardiac tamponade MC COD
Marfan’s: AD; fibrillin defect; aortic regurgitation/dissection; lens dislocation; MVP with sudden death
MC COD Marfan’s and Ehlers Danlos: aortic dissection
Phlebothrombosis: stasis of blood flow; deep veins below knee MC site
Pulmonary thromboembolism: emboli originate from femoral veins
Superficial migratory thrombophlebitis: sign of carcinoma of head of pancreas
Thoracic outlet syndrome: absent radial pulse with positional change
Turner's syndrome: lymphedema hands/feet in newborn; preductal coarctation
Spider telangiectasia: arteriovenous fistula; due to hyperestrinism (cirrhosis, pregnancy)
Capillary hemangioma in newborn: regress with age; do not surgically remove
Kaposi's sarcoma: HHN-8; vascular malignancy; MC cancer in AIDS
Bacillary angiomatosis: Bartonella henselae; vascular infection in AIDS
Small vessel vasculitis: palpable purpura, e.g., Henoch Schönlein purpura
Muscular artery vasculitis: vessel thrombosis with infarction; e.g., classical polyarteritis nodosa
Elastic artery vasculitis: absent pulse, stroke
Takayasus' arteritis: pulseless disease young Asian woman
Giant cell arteritis: temporal artery granulomatous vasculitis; ipsilateral blindness (ophthalmic artery)
Classical polyarteritis nodosa: muscular artery vasculitis with vessel thrombus infarction
Path findings: vessel inflammation at different stages; aneurysms from vessel weakness
S/S: infarctions in kidneys, skin, GI tract, heart; HBsAg in 30%
Diagnosis: angiography identifies aneurysms and thrombosis
Kawasaki's disease: coronary artery vasculitis/thrombosis/aneurysms in children
S/S: chest pain; desquamating rash; swelling hands/feet; cervical lymphadenopathy
Rx: IV γ-globulin
Buerger's disease (thromboangiitis obliterans): smoker's digital vasculitis; digital infarction
Raynaud's syndrome: digital vasculitis in PSS and CREST syndrome
S/S: digital pain; white-blue-red color changes
Cryoglobulinemia: protein gels in cold temperature; Raynaud's syndrome; HCV association
S/S: acral cyanosis relieved by coming indoors
Wegener's granulomatosis: association with c-ANCA; sinusitis, lung infarction, crescentic GN
Microscopic polyangiitis: palpable purpura; crescentic GN; association with p-ANCA
Henoch-Schönlein purpura: IgA-anti-IgA ICs; palpable purpura buttocks/legs; arthritis; IgA GN
Serum sickness vasculitis: e.g., horse antivenin in Rx of rattlesnake envenomation
Rocky Mtn spotted fever: tick borne Rickettsia infection; vasculitis causes petechia on palms → trunk
Meningococcemia: sepsis causes petechia/ecchymoses; potential for Waterhouse Friderichsen syndrome
Essential HTN blacks: defect in renal excretion of sodium; ↑ plasma volume, ↓ PRA
Renovascular HTN: atherosclerosis renal artery in men; fibromuscular hyperplasia renal artery women
S/S: epigastric bruit; ↑ PRA affected kidney, ↓ PRA unaffected kidney
Endocrine HTN: 1o HPTH, Graves/hypothyroidism, Cushing's, 1o aldosteronism, pheochromocytoma
Hypertension: LVH MC complication; AMI MC COD followed by stroke and renal failure
Afterload: resistance ventricles contract against
Preload: volume ventricles must eject
Concentric LVH: increased afterload; e.g., essential HTN, aortic stenosis
LVH with dilation/hypertrophy: increased preload; e.g., valve regurgitation; left to right shunts
LHF: forward failure; pulmonary edema, pillow orthopnea, paroxysmal nocturnal dyspnea
Systolic dysfunction: LHF due to decreased ventricular contractility (ischemia)
Diastolic dysfunction: LHF due to decreased ventricular compliance (hypertrophy)
RHF: backward failure; ↑ venous hydrostatic pressure; neck vein distention, hepatomegaly, edema
ACE inhibitors: decrease afterload and preload in heart failure
Diuretics in CHF: reduce preload
Non-pharmacologic Rx in CHF: restrict salt and water
AMI: MC COD in United States; left anterior descending coronary artery thrombosis MCC
Exertional angina: coronary artery atherosclerosis; subendocardial ischemia; ST depression
Prinzmetal's angina: coronary artery vasospasm; transmural ischemia; ST elevation
Sudden cardiac death: death within 1 hr of symptoms
Path findings: severe coronary artery atherosclerosis; absence of occlusive thrombosis
LAD coronary artery: anterior portion left ventricle, anterior 2/3rds IVS
RCA: posterior portion left ventricle and papillary muscle, inferior 1/3rd IVS, right ventricle
AMI: rupture of inflammatory plaque produces platelet thrombus
Ventricular fibrillation: MC COD in AMI
AMI: no gross changes until 24 hrs
S/S AMI: retrosternal pain radiating down arms, diaphoresis
AMI ruptures: 3rd–7th day
Anterior wall rupture: MC type; LAD thrombosis; cardiac tamponade
Posteromedial papillary muscle rupture: RCA thrombosis; mitral regurgitation with LHF
IVS rupture: LAD thrombosis; left to right shunt; RHF
Mural thrombus: anterior AMI; danger embolization
Pericarditis: first week in transmural AMI; 6 wks later autoimmune
S/S: friction rub; leaning forward relieves pain
Ventricular aneurysms: late manifestation of AMI; precordial systolic bulge; CHF MC COD
Right ventricular infarction: RCA thrombosis; hypotension, RHF, preserved left ventricular function
Diagnosis of AMI: CK-MB and troponins; CK-MB absent by 3 days; troponins last 7–10 days
LDH isoenzymes: no longer used; LDH 1/2 flip indicates AMI
Reinfarction: reappearance CK-MB after 3 days
ECG findings in AMI: inverted T waves; ST elevation; Q waves
Ejection fraction: EF = stroke volume/left ventricular end-diastolic volume; 80/120 = 0.66
By-pass surgery: use internal mammary artery and saphenous veins ("arterialize" after 10 yrs)
Angioplasty complication: localized dissection with thrombosis
Umbilical vein: highest O$_2$ saturation
Ductus arteriosis in fetus: shunts blood from pulmonary artery to aorta; PGE keeps it open
Ductus arteriosis in newborn: closes and becomes ligamentum arteriosum
Eisenmenger's syndrome: cyanosis due to reversal of left to right shunt
VSD: MC congenital heart disease; ↑ SaO$_2$ right ventricle (RV), pulmonary artery (PA)
ASD: patent foramen ovale; ↑ SaO$_2$ right atrium (RA), RV, PA; MC adult congenital heart disease
Down syndrome: endocardial cushion defect (combined ASD and VSD)
PDA: machinery murmur; close with indomethacin; ↑ SaO$_2$ PA
Tetralogy of Fallot: degree of pulmonic stenosis determines if cyanosis is present
Tetralogy of Fallot: ↓ SaO$_2$ left ventricle, aorta
Tetralogy of Fallot: ASD and PDA are cardioprotective
Complete transposition: cyanosis; aorta empties RV; PA empties left ventricle
Complications cyanotic heart disease: 2° polycythemia; infective endocarditis; metastatic abscesses
Pre-ductal coarctation: Turner's syndrome
Post-ductal coarctation: constriction distal to ligamentum arteriosum
S/S: upper extremity HTN; claudication; rib-notching; activation RAA also causes HTN
Acute rheumatic fever: type II hypersensitivity; group A streptococcus pharyngeal infection
Acute rheumatic fever: sterile vegetations mitral valve (regurgitation); myocarditis with Aschoff nodule
S/S: polyarthritis (MC), carditis, erythema marginatum, rheumatoid nodules, chorea
Mitral stenosis: chronic rheumatic fever; opening snap followed by mid-diastolic rumble
Mitral stenosis: left atrial dilation/hypertrophy—atrial fibrillation, thrombus, pulmonary edema, RHF
MVP: myxomatous degeneration of mitral valve; common in Marfan syndrome, Ehlers Danlos
S/S: mid-systolic click followed by a murmur; palpitations, chest pain, rupture of chordae
MVP click/murmur close to S1: decrease preload (stand, Valsalva, anxiety)
MVP click/murmur close to S2: increase preload (supine, squat, clench fist)
Mitral regurgitation: pansystolic murmur; S3 and S4 common
Causes: LHF, infective endocarditis, acute rheumatic fever
Aortic stenosis: systolic ejection murmur; syncope and angina with exercise; hemolytic anemia
Aortic stenosis murmur increased preload: worsens obstruction and increases murmur intensity
Aortic stenosis murmur decreased preload: decreases obstruction and decreases murmur intensity
Causes: bicuspid aortic valve; age-related sclerosis
Aortic regurgitation: bounding pulses; early diastolic blowing murmur
Austin Flint murmur: diastolic murmur; regurgitant flow on anterior leaflet mitral valve
Significance Austin Flint murmur: sign for AV replacement
Causes aortic regurgitation: essential HTN, infective endocarditis, acute rheumatic fever, dissection
Tricuspid regurgitation: pansystolic murmur ↑ intensity with inspiration
Causes: endocarditis IV drug abuse; RHF; carcinoid heart disease
Carcinoid heart disease: tricuspid regurgitation, pulmonic stenosis
Infected endocarditis (IE): Streptococcus viridans MCC; Staphylococcus aureus MCC IVDA
IE prosthetic heart valve: Staphylococcus epidermidis (coagulate negative)
IE ulcerative bowel disease: Streptococcus bovis
S/S: IC vasculitis—Roth spot, splinter hemorrhages; regurgitant murmurs; metastatic abscesses
Lab findings: positive blood culture
Libman Sacks endocarditis: sterile vegetations mitral valve associated with SLE
Coxsackievirus: MCC of myocarditis (lymphocyte infiltrate in myocardium) and pericarditis
Parasitic cause myocarditis: leishmaniasis in Chagas disease
Pericardial effusion: all chamber pressures are uniformly increased
S/S: muffled heart sounds, pulsus paradoxus, inspiratory neck vein distention
Dx and Rx: echocardiogram, pericardiocentesis, respectively
Pulsus paradoxus: drop in blood pressure > 10 mm Hg with inspiration
Constrictive pericarditis: TB MCC worldwide; pericardial knock
Congestive cardiomyopathy: generalized chamber enlargement; low ejection fraction
Causes: postpartum, cardiotoxic drugs, hypothyroidism, alcohol
Hypertrophic cardiomyopathy: MCC of sudden death in young person (due to conduction defects)
Site of obstruction: anterior leaflet mitral valve drawn against asymmetric thickened IVS
Effect decreased preload on systolic murmur: worsens obstruction and increases murmur intensity
Effect increased preload on systolic murmur: reduces obstruction and decreases murmur intensity
Restrictive cardiomyopathy: decreased compliance
Causes: iron, amyloid, glycogen; sarcoidosis; tropical endocardial fibrosis
Cardiac myxoma: benign tumor left atrium; embolization; syncope
Cardiac rhabdomyoma: childhood tumor; association with tuberous sclerosis
U wave: hypokalemia; MCC diuretic therapy (e.g., thiazides; loop diuretics).
Peaked T wave: hyperkalemia; MCC renal failure
ST depression: subendocardial ischemia (e.g., classical angina pectoris).
ST elevation: transmural ischemia (e.g., AMI), pericarditis, ventricular aneurysm
Atrial fibrillation: MC chronic arrhythmia; absent P waves; danger for embolization
Ventricular premature beats: wide QRS complexes; MC arrhythmia in coronary care unit
Ventricular fibrillation: MCC of death in an AMI
Anterior AMI: Q waves I V1–V4
Inferior AMI: Q waves in II, III, and aVF. Right coronary artery thrombosis.
Wolff-Parkinson-White: short PR interval with normal P wave; delta wave on upstroke of R wave

Respiratory

Alveolar O₂ calculation: %O₂ breathing (713) - PCO₂/0.8
Increased A-a gradient: primary lung disease; left to right shunts in heart
Forced vital capacity: total amount of air expelled after a maximal inspiration
Forced expiratory volume 1 second: amount of air expelled in 1 second after maximal inspiration
Choanal atresia: cyanotic when breast feeding; turns pink when crying
Nasal polyps: allergic (MC; adults only), aspirin, cystic fibrosis
Nasal polyp in a child: requires sweat test to exclude cystic fibrosis
Triad asthma: patient on aspirin (pain syndrome) with nasal polyps, asthma
Obstructive sleep apnea (OSA): snoring with intervals of apnea (respiratory acidosis with hypoxemia)
S/S: danger cor pulmonale; requires sleep test; Rx- O₂ with continuous positive airway pressure
Sinusitis: maxillary sinusitis MC in adults; ethmoiditis MC in children; S. pneumoniae MC
Nasopharyngeal carcinoma: association with EBV; metastasize to cervical nodes
Laryngeal carcinoma: smoking MCC; hoarseness; squamous cell carcinoma
Resorption atelectasis: MCC of fever 24–36 hrs after surgery
S/S: ↓ percussion; absent fremitus, breath sounds; inspiratory lag; elevated diaphragm
RDS: decreased production surfactant; airway collapse; hyaline membranes
Type II pneumocytes: synthesize surfactant (lecithin, phosphatidylcholine); stored in lamellar bodies
Surfactant: reduces surface tension in airways; ↑ synthesis cortisol, thyroxine; ↓ synthesis insulin
Causes RDS: prematurity, maternal diabetes, C-section
Maternal diabetes: maternal hyperglycemia → fetal hyperglycemia → ↑ fetal insulin which ↓ surfactant
Complications RDS: O₂ FR injury (blindness, bronchopulmonary dysplasia); necrotizing enterocolitis
Typical community acquired pneumonia: Streptococcus pneumoniae MCC
Typical pneumonia: bronchopneumonia, lobar pneumonia
S/S: productive cough; consolidation—↓ percussion, ↑ tactile fremitus
Atypical community acquired pneumonia: interstitial pneumonia; Mycoplasma pneumoniae MCC
S/S: low grade fever, non-productive cough, no signs consolidation
Nosocomial pneumonia: Pseudomonas aeruginosa MCC (respirators); others— S. aureus, E. coli
Rhinovirus: MCC common cold; hand to mouth transmission
Respiratory syncytial virus: MCC pneumonia and bronchiolitis in child
Parainfluenza virus: MCC croup in child; trachea area of obstruction
Cytomegalovirus: basophilic intranuclear inclusion surrounded by halo
Influenza: superimposed pneumonia with S. aureus increases mortality
Rubeola: Warthin-Finkeldey multinucleated giant cells
Chlamydia pneumaticia: atypical pneumonia; association with coronary artery disease
Chlamydia trachomatis: pneumonia in newborns; staccato cough; wheezing
Coxiella burnetii: only rickettsia without a vector
Mycoplasma pneumoniae pneumaticia: crowded condition; cold agglutinins; azithromycin
Streptococcus pneumoniae pneumaticia: gram positive diplococcus; azithromycin
Staphylococcus aureus pneumaticia: tension pneumatoceysts in children with cystic fibrosis
Corynebacterium diphtheriae: toxin produces ADP ribosylation of elongation factor 2
Haemophilus influenza: exacerbation chronic bronchitis; acute epiglottitis in children
Inspiratory stridor child: croup, epiglottitis
Pseudomonas aeruginosa: MCC of pneumonia and death in cystic fibrosis; green sputum
Klebsiella pneumoniae: mucoid sputum in alcoholic
Legionella pneumophila: silver stain; water coolers/mist (grocery produce, restaurants, zoo rain forest
Mycobacterium tuberculosis: strict aerobe; MC COD due to infectious disease worldwide
*Candida albicans*: vessel invader; yeasts and pseudohyphae

*Cryptococcus immitis*: pigeon excreta; narrow-based bud

*Aspergillus fumigatus*: septate hyphae with fruiting body; fungus ball, extrinsic asthma, vessel invader

*Mucor species*: non-septate; vessel invader; frontal lobe abscess in DKA

*Coccidioides immitis*: Southwest deserts; inhalation arthrospores in dust; spherule with endospores

*S/S*: erythema nodosum (painful nodules lower legs)

*Histoplasma capsulatum*: Ohio/central Mississippi river valley; excreta bats (spelunker), chickens

*H. capsulatum*: simulates TB; yeasts phagocytosed by macrophages

*Blastomyces dermatitidis*: overlaps histoplasmosis; broad-based buds; skin lesion simulates cancer

*Pneumocystis carinii*: cysts and trophozoites; pneumonia in HIV; Rx- trimethoprim/sulfamethoxazole

**Primary TB**: upper portion (lower lobe, lower portion upper lobe)

**Primary TB**: Ghon focus (subpleural caseation); Ghon complex (spread to hilar nodes)

**Reactivation TB**: cavitation lesion in upper lobe; kidney MC extrapolmonary site

**MAI**: atypical TB; MC TB in AIDS

**CF**: AR; 3 nucleotide deletion chromosome 7; defective CFTR (degraded in Golgi apparatus)

**S/S**: pneumonia, malabsorption, males sterile; + sweat test; *P. aeruginosa* pneumonia MC COD

**Lung abscess**: MCC aspiration oropharyngeal material (mixed aerobe/anaerobe); x-ray– air/fluid level

**Aspiration sitting**: posterobasal segment right lower lobe

**Aspiration supine**: superior segment right lower lobe

**Aspiration right side**: right middle lobe, posterior segment right upper lobe

**Pulmonary thromboembolism**: most derive from femoral vein

**Bronchial artery**: branch of aorta/intercostal artery; protects against developing pulmonary infarction

**Saddle embolus**: sudden death due to acute right heart strain

**S/S pulmonary infarction**: dyspnea and tachypnea; pleuritic chest pain; pleural effusion

**Dx**: ventilation/perfusion scan; respiratory alkalosis; hypoxemia

**Pain on inspiration**: pleuritic inflammation; pulmonary embolus, pneumonia, pneumothorax

**Pathogenesis pulmonary hypertension (PH)**: hypoxemia and respiratory acidosis

**Hypoxemia + respiratory acidosis**: vasoconstriction pulmonary vessels; vasodilation cerebral vessels

**Causes PH**: 1° lung disease (COPD, restrictive), recurrent emboli, mitral stenosis, OSA, left-right shunts

**Cor pulmonale**: PH + RVH

**S/S**: dyspnea; accentuated P2 (PH); parasternal heave (RVH)

**Restrictive lung disease**: ↓ compliance, ↑ elasticity; interstitial fibrosis/edema

**Restrictive lung disease (RLD)**: ↓ all volumes and capacities; ↑ FEV₁/FVC ratio

**ARDS**: RLD; non-cardiogenic pulmonary edema due to alveolar injury

**ARDS**: neutrophil destruction type I and II pneumocytes; hyaline membranes

**Causes**: septic shock (MC), aspiration gastric contents, severe trauma

**Pneumoconiosis**: inhalation mineral dust causing interstitial fibrosis; particles < 0.5 μm reach alveoli

**Caplan syndrome**: pneumoconiosis + rheumatoid nodules in lungs

**Coal worker's**: "black lung" disease; progressive massive fibrosis; no increased incidence cancer or TB

**Silicosis**: quartz; nodular opacities; foundry workers; ↑ incidence cancer and TB

**Sources asbestos**: roofing material, old buildings (9/11), pipe-fitter shipyard

**Ferruginous bodies**: asbestos fiber coated by iron

**Asbestosis**: benign pleural plaques (MC); bronchogenic carcinoma (MC cancer); mesothelioma

**Mesothelioma**: malignancy of serosa; no smoking association

**Sarcoidosis**: RLD; MC non-infectious lung and liver granulomatous disease

**S/S**: dyspnea, hilar adenopathy (non-caseating granulomas), uveitis, nodular skin lesions

**Lab findings**: ↑ ACE, hypercalcemia (macrophages synthesize 1α-hydroxylase)

**Kveim test**: intradermal injection sarcoid antigens causes skin reaction

**Farmer's lung**: RLD; lung reaction against thermophilic bacteria in moldy hay

**Silo filler's disease**: RLD; reaction against nitrogen dioxide in fermenting corn
Byssinosis: RLD; reaction against cotton, linen, hemp products in textile industry

Goodpasture's syndrome: RLD; anti-BM antibodies; begins in lungs and ends in renal failure

Collagen vascular RLD: SLE, rheumatoid arthritis, systemic sclerosis

Drugs RLD: amiodarone, bleomycin, busulfan, cyclophosphamide, methotrexate, nitrofurantoin

Obstructive lung disease: ↑ compliance, ↓ elasticity

Obstructive lung disease: ↑ RV, TLC; ↓ TV, VC; ↓ FEV₁₂₀ and FVC; ↓ FEV₁₂₀/FVC ratio

Obstructive lung disease: asthma, emphysema, chronic bronchitis, bronchiectasis

Asthma: extrinsic (type I hypersensitivity) and intrinsic types

S/S: expiratory wheezing (inflamed terminal bronchioles); LTC4-, D4-, E4 bronchoconstrictors

Charcot Leyden crystals: derive from crystalline material in eosinophil granules

Lab findings: initial respiratory alkalosis; respiratory acidosis requires intubation

Emphysema: destruction elastic tissue respiratory unit; lung hyperinflation; smoking MCC; pink puffer

Respiratory unit: respiratory bronchiole, alveolar duct, alveoli

Radiograph emphysema: ↑ AP diameter; depressed diaphragms; vertical heart

Pathogenesis: ↓ AAT, ↑ neutrophil destruction elastic tissue

Centriacinar emphysema: destruction/distention respiratory bronchioles upper lobe in smokers

Panacinar emphysema: destruction/distention entire respiratory unit lower lobes; AAT deficiency

Paraseptal emphysema: upper lobe destruction/distention alveolar ducts, alveoli; pneumothorax

Lab findings: normal to decreased PCO₂ (respiratory alkalosis)

Chronic bronchitis: productive cough 3 months/2 consecutive years; blue bloater (cyanosis)

Site of obstruction: terminal bronchioles (proximal to respiratory unit)

Lab findings: respiratory acidosis/hypoxemia

Bronchiectasis: obstruction/infection key causes; dilated bronchi/bronchioles extend to periphery

Causes: CF MCC, TB, immotile cilia syndrome

Immotile cilia syndrome: absent dynein arm in cilia; sinusitis, infertility, bronchiectasis, situs inversus

Central lung cancers: squamous cancer and small cell cancer; men > women

Peripheral lung cancers: adenocarcinoma; women > men

Squamous lung cancer: cavitate; secrete PTH-related protein

Small cell carcinoma: neuroendocrine tumor; secrete ACTH and ADH

Bronchioloalveolar carcinoma: no smoking relationship; lung consolidation resembling pneumonia

Scar carcinoma: usually adenocarcinoma developing in old TB scar

Bronchial carcinoma: low grade malignant; hemoptysis; rare cause carcinoid syndrome

Metastatic lung cancer: more common than primary cancer; breast cancer MCC

Pancoast tumor: squamous carcinoma posterior mediastinum; destruction superior cervical ganglion

S/S: Horner's syndrome– lid lag, miosis, anhydrosis; lower brachial plexus injury

Solitary coin lesion: granuloma MCC

Superior vena caval syndrome: primary lung cancer obstructs vessel; venous congestion

Anterior mediastinal masses: thymoma; nodular sclerosis Hodgkin's; teratomas

Posterior mediastinal masses: usually neurogenic tumors of ganglia

Myasthenia gravis: B cell hyperplasia of thymus MC abnormality; association with thymoma

Thymoma: association with hypogammaglobulinemia, autoimmune disease, pure RBC aplasia

Pleural effusions: transudates or exudates; CHF MCC

Spontaneous pneumothorax: rupture subpleural or intrapleural bleb; air/pleural cavity pressure same

S/S: pleuritic chest pain, dyspnea, tracheal shift ipsilateral side, absent breath sounds

Tension pneumothorax: flap-like pleural tear; increased pleural cavity pressure; compression atelectasis

S/S: as above except tracheal shift to opposite side

Gastrointestinal

Cleft lip/palate: failure of fusion of facial processes
Herpes labialis: multinucleated giant cell with acidophilic intranuclear inclusions on Tzanck prep
Hairy leukoplakia: EBV glossitis; pre-AIDS defining lesion; not precursor to cancer
Mumps: bilateral parotitis; unilateral orchitis; ↑ amylase
Diphtheria: pseudomembrane pharynx and trachea with cervical lymphadenopathy
Congenital syphilis: notched central incisors
Actinomycosis: anaerobic gram + filamentous bacteria; complication extracted dental abscess
S/S: draining sinuses with sulfur granules
Exudative tonsillitis: majority are viral; 20% group A streptococcus
Oral thrush: common in newborn; pre-AIDS defining lesion; yeasts and pseudohyphae
Dental caries: Streptococcus mutans
Peutz-Jegher's syndrome: mucosal pigmentation; hamartomatous polyps
Leukoplakia/erythroleukoplakia: biopsy to rule out squamous dysplasia or cancer
Squamous cell carcinoma: smoking and alcohol association; lower lip MC site
Smokeless tobacco: verrucoid squamous cell carcinoma
Gum hyperplasia: phentoyin, pregnancy, scurvy
Pleomorphic adenoma: MC benign tumor of salivary glands; parotid MC site
Mucoepidermoid carcinoma: MC malignant tumor major and minor salivary glands
Dysphagia for solids only: lesion obstructing esophagus; e.g., cancer; web
Plummer-Vinson syndrome: iron deficiency anemia causes esophageal web, glossitis, achlorhydria
Dysphagia for solids and liquids: motor abnormality; e.g., achalasia MCC; PSS or CREST syndrome
TE fistula: polyhydramnios; proximal esophagus ends blindly; distal esophagus derives from trachea
VATER syndrome: vertebral abnormalities, anal atresia, TE fistula, renal disease/radius abnormality
Zenker's diverticulum: MC pulsion diverticulum of esophagus; halitosis
GERD: relaxation of lower esophageal sphincter (LES) with acid reflux
GERD: MCC nocturnal cough and asthma
AIDS esophagitis: Candida MC, CMV, HSV
Barrett's esophagus: glandular metaplasia distal esophagus in GERD
Complications of Barrett's: precursor for adenocarcinoma, stricture
Esophageal varices: dilated left gastric coronary vein; sign portal hypertension from cirrhosis
Mallory Weiss syndrome: tear of distal esophagus from retching in alcoholic or bulimic
Boerhaave's syndrome: rupture of distal esophagus from retching; pneumomediastinum
Hamman's mediastinal crunch: pneumomediastinum (air in subcutaneous tissue)
LES ganglion cells: contain VIP—relaxes LES
Achalasia: failure relaxation LES (no VIP); absent ganglion cells myenteric plexus
S/S: aperistalsis/dilation of esophagus; regurgitation undigested food at night
X-ray achalasia: bird's beak appearance
Acquired achalasia: Chagas' disease; leishmania destroy ganglion cells
Distal adenocarcinoma esophagus: MC primary cancer; due to Barrett's esophagus
Squamous cell carcinoma of esophagus: smoking MCC; alcohol also causes
Melena: sign of upper GI bleed; acid changes Hb to hematin; peptic ulcer disease MCC
Hematemesis: vomiting blood; peptic ulcers MCC
Congenital pyloric stenosis: hypertrophy pyloric muscle; vomiting non-bile stained fluid in 2–4 weeks
Acute hemorrhagic (erosive) gastritis: NSAIDs MCC
Mucous barrier stomach: maintained by PGE; misoprostol PGE analog
Type A chronic gastritis: due to PA; achlorhydria with ↑ serum gastrin
Type B chronic gastritis: due to H. pylori; involves pylorus and antrum
H. pylori: curved rod; urease producer; MCC PUD, adenocarcinoma, gastric lymphoma
Gastric ulcer: lesser curvature pylorus and antrum; poor defense against acid; food aggravates pain
Duodenal ulcer: never malignant; ↑ acid production; food relieves pain
Perforated peptic ulcer: air under diaphragm causes pain in left shoulder
Menetrier's disease: giant rugal hyperplasia; protein loss from increased mucus
Zollinger-Ellison syndrome: malignant islet cell tumor secreting gastrin; part of MEN I syndrome
S/S: PUD in usual locations; sometimes multiple ulcers
Hypergastrinemia: ZE, achlorhydria, gastric distention, H2 or proton blockers, renal failure
Leiomyoma: MC benign tumor of stomach
Intestinal type adenocarcinoma: H. pylori related; ↓ incidence; lesser curvature pylorus/antrum
Diffuse type adenocarcinoma: limitis plastica; signet ring cells; Krukenberg tumors ovaries
Gastric lymphoma: stomach MC site for extranodal lymphomas; H. pylori associated
Malabsorption: steatorrhea; chronic pancreatitis, bile salt deficiency, small bowel disease
Causes bile salt deficiency: liver disease, bile salt resins, cholestasis, bacterial overgrowth, Crohn's
D-xylene screen: failure to reabsorb xylose indicates small bowel disease
Calcification of pancreas: chronic pancreatitis cause of malabsorption
Celiac disease: autoimmune disease; antibodies against gliadin in gluten; flat villi
Celiac disease: association with dermatitis herpetiformis
Whipple's disease: systemic infection; foamy macrophages with bacteria in small bowel submucosa
S/S: fever, polyarthritis, skin pigmentation
Invasive diarrhea: Campylobacter jejuni MCC; positive fecal smear for leukocytes
Secretory diarrhea: loss isotonic fluid; enterotoxins from E. coli and V. cholerae
Osmotic diarrhea: hypotonic loss fluid; laxatives, lactase deficiency
Rotavirus: MCC diarrhea in children
Norwalk virus: MCC diarrhea in adults
Cytomegalovirus: common cause diarrhea in AIDS; MCC cholecystitis and pancreatitis in AIDS
Staphylococcus aureus: preformed toxin causes food poisoning; culture food
Bacillus cereus: preformed toxin in fried rice and tacos; gram positive rods in stool
C. botulinum (adult): preformed neurotoxin (blocks acetylcholine release); paralysis and mydriasis
C. botulinum (child): colonization of bowel with release of neurotoxin; eating honey
C. difficile: pseudomembranous colitis post-antibiotics; toxin assay stool; Rx metronidazole
Shigella sonnei: produces dysentery (bloody diarrhea); associated with HUS
Salmonella enteritidis: gastroenteritis; animal reservoirs- poultry, turtles
Salmonella paratyphi: sepsis; osteomyelitis in HbSS
Salmonella typhi: typhoid fever; human transmission; bradycardia, neutropenia, splenomegaly
Carrier state site: gallbladder
M. tuberculosis: MCC intestinal TB in United States (swallow TB); Peyer's patch site of infection
Enterotoxigenic E. coli: secretory diarrhea (traveler's diarrhea); toxin stimulates guanylate cyclase
Vibrio cholerae: secretory diarrhea; toxin stimulates adenylate cyclase to produce cAMP
Oral Rx cholera: solution must contain glucose to reabsorb Na⁺ (cotransport)
Yersinia enterocolitica: mesenteric lymphadenitis; sepsis in iron overload states
Entamoeba histolytica: dysentery; trophozoites phagocytose RBCs; liver abscess; Rx metronidazole
Cryptosporidium parvum: MCC diarrhea in AIDS; acid-fast oocysts
Giardia lamblia: MC protozoal cause of diarrhea; cause of malabsorption; Rx metronidazole
Trichuris trichiura: rectal prolapse in children
Enterobius vermicularis: anal pruritus; urethritis in girls; no eosinophilia
Ascaris lumbricoides: intestinal obstruction due to adult worms; no eosinophilia
Necator americanus: hookworm; iron deficiency anemia
Strongyloides stercoralis: rhabditiform larvae in stool not eggs
Diphyllobothrium latum: fish tapeworm; vitamin B12 deficiency
Signs of small bowel obstruction: colicky pain; constipation and obstipation
Radiograph small bowel obstruction: air-fluid levels on x-ray
MCC small bowel obstruction: adhesions from previous surgery
Duodenal atresia: vomiting bile-stained fluid at birth; double bubble sign; Down syndrome
Hirschsprung disease: absent ganglion cells in submucosal/myenteric plexus rectosigmoid
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S/S: proximal bowel dilated but peristalses; no stool in rectal vault
**Hirschsprung association:** Down syndrome; Chagas disease
**Intussusception:** terminal ileum telescopes into cecum; obstruction plus bloody diarrhea
**Meconium ileus:** complication of cystic fibrosis
**Indirect inguinal hernia:** second MCC of small bowel obstruction; common in weight lifting
**Gallstone ileus:** obstruction of small bowel with gallstone + air in biliary tree
**Volvulus:** MC due to sigmoid colon twisting around mesentery
**Direct inguinal hernia:** protrudes through center of triangle of Hesselbach; no obstruction
**Umbilical hernia:** common in black children; may entrap bowel in adults
**Sigmoid colon:** MC site for polyps, cancer, diverticula
**Small bowel infarction:** diffuse abdominal pain with bloody diarrhea
**Causes small bowel infarction:** embolism (atrial fibrillation), thrombosis SMA or SMV
**Ischemic colitis:** splenic flexure pain with bloody diarrhea
**Mesenteric angina:** pain in splenic flexure 30 minutes after eating
**Angiodysplasia:** submucosal dilation of venules in cecum; cause of hematochezia
**Hematochezia:** massive loss of blood per rectum; diverticulosis MCC
**Meckel's diverticulum:** persistence omphalomesenteric duct
S/S: bleeding MC (iron deficiency in children), diverticulitis
**Meckel's diverticulitis:** mimics acute appendicitis; cannot differentiate without radionuclide scan
**Sigmoid diverticulum:** diverticulitis MC complication; MCC hematochezia and fistula formation
**Diverticulitis:** "left-sided acute appendicitis"
**Ulcerative colitis:** mucosal/submucosal ulceration; starts in rectum; crypt abscess; ↑ risk adenocarcinoma
S/S: left lower quadrant crampy pain with bloody diarrhea
**UC associations:** primary sclerosing cholangitis, seronegative HLA B27 + spondyloarthropathy
**Crohn's disease:** transmural inflammation; terminal ileum involved 80%; granulomas; skip lesions
S/S: colicky pain and diarrhea; fistulas (anal, bowel to bowel)
**Carcinoid tumor:** appendix MC site; terminal ileum MC site for carcinoid syndrome
**Carcinoid syndrome:** liver metastasis; flushing/diarrhea due to serotonin; increased urine 5-HIAA
**Tubular adenomas:** precursor lesion colon cancer; size and number determine risk of malignancy
**Villous adenoma:** greatest risk for colon cancer (30%); secrete mucus rich in protein and potassium
**Familial polyposis:** AD with 100% penetrance for developing colon cancer
**Gardner's syndrome:** AD, polyposis plus osteomas and desmoid tumors
**Turcot's syndrome:** AD, polyposis plus brain tumors
**Colorectal cancer:** second MC cancer and cancer killer in adults
**Left-sided colorectal cancer:** obstruct; MC location rectosigmoid
**Right-sided colorectal cancer:** bleed
**Acute appendicitis:** due to lymphoid hyperplasia in children and obstruction by fecolith in adults
**External hemorrhoids:** thrombose
**Internal hemorrhoids:** bleed; prolapse out of rectum

**Hepatobiliary/pancreas**

**Urobilinogen (UBG):** breakdown product CB in bowel (color of stool)
UBG: enterohepatic circulation to liver and kidney (color of urine)
**Alcoholic liver disease:** serum AST > ALT; ↑ serum GGT
**Viral hepatitis:** serum ALT > AST
**Cholestasis markers:** serum AP and GGT
**Unconjugated bilirubin:** macrophage degradation of heme; lipid soluble; never in urine
**Conjugated bilirubin (CB):** water soluble; never normal in urine
% CB < 20% (unconjugated): Gilberts, spherocytosis, physiologic jaundice newborn, ABO/Rh HDN
Gilbert's disease: AD; ↓ uptake and conjugation; bilirubin increases with fasting
Physiologic jaundice newborn: unconjugated hyperbilirubinemia; begins on day three
% CB 20–50%: viral/alcoholic hepatitis
% CB > 50%: bile duct obstruction (intra or extrahepatic); carcinoma head of pancreas
Negative urine bilirubin + trace urobilinogen: normal urine
Positive urine bilirubin, absent urobilinogen: obstructive jaundice
Positive urine bilirubin + increased urobilinogen: hepatitis
Negative urine bilirubin + increased urobilinogen: extravascular hemolytic anemia
Markers of severity of liver disease: albumin, PT
Hepatitis A: protective antibodies; day care centers, jails, homosexuals, traveling; not chronic
Hepatitis B: protective antibodies; accidental needle stick, IVDA; hepatocellular cancer
Hepatitis C: no protective antibodies; post-transfusion hepatitis; chronic state; hepatocellular cancer
Hepatitis D: no protective antibodies; requires HBsAg
Anti-HBs alone: vaccination
Anti-HBs + anti-HBc-IgG: recovered from HBV
HBsAg + HBeAg + HBV DNA + anti-HBc-IgM: acute HBV/chronic HBV infective carrier if >6 mths
Anti HBe-IgM alone: serologic gap; not infective
HBsAg + anti-HBc-IgM: chronic HBV healthy carrier
Fulminant hepatic failure: viral hepatitis and acetaminophen MC causes
Spontaneous peritonitis: E. coli in adults; S. pneumoniae in children; complication of ascites
Granulomatous hepatitis: TB MC bacteria
amebiasis: E. histolytica; flash shaped ulcers in cecum; liver abscess; Rx: metronidazole.
Echinococcosis: Echinococcus granulosus; sheep dog definitive host; man intermediate host
Schistosomiasis: Schistosoma mansoni; adult worms in portal vein; “pipe stem cirrhosis”
Clonorchiasis: Clonorchis sinensis; ingesting encysted larvae in fish; cholangiocarcinoma
Congestive hepatomegaly (centrilobular necrosis): "nutmeg" liver; RHF MCC
Hepatic vein thrombosis: Budd-Chiari syndrome; painful hepatomegaly; ascites; portal hypertension
Portal vein thrombosis: ascites, portal hypertension, no hepatomegaly
Alcohol related disorders: fatty change; alcoholic hepatitis; cirrhosis
Hypertriglyceridemia in alcoholics: ↑ synthesis of glycerol 3P (substrate for TG synthesis)
Hypoglycemia in alcoholics: ↓ gluconeogenesis (↑ NADH causes pyruvate to convert to lactate)
Ketoacidosis in alcoholics: ↑ lactate, ↑ βOHB (acetyl CoA converted to AcAc and then β-OHB)
Primary biliary cirrhosis: granulomatous destruction triad bile ducts; anti-mitochondrial antibody
Primary sclerosing cholangitis: association with ulcerative colitis; MCC of cholangiocarcinoma
Extrahepatic biliary atresia: neonatal cholestasis
Drugs causing hepatitis: acetaminophen, isoniazid, halothane
Anabolic steroids: intrahepatic cholestasis
Estrogen/oral contraceptives: intrahepatic cholestasis; hepatic adenoma (intraperitoneal hemorrhage)
Methotrexate: liver fibrosis, fatty change
Liver angiosarcoma: vinyl chloride
Hemochromatosis: AR; increased iron reabsorption; liver target organ
S/S: cirrhosis; "bronze diabetes" – skin pigmentation + destruction of islet cells; malabsorption
Lab: ↑ serum ferritin, iron, % saturation; ↓ TIBC
Wilson's disease: AR disease; defect in copper excretion in bile and synthesis of ceruloplasmin
S/S: cirrhosis, movement disorder (necrosis in putamen), Kayser Fleisher ring (Descemet's membrane)
Lab: ↓ ceruloplasmin (causes ↓ total copper); ↑ serum/urine free copper
HELPP syndrome: pre-eclampsia; Hemolytic anemia, ELevated transaminases, Low Platelets
AAT deficiency in child: AR, cannot secrete AAT from liver cell; cirrhosis; hepatocellular carcinoma
Reye syndrome: coma and microvesicular fatty change post viral infection; increased ammonia
Cirrhosis: irreversible fibrosis; regenerative nodules; portal hypertension

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Causes cirrhosis: alcohol (MC), HBV/HCV, hemochromatosis, Wilson's, AAT deficiency, 1⁰ biliary
Hepatic encephalopathy: mental status changes; ↑ serum ammonia
Portal hypertension: ascites; varices; splenomegaly; hemorrhoids; caput medusae
Cause of ascites: portal hypertension; hypoalbuminemia; secondary aldosteronism
Rx: use aldosterone blocker (acidosis increases loss ammonium in stool)
Hyperestrinism in men: gynecomastia; spider angiomas; female hair distribution
Lab findings cirrhosis: ↓ BUN, glucose, sodium, potassium, calcium (↓ vitamin D); ↑ PT
Liver cell adenoma: estrogen related; intraperitoneal hemorrhage
Liver cancer: metastasis MC cancer; lung cancer MC primary site
Hepatocellular carcinoma: chronic HBV and HCV MCC; ↑ AFP; hepatic/portal vein invasion
Cholangiocarcinoma: primary sclerosing cholangitis MCC, C. sinensis
Pathogenesis cholesterol stones: bile with too much cholesterol and too little bile salts
Black pigment stones: sign of extravascular hemolytic anemia (spherocytosis, HbSS)
Acute cholecystitis: stone impacted in cystic duct; right upper quadrant colicky pain radiation to shoulder
Chronic cholecystitis: chemical inflammation
Gallbladder cancer: risk factors—cholelithiasis and porcelain gallbladder
Acute pancreatitis: causes—alcohol and gallstones; ↑ amylase and lipase (more specific)
S/S: epigastric pain with radiation into back
Sentinel loop: localized ileus of duodenum due to acute pancreatitis
Pancreatic pseudocyst: abdominal mass; persistence of ↑ serum amylase > 1 week
Chronic pancreatitis: alcohol abuse, CF; malabsorption, pain, type 1 diabetes
Pancreatic cancer: smoking MCC
S/S: jaundice/acholic stools; palpable gallbladder; superficial migratory thrombophlebitis

Kidney, lower urinary tract

First sign tubule cell dysfunction: inability to concentrate urine
Fixed specific gravity: chronic renal failure; cannot concentrate or dilute urine
Negative urine bilirubin + trace urobilinogen: normal urine
Positive urine bilirubin, absent urobilinogen: obstructive jaundice
Positive urine bilirubin + increased urobilinogen: hepatitis
Negative urine bilirubin + increased urobilinogen: extravascular hemolytic anemia
Positive urine nitrite + positive urine leukocyte esterase: urinary tract infection
Sterile pyuria: positive urine leukocyte esterase but negative standard culture; TB, C. trachomatis
Prerenal azotemia: ↑ BUN and creatinine; ↓ renal blood flow (e.g., heart failure, hypovolemia)
Renal azotemia: ↑ BUN and creatinine due to intrinsic renal disease (acute tubular necrosis)
Postrenal azotemia: ↑ BUN and creatinine due to obstruction to urine flow
Serum BUN:creatinine ratio: < 15:1 (renal failure); > 15:1 (prerenal or postrenal azotemia)
BUN 80 mg/dL:creatinine 8 mg/dL: ratio 10/1—renal failure
BUN 80 mg/dL:creatinine 2 mg/dL: ratio 40/1—prerenal azotemia or postrenal azotemia
Creatinine clearance: measures GFR
Proteinuria: important sign of renal dysfunction
RBC casts: nephritic type of glomerulonephritis
WBC casts: acute pyelonephritis, acute tubulointerstitial nephritis
Fatty casts with Maltese crosses: nephrotic syndrome
Hyaline casts: normal unless associated with proteinuria
Renal tubular cell casts: acute tubular necrosis
Waxy or broad casts: chronic renal failure
Cystinuria: hexagonal crystals
Horseshoe kidney: Turner's syndrome; lower poles fused
Renal dysplasia: MC childhood cystic disease; abnormal development; flank mass
Maternal oligohydramnios: fetal juvenile polycystic kidney disease; Potter's facies in newborn
Adult polycystic kidney disease: AD; hypertension MC sign; cerebral berry aneurysms
Visceral epithelial cells: synthesize basement membrane
Glomerular BM: negative charge due to heparan sulfate
Nephritic syndrome: oliguria; RBC casts; hypertension; mild to moderate proteinuria
Nephrotic syndrome: proteinuria > 3.5 g/day; ascites and pitting edema; fatty casts; fusion of podocytes
Immunofluorescence: linear (anti-glomerular BM antibodies); granular (IC deposition)
IgA GN: MC GN; usually nephritic; episodic hematuria; mesangial IC (IgA-anti-IgA) deposits
Post-streptococcal GN: nephritic; subepithelial deposits; skin/pharyngeal infections; anti-DNAase B
SLE type IV GN: nephritic; subendothelial deposits; anti-DNA antibodies
Crescentic GN: crescents from parietal cell proliferation; worst GN; Goodpasture's, Wegener's
Goodpasture's: nephritic; anti-BM antibodies (glomerular + pulmonary capillary); crescentic GN
S/S: young male with hemoptysis progressing to renal failure
Minimal change disease (lipoid nephrosis): MCC childhood nephrotic syndrome
Lipoid nephrosis: podocyte fusion; loss of negative charge in glomerular BM
Focal segmental glomerulosclerosis: nephrotic syndrome; AIDS and IV heroin abuse
Membranous GN: MCC adult nephrotic syndrome; subepithelial deposits; epimembranous spikes
Causes membranous GN: HBV, ACE inhibitors, cancer
Type I MPGN: nephrotic; subepithelial deposits; HCV association; tram tracks
Type II MPGN: nephrotic; C3 nephritic factor; intramembranous ICs (dense deposit disease)
DM nodular glomerulosclerosis: microalbuminuria first sign
DM glomerulosclerosis: nodules with collagen in mesangium; hyaline arteriolosclerosis of arterioles
ACE inhibitors DM glomerulosclerosis: inhibit angiotensin II vasoconstriction of efferent arterioles
Alport's syndrome: XD hereditary nephritis with sensorineural hearing loss
Ischemic ATN: prerenal azotemia MCC; renal tubular cell casts; BUN:creatinine ratio < 15:1
Ischemic ATN: disruption of BM in proximal tubule and thick ascending limb
Nephrotic ATN: aminoglycosides, IV dye, Pb/mercury poisoning
Nephrotic ATN: proximal tubule dysfunction; intact BM
Oliguria: prerenal azotemia, ATN, glomerulonephritis, postrenal azotemia
Acute pyelonephritis: vesicoureteral reflux with ascending infection; WBC casts, fever, flank pain
Chronic pyelonephritis: U-shaped scars overlying blunt calyces
Drug-induced tubulointerstitial nephritis: type I/IV reaction; e.g., penicillin
S/S: ARF, fever, rash, eosinophilia, eosinophiluria, WBC casts
Analgesic nephropathy: aspirin plus acetaminophen; renal papillary necrosis; IVP with ring defect
Myeloma kidney: BJ protein produces foreign body reaction in tubules
Urate nephropathy: prevent by giving allopurinol prior to chemotherapy
CRF: fixed specific gravity; BUN:creatinine < 15:1; waxy and broad casts
Renal osteodystrophy CRF: hypovitaminosis D (no 1-α-hydroxylase) produces osteomalacia
Renal osteodystrophy CRF: osteoporosis from metabolic acidosis
Renal osteodystrophy CRF: secondary HPTH with increased osteoclastic activity
S/S CRF: pericarditis, prolonged bleeding time, normocytic anemia, pathologic fractures
Benign nephrosclerosis: kidney of hypertension; shrunken kidneys due to hyaline arteriolosclerosis
Malignant hypertension: renal failure; encephalopathy; BP ≥ 210/ ≥ 120 mm Hg; IV nitroprusside
Renal findings: necrotizing arteriolitis; "flea bitten" kidney; hyperplastic arteriolosclerosis
Renal infarction: pale infarcts; hematuria; common in polyarteritis nodosa
Hydronephrosis: renal stone MCC; atrophy of cortex/medulla; postrenal azotemia
Renal stones: most contain calcium (calcium oxalate/phosphate); hypercalcuiuria MC risk factor
S/S: colicky pain radiating into groin, hematuria; x-ray usually shows stone
Staghorn calculus: due to urease producing organisms (Proteus); alkaline urine pH; ammonia smell
Angiomyolipoma: hamartoma; associated with tuberous sclerosis

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Renal cell carcinoma: smoking MCC; invasion renal vein/vena cava; lung, bone mets; yellow colored
S/S: flank mass, hematuria; ectopic hormones (EPO, PTH related peptide), left-sided varicocele
Renal pelvis transitional cell carcinoma: smoking MCC, phenacetin, aniline dyes, cyclophosphamide
Wilm's tumor: hypertension, unilateral abdominal mass in child; aniridia/hemihypertrophy in AD types
Urine draining from umbilicus: persistent urachus
Retropertitoneal fibrosis: produces hydronephrosis
Bladder extrophy: abdominal wall defect + episadias
Bladder diverticula: most commonly due to prostatic hyperplasia with urethral obstruction
Acute cystitis: E. coli; females > males; no fever, flank pain, or WBC casts
Bladder transitional cell carcinoma: smoking MCC, aniline dyes, cyclophosphamide; papillary
S/S: hematuria; hydronephrosis
Bladder adenocarcinoma: risk factors—persistent urachus, extrophy
Bladder squamous cell carcinoma: Schistosoma hematobium infection
Hypospadias: ventral opening on penis due to failure closure of urethral folds
Epispadias: dorsal opening on penis due to defect in genital tubercle
Peyronie's disease: painful curvature penis due to fibromatosis
Priapism: persistent/painful erection; HbSS
Squamous cell carcinoma penis: HPV and lack of circumcision most important risk factors
Cryptorchidism: undescended testis; risk for seminoma applies to cryptorchid testis and normal testis
Orchitis: mumps usually unilateral (infection uncommon)
Epididymitis: < 35: N. gonorrhoeae, C. trachomatis; > 35 E. coli, P. aeruginosa
S/S: scrotal pain relieved by elevation of scrotum (Prehn's sign)
Varicocele: left-sided scrotal mass; spermatic vein drains into left renal vein; infertility common
Varicocele: may be due to invasion of left renal vein by renal cell carcinoma
Hydrocele: persistent tunica vaginalis; scrotum transilluminates
Torsion of testicle: testicle high in canal; absent cremasteric reflex
Testicular cancer: unilateral painless mass that does not transilluminate
Risk factors: cryptorchid testis, Klinefelter's, testicular feminization
Seminoma: MC cancer; radiosensitive; large cells with lymphoid infiltrate; small percentage have hCG
Spermatocytic variant: > 65 yrs of age
Embryonal carcinoma: hemorrhage/necrosis; hematogenous spread before lymphatic; ↑ AFP, hCG
Yolk sac tumor: MC testicular cancer in boys; ↑ AFP
Choriocarcinoma: most aggressive testicle cancer; ↑ hCG
Teratoma: more often benign in children than adult
Teratocarcinoma: teratoma + embryonal carcinoma
Malignant lymphoma: MC type in elderly; metastasis not primary cancer
Prostate: DHT derived stimulation embryo; periurethral area—hyperplasia; peripheral area—cancer
Prostatitis: perineal pain, fever; WBCs at end of voiding
Benign prostatic hyperplasia: DHT/estrogen-mediated, glandular/smooth muscle hyperplasia
S/S: all men develop; urethral obstruction MC (hesitancy, dribbling, nocturia), hematuria, dysuria
Rx: α-adrenergic blockers, 5-α-reductase inhibitors
Prostate cancer: DHT-mediated; palpable with rectal exam; osteoblastic metastasis (↑ AP)
PSA: sensitive but not specific for prostate cancer; ↑ in hyperplasia
Kallmann's syndrome: absent GnRH, anosmia, absence of taste
Impotence: failure to sustain an erection; psychogenic in most cases (erections present at night)
Erection: parasympathetic response
Ejaculation: sympathetic response
Leydig cell failure: ↑ LH; ↓ testosterone, sperm count; normal FSH
Seminiferous tubule failure: ↑ FSH (↓ inhibin); ↓ sperm count; normal LH and testosterone
Leydig and seminiferous tubule failure: ↑ FSH and LH; ↓ testosterone and sperm count
Y chromosome: determines genetic sex
Testosterone: develops seminal vesicles, epididymis, vas deferens
Dihydrotestosterone: develops prostate and male external genitalia
Male pseudohermaphrodite: genetic male; phenotypically female
Testicular feminization: XR; deficient androgen receptors; MCC male pseudohermaphrodite
Klinefelter's syndrome: XXY; 1 Barr body; female secondary sex characteristics

Gynecology

Herpes genitalis: recurrent painful vesicles; multinucleated squamous cells with intranuclear inclusions
Human papilloma virus: condyloma acuminata; koilocytosis (wrinkled nuclei surrounded by a halo)
Chlamydia trachomatis: metaplastic squamous cells with vacuoles containing elementary bodies
S/S: non-specific urethritis, cervicitis, PID, ophthalmia neonatorum
Neisseria gonorrhoeae: urethritis, cervicitis, PID; ophthalmia neonatorum, gram negative diplococcus
Ophthalmia neonatorum first week: N. gonorrhoeae
Ophthalmia neonatorum second week: C. trachomatis
Lymphogranuloma venereum: C. trachomatis subtype
S/S: scrotal/vulva lymphedema; granulomatous microabscesses; rectal strictures in females
Chancroid: painful ulcer, adenopathy, Hemophilus ducreyi
Granuloma inguinale: Calymmatobacterium granulomatis; raised ulceration but no lymphadenopathy
Treponema pallidum: spirochete; produces vasculitis of arterioles (plasma cell infiltrate)
Primary syphilis: painless chancre
Secondary syphilis: rash on palms/soles; condyloma lata; generalized adenopathy
Tertiary syphilis: neurosyphilis (e.g., tabes dorsalis), aortic arch aneurysm, gummas
RPR/VDRL: reagin antibodies against cardiolipin; ↓ titer with Rx of syphilis
RPR/VDRL: false positive with anticardiolipin antibodies (common in SLE)
FTA-ABS: confirmatory test for syphilis; not distinguish active from treated disease
FTA-ABS: remains positive after Rx
Trichomonas vaginalis: flagellate protozoan; cervicitis/vaginitis; Rx metronidazole both partners
Gardnerella vaginalis: vaginal pH > 5; bacterial vaginosis; clue cells; Rx metronidazole
Candida vaginitis: white, curd-like discharge; DM, antibiotics, pregnancy; Rx fluconazole
Vulvar squamous cancer: MC vulvar cancer; HPV association
Vulvar leukoplakia: biopsy to R/O squamous dysplasia/cancer
Lichen sclerosis vulva: epidermal atrophy; slight risk for squamous cancer
Squamous hyperplasia vulva: leukoplakia; no cancer risk
Paget's disease: intraepithelial adenocarcinoma (mucin production) of vulva
Malignant melanoma: vulva location; similar to Paget cells but not mucin positive
Gartner's duct cyst: lateral wall vagina; persistent mesonephric duct
Embryonal rhabdomyosarcoma: bloody, grape-like vaginal mass young girl
Vaginal adenosis: maternal exposure to DES; precursor clear cell adenocarcinoma vagina
Vaginal squamous cancer: usually extension of cervical cancer
Rokitansky-Küster-Hauser: absence of vagina and uterus
Nabothian cysts: endocervical glands covered by metaplastic squamous epithelium
Pathologic cervicitis: trichomonas, HSV-2, C. trachomatis (follicular cervicitis)
Cervical Pap: superficial squamous (estrogen), intermediate (progesterone), parabasal (no hormone)
Normal: 70% superficial, 30% intermediate
Atrophic: 100% parabasal cells
Hyperestrinism: 100% superficial cells
Pregnancy: 100% intermediate cells
Endocervical cells: sign of adequately performed Pap smear
Cervical polyp: bleeding after intercourse; non-neoplastic
Cervical dysplasia: begins in transformation zone; associated with low and high risk HPV
Risk factors cervical dysplasia/cancer: early onset sexual activity; multiple partners; smoking; OC
CIN: cervical intraepithelial dysplasia; mild, moderate, severe (in-situ)
Cervical cancer: ↓ incidence (Pap smear); 45-yr-old; COD renal failure from obstruction of ureters
S/S: cervical discharge; bleeding after intercourse
Sequence to menarche: breast budding, growth spurt, pubic hair, axillary hair, menarche
Proliferative phase cycle: estrogen-dependent; ↑ estrogen inhibits FSH and stimulates LH
Ovulation: day 14-16; LH surge; subnuclear vacuoles; ↑ body temperature
Secretory phase cycle: progesterone-dependent
Menses: drop in estrogen/progesterone stimulates apoptosis; plasmin prevents clotting
FSH: stimulates follicle and aromatase synthesis in granulosa cells
LH: stimulates androgen synthesis in proliferative phase and progesterone synthesis in secretory phase
Day 21: day of implantation of fertilized egg
Pregnancy: ↑ plasma volume > RBC mass; ↑ GFR; ↑ thyroxine/cortisol (increased binding proteins)
hCG: LH analogue produced by syncytiotrophoblast
hCG: stimulates corpus luteum of pregnancy to synthesize progesterone for 8-10 weeks
Estrone: estrogen of postmenopausal woman; aromatization of adrenal androstenedione
Estradiol: estrogen of non-pregnant woman in reproductive life; aromatization of testosterone
Estriol: estrogen of pregnancy
Menopause: ↑ FSH (best screen; due to ↓ estrogen), ↑ LH
S/S: secondary amenorrhea, hot flushes
Hirsutism: ↑ hair in normal areas
Virilization: hirsutism + male secondary sex characteristics (clitoromegaly)
Test for hirsutism/virilization: ↑ testosterone– ovarian source; ↑ DHEA-sulfate– adrenal source
Polycystic ovarian syndrome (POS): ↑ LH; ↓ FSH; ↑ estrogen and androgens
S/S: hirsutism, oligomenorrhea, infertility; enlarged ovaries with subcortical cysts; LH:FSH > 2:1
Menorrhagia: excess menstrual flow; MCC iron deficiency in women
Dysmenorrhea: painful menses; 1st PGF2α, 2nd endometriosis
DUB: bleeding related to hormone rather than anatomic causes
Anovulatory DUB: menarche and perimenopause; estrogen excess without progesterone
Ovulatory DUB: irregular shedding, inadequate luteal phase
Primary amenorrhea: no menses by 16 years old
Secondary amenorrhea: no menses for 3 months
Amenorrhea–hypothalamic/pituitary dysfunction: ↓ FSH/LH; e.g., hypopituitarism
Amenorrhea–ovarian dysfunction: ↑ FSH/LH; e.g., Turner's syndrome
Amenorrhea–end-organ disease: normal FSH/LH; e.g., imperforate hymen
Asherman syndrome: surgical removal of stratum basalis
Primary amenorrhea–normal secondary sex characteristics: constitutional delay MCC
Primary amenorrhea–lack secondary sex characteristics: Turner's
Turner's syndrome: XO; no Barr bodies; XO/XY types have gonadoblastomas; streak gonads (no eggs)
S/S: newborn with lymphedema hands/feet; cystic hygroma in neck (web); short stature; 1st amenorrhea
Secondary amenorrhea: pregnancy MCC; prolactinoma; anorexia nervosa; pituitary adenoma
Asherman syndrome: removal of stratum basalis causing scarring; secondary amenorrhea
Endometritis: group B streptococcus; intrauterine device (Actinomyces); chronic– plasma cells
Endometrial polyp: menorrhagia; not a precursor for endometrial cancer
Adenomyosis: functioning endometrial glands and stroma in myometrium; enlarged uterus
Endometriosis: functioning glands and stroma outside uterus; reverse menses; ovary MC site
S/S: dysmenorrhea, painful stooling, bowel obstruction; "powder burn" appearance
Endometrial hyperplasia: unopposed estrogen; simple/complex types; precursor endometrial cancer
Causes: obesity, estrogen Rx, polycystic ovarian syndrome

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Endometrial cancer: obesity, nulliparity, estrogen Rx, early menarche/late menopause; OC protective
S/S: bleeding in postmenopausal woman
Leiomyoma uterus: menorrhagia, obstructive delivery; not a precursor for leiomyosarcoma
Leiomyosarcoma: MC sarcoma: necrosis + atypical mitotic spindles
Ectopic pregnancy: PID MC risk factor; intraperitoneal hemorrhage; screen with β-hCG
Follicular cyst: MC ovarian mass in young woman
Risk factors ovarian tumors: nulliparity and genetic factors; OC protective
Serous ovarian tumors: surface-derived; ↑ bilaterality; psammoma bodies in malignant type
Mucinous ovarian tumors: surface-derived; pseudomyxoma peritonei in malignant type
Endometrioid carcinoma: resembles endometrial cancer; association with endometriosis
Cystic teratoma: MC benign germ cell tumor (<1% malignant); hair/teeth; calcifications
Dysgerminoma: MC malignant germ cell tumor; associated with streak gonads of Turners
Yolk sac tumor: MC germ cell tumor young girl; ↑AFP; Schiller-Duval bodies
Meigs syndrome: ovarian fibroma, ascites, right-sided pleural effusion
Granulosa tumor: low grade malignant; hyperestrinism, Call Exner bodies
Thecoma: benign; yellow color; hyperestrinism
Leydig cell and Sertoli cell tumors: hyperandrogenism
Gonadoblastoma: XY phenotype of Turner's
Krukenberg tumors: metastatic stomach cancer; signet ring cells
Single umbilical artery: ↑ incidence congenital defects
Syncytiotrophoblast: lining of villi; produces hCG and human placental lactogen
Human placental lactogen: responsible for mild glucose intolerance in pregnancy
Abruptio placenta: retroplacental clot; painful bleeding; hypertension, cocaine, smoking
Placenta previa: placenta implanted over cervical os; painless bleeding
Placenta accreta: direct implantation into myometrium without intervening decidua; hysterectomy
Twin placenta: monochorionic always identical twins; dichorionic may be identical or fraternal
Siamese twins: monoamniotic monochorionic twin placenta
Enlarged placenta: DM, Rh HDN, syphilis
Complete mole: benign neoplasm of chorionic villi; dilated villi; no embryo; 46 XX (both male)
S/S: preeclampsia in first trimester; ↑ incidence choriocarcinoma
Partial mole: embryo present; 68 XXY; no transformation into choriocarcinoma
Choriocarcinoma: malignancy of trophoblastic tissue (syncytiotrophoblast, cytотrophoblast)
Risk factors: complete mole (MC), spontaneous abortion, normal pregnancy
S/S: ↑ hCG; lung metastasis; good prognosis
Chorioamnionitis: group B streptococcus (S. agalactiae) infection
Preeclampsia: abnormal placentation causing placental ischemia; ↑ in vasoconstrictors (ATII)
S/S: hypertension, proteinuria, pitting edema; begins in third trimester
Spontaneous abortion: 50% have karyotype deformity (trisomy 16)
Ammniotic fluid: fetal urine
Polyhydramnios: TE fístula, duodenal atresia, open neural tube defects
Oligohydramnios: infantile polycystic disease
↑ Serum AFP: open neural tube defect
↓ Serum AFP: Down syndrome
Urine estriol: fetal adrenal, placental, maternal liver involved in its production
Down syndrome triad: ↑ β-hCG, ↓ serum AFP, ↓ urine estriol
FCC: MC breast mass < 50-yrs-old; atypical hyperplasia cancer risk; lumpy, painful breasts
Sclerosing adenosis: component of FCC; involves terminal lobules often has microcalcifications
Fibroadenoma: benign stromal tumor; MC movable mass in women < 35-yrs-old
Intraductal papilloma: benign tumor lactiferous duct/sinus; MCC bloody nipple discharge < 50-yr-old
Invasive ductal cancer: MCC breast mass in woman > 50-yrs-old
Breast cancer risk: unopposed estrogen; family history first-degree relatives
Breast cancer: painless mass upper outer quadrant in woman > 50-yr-old
Mammography: screening test to detect non-palpable masses
Palpable breast mass: order fine needle aspiration (not a mammogram)
Ductal carcinoma in situ: necrotic centers (comedo); microcalcifications common
Paget’s disease of breast: invasive ductal cancer into nipple; Paget’s cells similar to vulvar Paget’s
Medullary carcinoma: bulky tumor with large cells and lymphoid infiltrate
Inflammatory carcinoma: orange peel appearance; lymphatics blocked by tumor (lymphedema)
Lobular cancer: MC cancer of terminal lobule; ↑ bilaterality
Phyllodes tumor: low grade malignant tumor of stroma
ERA-PRA positive tumors: tumors responding to hormones; candidate for tamoxifen (anti-estrogen)
ERB-B2 oncogene positive breast cancer: aggressive breast cancer
Gynecomastia: estrogen stimulation of male breast
Gynecomastia: normal in newborn, puberty (no surgery), old age; cirrhosis MC pathologic cause

Endocrine

Overactive endocrine syndrome: most often adenomas; use suppression tests (most do not suppress)
Tumors that suppress: prolactinoma (bromocriptine), pituitary Cushings (high dose dexamethasone)
Underactive endocrine syndrome: autoimmune destruction MCC; stimulation tests
Hypopituitarism adults: non-functioning adenoma MCC, Sheehan’s postpartum necrosis (stop lactation)
Hypopituitarism in children: craniopharyngioma (Rathke’s pouch remnant) MCC; visual field defects
S/S ↓ FSH and LH: amenorrhea, ↓ testosterone in male
Growth hormone functions: muscle growth, gluconeogenesis; release of insulin growth factor (IGF)
IGF: synthesized in liver; bone and cartilage growth
S/S ↓ GH/IGF in children: growth retardation; ↓ height and weight
Sleep and arginine infusion: stimulation tests for GH and IGF
S/S ↓ GH/IGF in adults: hypoglycemia
S/S ↓ TSH: secondary hypothyroidism; ↓ T4, ↓ TSH; muscle weakness, dry skin
S/S ↓ ACTH: secondary hypocortisolism; ↓ cortisol, ↓ ACTH; fatigue; hypoglycemia
Metraidone: stimulation test for ACTH reserve
Metraidone: blocks adrenal 11-hydroxylase → ↑ ACTH and 11-deoxycortisol (proximal to block)
Metraidone test+ ↓ ACTH and 11-deoxycortisol: pituitary/hypothalamic dysfunction
Metraidone test+ ↑ ACTH and ↓ 11-deoxycortisol: Addison’s disease
Diabetes insipidus: loss ADH (central), refractory to ADH (nephrogenic); always diluting urine
CDI: ↓ UOsm and ↑ P0sm with water deprivation; vasopressin causes ↑ UOsm > 50%
 Causes CDI: pituitary stalk transection, hypothalamic lesion (site for ADH synthesis)
NDI: ↓ UOsm and ↑ P0sm with water deprivation; vasopressin causes ↑ UOsm < 50%
 Causes NDI: lithium, demeclocycline, nephrocalcinosis, severe hypokalemia
Gigantism: GH secreting pituitary adenoma before epiphyses have fused
Acromegaly: GH secreting pituitary adenoma after epiphyses have fused
S/S acromegaly: cardiomyopathy; large hands, feet, jaw; hyperglycemia
Prolactin: inhibited by dopamine
Prolactinoma: MC pituitary tumor; secondary amenorrhea and galactorrhea; prolactin inhibits GnRH
Rx: surgery or bromocriptine (dopamine analog)
Other causes hyperprolactinemia: primary hypothyroidism, drugs
Inappropriate ADH syndrome: hyponatremia < 120 mEq/L; ↑ UOsm (always concentrating urine)
 Causes: small cell carcinoma lung, CNS injury, chlorpropamide
Rx: restrict water; demeclocycline in small cell carcinoma
Serum T4: ↑ or ↓ in free hormone or thyroid binding globulin (TBG)
↑ Serum T4 and normal TSH: ↑ TBG; due to ↑ in estrogen
↑ Serum T4 and ↓ TSH: thyrotoxicosis
↓ Serum T4 and normal TSH: ↓ TBG; due to anabolic steroids
↓ Serum T4 and ↑ TSH: primary hypothyroidism
↓ Serum T4 and ↓ TSH: secondary hypothyroidism
TSH: negative feedback with T4 and T3; best screening test
I_{131} uptake: ↑ in Graves; ↓ in thyroiditis, patient taking excess thyroid, hypothyroidism
Cold nodule: non-functioning nodule; no uptake I_{131}
Hot nodule: functioning nodule; ↑ uptake I_{131}
Thyroglossal duct cyst: midline cystic mass
Branchial cleft cyst: cyst in anterolateral neck
Acute/subacute thyroiditis: painful thyroid; early thyrotoxicosis; ↓ I_{131} uptake
Hashimoto's thyroiditis: MCC hypothyroidism; HLA Dr3/Dr5; inhibitory IgG TSH receptor antibody
Hashimoto's thyroiditis: ↑ anti microsomal and thyroglobulin antibodies
S/S: muscle weakness, periorbital puffiness, ↓ reflexes, diastolic hypertension, constipation, dry skin,
Lab: ↓ T4, ↑ TSH
Cretinism: maternal hypothyroidism before fetal thyroid developed, genetic disorder
S/S: mental retardation; short stature and increased weight; coarse skin
Thyrotoxicosis: any cause ↑ thyroid hormone activity; Graves disease, excess hormone, thyroiditis
Hyperthyroidism: ↑ synthesis thyroid hormone; Graves disease and toxic nodular goiter
Graves disease: autoantibody against TSH receptor (type II reaction); HLA Dr3
S/S unique to Graves: exophthalmos, pretibial myxedema
S/S thyrotoxicosis: tachycardia/atrial fibrillation, systolic hypertension, diarrhea, brisk reflexes
Lab thyrotoxicosis: ↑ T4, ↓ TSH, ↑ glucose, calcium
I_{131} uptake: ↑ Graves, toxic nodular goiter; ↓ thyroiditis, excess hormone, hypothyroidism
Rx Graves disease: β-blocker; drug to decrease hormone synthesis (propylthiouracil)
Toxic nodular goiter: hyperthyroidism; develops out of a multinodular goiter; no exophthalmos
Goiter: enlarged thyroid; iodine deficiency MCC; relative thyroid hormone deficiency
S/S: rapid enlargement due to hemorrhage into cyst; Rx thyroxine
Solitary thyroid nodule woman: most often benign (cyst)
Solitary thyroid nodule man or child: often malignant
Papillary carcinoma thyroid: MC thyroid cancer; radiation exposure; psammoma bodies
Follicular carcinoma thyroid: invades blood vessels
Medullary carcinoma thyroid: parafollicular cells; calcitonin; amyloid (calcitonin conversion)
MEN I syndrome: pituitary tumor, parathyroid adenoma, pancreatic tumor (ZE or β-islet cell tumor)
MEN IIa syndrome: medullary carcinoma thyroid, pheochromocytoma, parathyroid adenoma
MEN IIb syndrome: medullary carcinoma thyroid, pheochromocytoma, mucosal neuromas
Alkalotic pH: tetany with normal total calcium, ↓ ionized calcium and ↑ PTH
Hypoalbuminemia: ↓ total calcium, normal ionized calcium and PTH
Tetany: ↓ ionized calcium level; threshold potential comes closer to resting potential
S/S: thumb adducts into palm, twitching after tapping of facial nerve
PTH: maintains ionized Ca^{2+}; ↑ Ca^{2+} renal reabsorption; ↓ phosphate/bicarbonate reabsorption in kidneys
Primary HPTH: ↑ Ca^{2+}, hypophosphatemia, ↑ PTH
Cause: adenoma MCC, hyperplasia, cancer
S/S: renal stone, peptic ulcers, pancreatitis, hypertension, metastatic calcification
Secondary HPTH: ↓ Ca^{2+}, ↑ PTH; hypovitaminosis D from renal failure MCC
Malignancy-induced hypercalcemia: ↑ Ca^{2+}, ↓ PTH; all other non-parathyroid causes same results
Causes hypercalcemia: osteolytic lesions, sarcoidosis, ↑ vitamin D, PTH-related peptide, myeloma
Tertiary HPTH: hypercalcemia developing from secondary HPTH
Primary hypoparathyroidism: \( \downarrow \text{Ca}^{2+} \) and \( \downarrow \text{PTH} \)

Causes: previous thyroid surgery, autoimmune, DiGeorge syndrome
S/S: tetany; calcification basal ganglia

Pseudohypoparathyroidism: \( \downarrow \text{Ca}^{2+} \) with normal to \( \uparrow \text{PTH} \); end-organ resistance to PTH

Other causes \( \downarrow \text{Ca}^{2+} \): hypomagnesemia (\( \downarrow \text{PTH} \)), \( \downarrow \text{vitamin D} \), DiGeorge
\( \downarrow \text{Ca}^{2+} \downarrow \text{PTH} \): primary hypoparathyroidism
\( \downarrow \text{Ca}^{2+} \uparrow \text{PTH} \): secondary hyperparathyroidism
\( \uparrow \text{Ca}^{2+} \uparrow \text{PTH} \): primary hyperparathyroidism
\( \uparrow \text{Ca}^{2+} \downarrow \text{PTH} \): malignancy induced hypercalcemia; other causes hypercalcemia

Waterhouse-Friderichsen syndrome: meningococcemia with bilateral adrenal hemorrhage due to DIC

Addison's disease: autoimmune destruction adrenal cortex MCC, adrenogenital syndrome, metastasis
S/S: hypotension (salt loss), hyperpigmentation (ACTH), hypoglycemia
Lab: \( \downarrow \) sodium, cortisol; \( \uparrow \) potassium, \( \uparrow \) ACTH

Adrenogenital syndrome: AR; enzyme deficiency; hypocortisolism; hyperpigmentation from \( \uparrow \) ACTH

21-Hydroxylase deficiency: \( \uparrow \) 17 KS, \( \downarrow \) 17 OH, lose salt, hypotension; female pseudohermaphrodite

11-Hydroxylase deficiency: \( \uparrow \) 17 KS, \( \uparrow \) 17 OH, retain salt, hypertension; female pseudohermaphrodite

17-Hydroxylase deficiency: \( \downarrow \) 17 KS, \( \downarrow \) 17 OH, retain salt, hypertension; male pseudohermaphrodite

MCC Cushings: long-term corticosteroid therapy

Tests Cushings syndrome: low/high dose dexamethasone suppression; urine free cortisol (best test)

Normal dexamethasone suppression: cortisol analogue; \( \downarrow \) ACTH and \( \uparrow \) cortisol

Pituitary Cushings: MCC Cushings's; ACTH secreting pituitary tumor
Lab: low dose dexamethasone not suppress cortisol; high dose suppresses

Adrenal Cushings: adrenal adenoma secreting cortisol; suppressed ACTH
Lab: no suppression with low/high dose dexamethasone

Ectopic Cushings: ACTH secreting small cell carcinoma of lung; high ACTH and cortisol levels
Lab: no suppression with low/high dose dexamethasone

S/S Cushings: purple stria, truncal obesity, hypertension, DM

Primary aldosteronism: benign adenoma in zona glomerulosa

S/S: hypertension and muscle weakness (hypokalemia), no pitting edema
Lab: hypernatremia, hypokalemia, metabolic alkalosis, \( \uparrow \) urine K\(^+\) and Na\(^+\)

Pheochromocytoma: benign tumor in adrenal medulla in adults
Associations: von Hippel Lindau, neurofibromatosis, MEN IIA and IIB

S/S: labile hypertension, anxiety, sweating, headache
Lab: \( \uparrow \) 24 hr urine for VMA and metanephrines

Neuroblastoma: malignant tumor adrenal medulla child; widespread metastasis; hypertension

\( \beta \)-islet cell tumor (insulinoma): benign tumor; hypoglycemia, \( \uparrow \) insulin and C-peptide

Patient taking excess insulin: hypoglycemia, \( \uparrow \) insulin, \( \downarrow \) C-peptide

Glucagonoma: malignant \( \alpha \)-islet cell tumor; hyperglycemia and rash

Zollinger Ellison syndrome: malignant islet cell tumor secreting gastrin; peptic ulcers

Somatostatinoma: malignant \( \delta \) islet cell tumor; DM, malabsorption, cholelithiasis, achlorhydria

VIPoma: malignant islet cell tumor; diarrhea, hypokalemia, achlorhydria

DM: organ damage correlates with glycemic control

Type 1: young, thin person; no insulin; HLA DR3/4; insulinitis; islet cell antibodies; ketoacidosis

Type 2: older person; obese; relative insulin deficiency (\( \downarrow \) insulin receptors, postreceptor problems)

Type 2: family history; fibrotic islet cells with amyloid; hyperosmolar nonketotic coma

\( \uparrow \) Non-enzymatic glycosylation: glucose attaches to amino acids in basement membranes

Non-enzymatic glycosylation: \( \uparrow \) vessel permeability producing hyaline arteriolsclerosis

Osmotic damage: glucose converted into sorbitol by aldose reductase

Osmotic damage: lens (cataracts), Schwann cell (neuropathy), pericytes retinal vessels (microaneurysms)
Pathogenesis hyperglycemia: ↑ gluconeogenesis (most important), glycogenolysis
Pathogenesis hyperlipidemia: no insulin to stimulate capillary lipoprotein lipase; ↑ chylomicrons/VLDL
Pathogenesis ketoacidosis: ↑ oxidation fatty acids with excess acetyl CoA; liver synthesis ketone bodies
Most commons due to DM: neuropathy, blindness, CRF, hyperglycemia, non-traumatic amputation
Glycosylated HbA1c: measure of long term glycemic control (8-12 weeks)
Gestational DM: ↑ placental size, human placental lactogen
Complications: macrosomia (↑ muscle/fat from insulin), RDS, newborn hypoglycemia (↑ insulin)
Hypoglycemia: insulin/oral hypoglycemics MCC, liver disease; carnitine deficiency
Carnitine deficiency: no β-oxidation of fatty acids; all cells compete for glucose

Musculoskeletal/soft tissue

Monosodium urate crystals (MSU): yellow when parallel to slow ray of compensator
Calcium pyrophosphate crystals (pseudogout): blue when parallel to slow ray of compensator
Osteoarthritis: degeneration articular cartilage; subchondral cysts; eburnation; osteophytes at margins
Joints: weight bearing (femoral head); DIP joint (Heberden's nodes), PIP joints (Bouchard nodes)
Neuropathic joint: 2nd to neurologic disease: DM, syringomyelia, tabes dorsalis
Rheumatoid arthritis (RA): female dominant; HLA Dr4
RF: IgM antibody against Fc portion IgG; causes inflammation of synovial tissue
Pannus: inflamed hyperplastic synovial tissue destroys articular cartilage; joint fusion
Joints: MCP and PIP joints
S/S: morning stiffness; ulnar deviation of hands; carpal tunnel (entrapped median nerve)
Rx: methotrexate often used as initial therapy, aspirin
Sjogren's syndrome: destruction lacrimal and minor salivary glands; RA; anti-SSA/SSB
S/S: dry eyes and dry mouth
Caplan syndrome: pneumoconiosis + rheumatoid nodules in lungs
Felty's syndrome: RA + splenomegaly with hypersplenism
Gouty arthritis: underexcretion uric acid; big toe first affected; tophus in soft tissue sign chronic gout
Gout associations: alcohol; Pb poisoning
Tophus: MSU crystals produce foreign body giant cell reaction next to joint
Uricosuric agents: probenecid and sulfinpyrazone
Allopurinol: ↓ synthesis uric acid; xanthine oxidase inhibitor
Pseudogout: involves knee; linear calcification in articular cartilage
Ankylosing spondylitis: HLA-B27 seronegative (RF negative) spondyloarthropathy; male dominant
S/S: sacroiliitis; bamboo spine causing kyphosis; aortitis; uveitis
Associations: C. trachomatis MC, psoriasis, ulcerative colitis, Shigella, Campylobacter, Yersinia
Reiter's syndrome: HLA-B27; Chlamydia urethritis; arthritis; conjunctivitis; Achilles tendon periostitis
Osteomyelitis children: hematogenous spread of Staphylococcus aureus to metaphysis
Osteomyelitis in HbSS: Salmonella paratyphi
Pseudomonas aeruginosa osteomyelitis: puncture of foot when wearing rubber foot wear
Tuberculous osteomyelitis: usually involves vertebra (Pott's disease)
Disseminated gonococccemia: female dominant, C6-C9 deficiency
Disseminated gonococccemia: septic arthritis (knee); tendinitis/synovitis and skin pustules in feet/wrists
Lyme disease: bite Ixodes tick; Borrelia burgdorferi; reservoirs white footed mouse, white tailed deer
Early S/S: erythematous concentric rash (erythema chronicum migrans), Rx doxycycline
Late S/S: arthritis, Bell's palsy (often bilateral), myocarditis, Rx doxycycline
Babesiosis: carried by Ixodes tick; Babesia is intraerythrocytic parasites; hemolytic anemia
Cat bite: potential for Pasteurella multocida septic arthritis
Osgood Schlatter's: inflammation proximal tibial apophysitis at patellar tendon insertion; knobby knee
Osteogenesis imperfecta: AD; ↓ synthesis type I collagen; pathologic fractures; blue sclera
Blue sclera: reflection choroidal veins
Achondroplasia: AD; impaired enchondral calcification and premature closure of epiphyses
S/S: normal head/vertebral column, short extremities
Osteopetrosis: AD/AR; osteoclast defect; too much bone; pathologic fractures
Osteoporosis: ↓ bone mass and density; pathologic fractures
Postmenopausal osteoporosis: estrogen deficiency– ↑ osteoclastic activity, ↓ osteoblastic activity
S/S: vertebral compression fractures, Colles fracture
Colles fracture: fractured distal radius with dinner fork appearance
Prevention: estrogen (under investigation), calcium, vitamin D, stress exercises (walking, weight lifting)
Aseptic necrosis femoral head: femoral head fracture, corticosteroids, sickle cell disease; MRI best test
Scaphoid bone fracture: aseptic necrosis in wrist bone
Volkman's ischemic contracture: fracture of distal radius; damage to brachial artery and median nerve
Legg-Perthe's disease: aseptic necrosis of ossification center (femoral head) in children
Paget's disease: elderly males; lytic/blastic bone lesions produce thick, weak bone
S/S: pathologic fractures; ↑ serum AP; ↑ risk for osteogenic sarcoma
Osteoid osteoma: radiolucent lesion in cortex proximal femur; nocturnal pain relieved by aspirin
Osteogenic sarcoma: adolescent male; RB suppressor gene association; distal femur; ↑ AP
Radiograph: "sunburst" appearance, Codman's triangle
Ewing's sarcoma: primitive neuroectodermal tumor; round cell tumor
Radiograph: "onion skinning"
Osteochondroma: MC benign bone tumor; exophytic growth off metaphysis of distal femur
Chondrosarcoma: MC malignant cartilaginous tumor; pelvic bones, proximal femur
Giant cell tumor: epiphysis distal femur/proximal tibia; giant cells + neoplastic mononuclear cells
Muscle weakness: primary muscle disease, neurosympathetic disease, neurogenic disease
Duchenne's muscular dystrophy: XR; deficiency dystrophin; ↑ serum CK at birth; waddling gait
Dystrophin: attaches portions of cell membrane to sarcomere; important in contraction
Becker's dystrophy: XR, defective dystrophin
Myotonic dystrophy: AD; trinucleotide repeat disorder; cannot release grip
Myasthenia gravis: autoantibody against acetylcholine receptors (type II); thymic hyperplasia B cells
S/S: diplopia at end of day first sign; dysphagia solids/liquids upper esophagus; thymoma
Dupuytren's contracture: fibromatosis palmar fascia
Lipoma: MC soft tissue tumor
Liposarcoma: MC adult sarcoma
Embryonal rhabdomyosarcoma: MC childhood sarcoma
Autoimmune disease: loss of self-tolerance
Serum ANA: greatest sensitivity for detecting SLE
SLE: type III reaction; confirm with anti-dsDNA, anti-Sm
S/S: malar rash, photophobia, joint pain, fibrinous pericarditis, nephritic GN
Drug-induced lupus: procainamide, hydralazine; anti-histone antibodies
Antiphospholipid antibodies: lupus anticoagulant, anti-cardiolipin antibodies; vessel thrombosis
PSS: excess collagen; anti-topoisomerase antibodies
S/S: dysphagia solids/liquids, Raynaud's, interstitial lung disease, renal failure
CREST: centromere ab/calcinosis; Raynaud; esophageal dysmotility; scierodactyly, telangiectasia
Dermatomyositis/polymyositis: ↑ serum CK; risk of malignancy
Mixed connective tissue disease: anti-ribonucleoprotein antibody
Antibody against acetylcholine receptor: myasthenia gravis
Antibody against basement membrane: Goodpasture's syndrome
Antibody against endomysium and gliadin: celiac disease
Antibody against insulin and islet cell: type I diabetes
Antibody against intrinsic factor and parietal cell: pernicious anemia
Antibody against microsome and thyroglobulin: Hashimoto's thyroiditis
Antibody against mitochondria: primary biliary cirrhosis
Antibody against proteinase 3 of neutrophil (cANCA): Wegener's granulomatosis
Antibody against myeloperoxidase of neutrophil (pANCA): microscopic polyangiitis
Antibody against TSH receptor: Graves disease

Skin

Ichthyosis vulgaris: ↑ thickness of stratum corneum; absent granular layer
Solar lentigo: "liver spot" in elderly; increased melanocytes
Senile purpura: trauma to fragile vessels on dorsum of hands; normal finding in elderly
Acute eczema: weeping rash with vesicles
Chronic eczema: dry, thickened, pruritic skin
Atopic dermatitis: dry skin, eczema (type I reaction); children— face, intertriginous areas
Allergic contact dermatitis: type IV hypersensitivity; poison ivy, nickel rash
Contact photodermatitis: tetracycline; rash in sun exposed areas
Superficial dermatophytoses: KOH preparation shows fungi located in stratum corneum
Tinea capitis: Trichophyton tonsurans MCC (negative Wood's lamp)
Tinea capitis child with dog: Microsporum canis (positive Wood's lamp)
Tinea versicolor: hypopigmentation; Malassezia furfur; "spaghetti" (hyphae)"meatball" KOH
Seborrheic dermatitis: dandruff; Malassezia furfur
Molluscum contagiosum: poxvirus; bowel-shaped with central depression filled with keratin
Rubeola: Koplik's spots; Warthin-Finkeldey giant cells
Rubella: teratogenic; rash; postauricular adenopathy; arthritis in adults
Parvovirus: "slapped face"; RBC aplasia, aplastic anemia (HbSS), spontaneous abortions, arthritis
Roseola: HSV-6; high fever and then rash
Toxic shock syndrome: toxin-producing S. aureus; tampon wearing; hypotension, desquamating rash
Scarlet fever: group A streptococcus with erythrogenic toxin; strawberry tongue
Actinic (solar) keratosis: precursor for squamous cell carcinoma; recur when scrapped off
Psoriasis: elevated salmon-colored plaques covered by silver-colored scales; nail pitting
Pityriasis rosea: herald patch followed by rash in lines of cleavage
Varicella: chickenpox; rash at different stages; Reye syndrome association
Herpes zoster: vesicular rash following a sensory dermatome
HSV and Varicella-zoster virus: remain latent in sensory ganglia
Impetigo: group A streptococcus; honey crusted lesions on face
Pemphigus vulgaris: autoimmune disease; IgG antibodies against intercellular attachment sites
Pemphigus vulgaris: intraepidermal bullae; acantholytic cells; row of tombstones
Bullous pemphigoid: autoimmune disease; IgG antibodies against basement membrane
Bullous pemphigoid: subepidermal bullae
Pemphigus vulgaris/bullous pemphigoid: type II hypersensitivity
Dermatitis herpetiformis: autoimmune disease; IgA ICs; subepidermal bullae with neutrophils
Dermatitis herpetiformis: association with celiac disease
Erythema multiforme: vesicles and bullae; bullseye appearance
Risk factors: drugs, M. pneumoniae infection
Stevens Johnson syndrome: erythema multiforme involving mouth
Acne vulgaris: androgen dependent (receptor on sebaceous glands)
Acne vulgaris: Propionibacterium acnes lipases produce fatty acids causing inflammation
Acne rosacea: pustular, erythematous lesion on face resembling malar rash
Urticaria: type I and III reactions; type I due to mast cell release of histamine (drugs, fire ant bites)
Angioedema: subcutaneous swelling
Causes: ACE inhibitor (bradykinin); C1 esterase inhibitor deficiency (C2 and C4 decreased)
Sporotrichosis: traumatic implantation Sporothrix fungus into subcutaneous tissue
Causes: rose gardener, lobster fisherman (sphagnum moss)
S/S: chain of subcutaneous nodules
Tuberculous leprosy: intact cellular immunity (positive lepromin skin test); granulomas; no organisms
S/S: autoamputation of digits; skin depigmentation and anesthnesia
Lepromatous leprosy: defective cellular immunity (negative lepromin skin test); no granulomas
S/S: leonine face, erythema nodosum during treatment
Histology: Grenz zone (zone free organisms) foamy macrophages with organisms
Rx: dapsone
Erythema nodosum: painful nodule on shins; subcutaneous fat inflammation
Associations: coccidioidomycosis, TB, leprosy
Keratoacanthoma: benign neoplasm; mimics squamous cancer; spontaneously resolves
UVB light cancers: basal cell carcinoma, squamous cell carcinoma, malignant melanoma
Vitiligo: autoimmune destruction melanocytes producing skin depigmentation
Seborrheic keratosis: pigmented, wart-like lesion; "stuck on" appearance
Leser-Trelat sign: multiple outcroppings seborrheic keratosis; consider stomach cancer
Acanthosis nigricans: verrucoid pigmented lesion usually in axilla; associated with gastric cancer
Chloasma: pregnancy mask due to increased melanocytes
Nevoid melanocytic nevus: benign pigmented tumor modified melanocytes
Histology: nevoid cells proliferate along basal cell area, dermis, or both places
Dysplastic nevus: precursor for malignant melanoma
Malignant melanoma: malignant tumor of melanocytes; most rapidly increasing cancer worldwide
ABCD for melanoma: A, asymmetry; B, irregular border; C, color change; D, increased diameter
Risk factors: severe sunburn at early age (MC), dysplastic nevi
Radial growth phase: spreads laterally in epidermis/superficial dermis but does not result in metastasis
Vertical growth: malignant cells penetrate into dermis; potential for metastasis
Lentigo maligna melanoma: face of elderly
Superficial spreading melanoma: lower extremities, back
Nodular melanoma: aggressive tumor with no radial growth phase
Acral lentiginous melanoma: palms, soles, under nails; may occur in blacks
Prognosis: depends most on depth of invasion
Prevention: sunscreen > 15
Porphyria cutanea tarda: photosensitive bullous disease; deficiency uroporphyrinogen decarboxylase
S/S: hypertrichosis, fragile skin, port wine colored urine (uroporphyrins)
Black widow (Latrodectus) envenomation: neurotoxin; abdominal muscle cramps
Brown recluse (Loxosceles) envenomation: necrotoxin; skin ulcer

CNS/PNS/special senses

CSF: choroid plexus in ventricles; enters subarachnoid space; removed by arachnoid granulations
CSF: less protein and glucose than serum; scant number of cells; ↑ chloride
Xanthochromia: yellow colored CSF due to bilirubin pigment; indicates subarachnoid hemorrhage
Papilledema of optic nerve: sign of cerebral edema (intracranial hypertension)
Uncal herniation: intracranial hypertension; medial portion temporal lobe thru tentorium cerebelli
S/S: midbrain hemorrhage; CN III palsy (pupil down/out); mydriasis
Mydriasis in uncal herniation: compression of parasympathetic system
Cerebellar tonsils herniate into foramen magnum: intracranial hypertension
Hydrocephalus: ↑ CSF volume with distention of ventricles
Non-communicating: blockage aqueduct Sylvius MCC newborn
Communicating: choroid plexus papilloma; scarring of arachnoid granulations
Adults with hydrocephalus: progressive dementia, wide-based gait, urinary incontinence
Open neural tube defects: folate must be adequate before pregnancy; ↑ AFP
Spina bifida occulta: dimple overlying skin L5-S1; vertebral arch not completely closed
Meningocele: vertebral defect with meninges
Meningomyelocele: vertebral defect with meninges and spinal cord
Arnold Chiari syndrome: elongation medulla/cerebellar tonsils through foramen magnum
S/S: hydrocephalus, syringomyelia, meningo(myelo)cele
Dandy Walker syndrome: hypoplasia of cerebellar vermis; hydrocephalus
Syringomyelia: enlarged cervical cord; fluid filled cyst in cervical spinal cord
S/S: loss pain/temperature upper extremities (spinthalamic); motor loss in hands (anterior horn cells)
Tuberculous sclerosis: AD; mental retardation; hamartomas CNS/kidney; shagreen patches skin
Tuberculous sclerosis: angiomylipomas kidneys; rhabdomyoma of heart
Neurofibromatosis: AD; pigmented neurofibromas; café au lait spots
Associations: pheochromocytoma, brain tumors, acoustic neuromas
Meningitis: nuchal rigidity
CSF findings viral meningitis: ↑ CSF protein, normal CSF glucose, ↑ lymphocytes
CSF findings bacterial meningitis: ↑ CSF protein, ↓ CSF glucose, ↑ neutrophils
Encephalitis: inflammation of brain; mental status abnormalities; coma
Coxsackievirus: MCC viral meningitis
HSV-1: hemorrhagic necrosis in temporal lobes
Rabies: skunk and bat common vectors; Negri bodies in neurons; hydrophobia; flaccid paralysis
CMV: intranuclear inclusions; periventricular calcification in congenital infection
Polio virus: destruction of anterior horn cells; flaccid paralysis
Subacute sclerosing panencephalitis: slow virus disease due to rubeola
Progressive multifocal leukoencephalopathy: slow virus disease due to JC virus; common in AIDS
Creutzfeldt-Jakob disease: prions; spongiform encephalopathy
Risk factors: contact with human brain or contaminated beef (bovine disease)
Meningitis newborn: Streptococcus agalactiae (group B) MCC; E. coli (second)
Listeria monocytogenes: newborn meningitis; gram + rods; pregnant mother should avoid soft cheeses
Neisseria meningitidis: MCC meningitis 1 mth–18-yrs-old; petechia and DIC characteristic
Streptococcus pneumoniae: MCC meningitis > 18-yrs-old
Mycobacterium tuberculosis: complication primary TB; base of brain meningitis with vasculitis
Neurosyphilis: CSF with positive VDRL
Meningovascular syphilis: vasculitis causing strokes
General paresis: syphilis with dementia and brain atrophy
Tabes dorsalis: posterior root ganglia/posterior column; ataxia; absent DTRs; Argyll-Robertson pupil
Argyll-Robertson pupil: pupils accommodate but does not react to direct light
Cryptococcus neoformans: MC opportunistic CNS fungal disease; positive India ink
Muco species: frontal lobe abscess in DKA
Toxoplasma gondii: MCC space occupying lesion in AIDS; avoid cat litter and raw meat in pregnancy
Congenital toxoplasmosis: calcification basal ganglia; blindness; mental retardation
Naegleria and Acanthamoeba: amoeba in fresh water; meningoencephalitis
Taenia solium: pork tapeworm; adult with worms definitive host; adult with larva intermediate host
Cysticercosis: larval form of T. solium; produces blindness and calcified cysts in CNS (seizures)
Coup injuries: contusions at site of injury
Contrecoup injuries: contusion on opposite side; frontal and temporal lobes
Epidural hematoma: temporoparietal skull fracture; tear middle meningeal artery
Subdural hematoma: tear bridging veins; venous blood clot; fluctuating levels consciousness
Hypoxic injury: neurons more susceptible to damage than neuroglial cells
Laminar necrosis: liquefactive necrosis at watershed areas in cortex
Atherosclerotic stroke: pale infarction (liquefactive necrosis) extending to periphery of cerebral cortex
Causes atherosclerotic stroke: thrombosis of middle cerebral artery or carotid artery
MCA stroke: contralateral weakness/sensory loss; expressive aphasia if left hemisphere stroke
Amaurosis fugax: loss vision described as curtain going down and then up
Cause: embolus atherosclerotic plaque to branch of retinal artery (Hollenhorst plaque)
Vertebrobasilar stroke: vertigo, ataxia, ipsilateral sensory loss face/contralateral hemiparesis/sensory
Embolic stroke: hemorrhagic infarction extending to periphery cerebral cortex due to embolization
Intracerebral hemorrhage: complication hypertension
Cause of intracerebral hemorrhage: rupture of aneurysm of lenticulostriate vessels
Location of intracerebral hemorrhage: basal ganglia MC site
Subarachnoid hemorrhage: rupture of congenital berry aneurysm; severe occipital headache
Lacunar stroke: microinfarctions; due to hyaline arteriolosclerosis (hypertension, diabetes)
Pure motor stroke: posterior limb internal capsule
Pure sensory stroke: thalamus
Multiple sclerosis: autoimmune destruction myelin sheath/oligodendrocytes; plaques in white matter
S/S: scanning speech, intention tremor, nystagmus, paresthesias, weakness
Bilateral internuclear opthalmoplegia: multiple sclerosis; demyelination MLF
CSF with oligoclonal bands: sign of demyelination
Central pontine myelinolysis: rapid intravenous correction of hyponatremia in alcoholic
Alzheimer's disease: MCC dementia
Alzheimer's disease: chromosome 21 codes for amyloid precursor protein
Alzheimer's disease: amyloid-β destroys neurons; occipital lobe spared
Alzheimer's disease: density of neurofibrillary tangles and senile plaques
Down syndrome: develop Alzheimer's disease at early age; 3 functioning chromosome 21s
Apo E gene allele e4: gene product has high affinity for amyloid-β
Parkinson's disease: depigmentation substantia nigra neurons; Lewy bodies; dopamine
S/S: extrapyramidal (muscle rigidity), resting tremor, festinating gait
Causes: CO poisoning, Wilson's, MPTP (meperidine derivative), drugs
Huntington's disease: AD; atrophy of caudate nucleus; trinucleotide repeat disorder (anticipation)
S/S: movement disorder; dementia
Amyotrophic lateral sclerosis (ALS): degeneration of lower/upper motor neurons; no sensory changes
Werdnig Hoffman disease: childhood type of ALS
Wilson's disease: AR; excess copper; cystic degeneration of putamen/globus pallidus
Vitamin B₁₂ deficiency: posterior column (proprioception, vibration); lateral corticospinal tract (UMN)
Alcohol: Wernicke-Korsakoff syndrome, cerebellar atrophy, central pontine myelinolysis
Wernicke encephalopathy: thiamine deficiency; IV with glucose can prompt acute attack
Wernicke encephalopathy: mamillary body hemorrhage (ring hemorrhages)
S/S: confusion, ataxia, nystagmus, opthalmoplegia
Korsakoff's psychosis: limbic system; antegrade and retrograde memory deficits
Acute intermittent porphyria (AIP): AD; deficiency uroporphyrinogen synthase; porphobilinogen
S/S: drug induced (alcohol, barbiturates); abdominal pain ("bellyful of scars"); dementia
Window sill test: urine in AIP colorless; turns port wine color with exposure to light (porphobilin)
Rx: heme infusions (inhibits δ-aminolevulinic acid synthetase)
Adult brain tumors: 70% supratentorial; frontal lobe MC site
Childhood brain tumors: 70% infratentorial; cerebellum MC site
Adult brain tumors (descending order): GBM, meningioma, acoustic neuroma
GBM: high grade astrocytoma; hemorrhage and necrosis; may cross corpus callosum
Meningioma: female dominant; arise from arachnoid granulations; psammoma bodies; seizures
Acoustic neuroma: schwannoma VIIIth nerve; tinnitus; sensorineural hearing loss; neurofibromatosis
Childhood brain tumors: astrocytoma cerebellum (MC), medulloblastoma
Astrocytoma: MC primary brain tumor; frontal lobe MC site in adult (cerebellum in child)
Medulloblastoma: malignant tumor cerebellum; invades fourth ventricle
Ependymoma: arises in 4th ventricle in children and cauda equina in adults
Oligodendroglioma: frontal lobe tumor with dystrophic calcification
CNS lymphomas: metastasis MCC; primary CNS lymphoma associated with EBV in AIDS
Metastasis: MC brain malignancy; lung cancer MC site of origin; junction gray and white matter
Schwannoma: benign tumor Schwann cell; MC peripheral nerve tumor; alternating dark and light areas
AIDS dementia: due to HIV; multinucleated microglial cells
CMV retinitis: MCC of blindness in AIDS; Rx– ganciclovir (foscarnet if unsuccessful)
Peripheral neuropathy: myelin destruction (sensory; paresthesias); axon destruction (muscle atrophy)
Peripheral neuropathy: DM MCC; thiamine/pyridoxine deficiency; vinca alkaloids
Guillain-Barre syndrome: MCC autoimmune demyelination of peripheral and spinal nerves
Risk factors: M. pneumoniae, influenza vaccine, Campylobacter jejuni
S/S: ascending paralysis; CSF– increased protein, lymphocytes; Rx– plasmapheresis
Charcot-Marie-Tooth: AD; common peroneal nerve palsy; inverted bottle appearance
Idiopathic Bell's palsy: facial muscle paralysis due to inflammation of cranial nerve VII
Lyme disease: facial nerve MC cranial nerve involved; bilateral Bell's palsy
Bacterial conjunctivitis: Staphylococcus aureus
Viral conjunctivitis: adenovirus MC; HSV-1 (dendritic ulcers)
Sudden loss of vision: amaurosis fugax, central retinal artery or vein occlusion
Uveitis: inflammation of iris, choroid, ciliary body; blury vision; ankylosing spondylitis, sarcoidosis
Optic neuritis: multiple sclerosis MCC; methyl alcohol poisoning
Glaucoma: increased intraoculal pressure; fluid cannot exit canal of Schlemm; causes optic atrophy
Optic atrophy: blindness; pale disc; glaucoma, optic neuritis
Macular degeneration: MCC permanent visual loss in elderly
Meniere's disease: increased endolymph; tinnitus, vertigo, sensorineural hearing loss
Presbyacusis: MCC sensorineural hearing loss in elderly
Otosclerosis: MCC conductive hearing loss in elderly; fusion of ear ossicles
Impacted wax in outer ear canal: conduction hearing loss
Weber test lateralizes to left ear, bone > air conduction (Rinne test): conduction loss left ear
Weber test lateralizes to left ear, air > bone conduction both ears: sensorineural hearing loss right ear
Otitis media: MCC conduction hearing loss in children; S. pneumoniae MCC
Malignant external otitis in diabetic: Pseudomonas aeruginosa

TOPICS NOT COVERED

Immunopathology

T cells: 60–70% total lymphocyte count; ↓ AIDS, DiGeorge, adenine deaminase deficiency
B cells: 10–20% total lymphocyte count; ↓ Bruton's, adenine deaminase deficiency
Antigen presenting cells: B cells, macrophages, dendritic cells
Langerhan's cells: antigen presenting cell in skin
Major histocompatibility complex: chromosome 6; HLA genes for self-identity
Class I proteins: recognized by CD8 T cells and NK cells
Class II proteins: recognized by CD4 Th cells
Type I reactions: IgE antibodies; mast cells; wheal and flare with bee sting
Type II reactions: antibody-mediated; Goodpasture's syndrome, rheumatic fever
Type III reactions: immune complex-mediated; SLE glomerulonephritis
Type IV reactions: cellular immunity; granuloma, positive PPD
Delayed reaction hypersensitivity reactions: CD4 Th cells and macrophages
Cytotoxic reactions: CD8 T cells; killing viral infected cells and neoplastic cells

Graft viability: ABO compatibility most important; HLA match

Fetus: allograft that is not rejected

Hyperacute rejection: type II hypersensitivity; ABO incompatibility or anti-HLA antibodies

Acute rejection: predominately cell-mediated reaction; MC rejection

Graft vs host reaction: jaundice, rash, bloody diarrhea

IgA immunodeficiency: MC hereditary immunodeficiency; giardiasis, allergies

Bruton's agammaglobulinemia: XR; pre B cannot develop into B cells; S. pneumoniae infections

DiGeorge syndrome: failure 3rd/4th pharyngeal pouches to develop; T cell deficiency; absent thymus

S/S DiGeorge syndrome: absent thymic shadow; Candida, Pneumocystis infections; hypoparathyroidism

Adenine deaminase deficiency: AR; combined B and T cell deficiency; gene therapy

Wiskott Aldrich syndrome: XR; combined B and T cell deficiency; eczema, thrombocytopenia

AIDS: MC acquired immunodeficiency

HIV: attaches to gp120 in CD4 Th cells; cytolysis; reverse transcriptase

HIV transmission: MC sexually-transmitted; anal intercourse in homosexuals MCC

HIV transmission in health care workers: accidental needle stick from HIV positive patient

Follicular dendritic cell: reservoir for HIV in lymph nodes in latent phase

AIDS: HIV positive plus CD4 Th cell ≤ 200 cells/μL or AIDS-defining condition

Pneumocystis carinii pneumonia: MC AIDS-defining disorder

Screening test for HIV: ELISA test; detects anti-gp 120

Confirmatory test for HIV: Western blot

HIV test with two peaks: p24 antigen; positive prior to seroconversion and when AIDS is diagnosed

MC cancer in AIDS: Kaposi sarcoma

MC infections CD4 Th < 100 cells/μL: CMV, toxoplasmosis, M. avium-intracellulare

Hereditary angioedema: deficiency C1 esterase inhibitor; ↓ C2, C4, normal C3

Fluids and Hemodynamics

Osmosis: H₂O shift between ECF and ICF; controlled by serum Na⁺ and glucose

Serum Na⁺ ~ TBNa⁺/TBW: decreased TBNa⁺ dehydration; increased TBNa⁺ pitting edema

Isotonic loss: serum Na⁺ normal; adult diarrhea, loss whole blood; Rx with 0.9% saline

Isotonic gain: serum Na⁺ normal; Rx with salt and H₂O restriction

Hyponatremia: ICF expanded; central pontine myelinolysis with rapid IV correction

Hyponatremia hypotonic gain pure water: inappropriate ADH syndrome

Hyponatremia hypotonic gain TBNa and TBW: pitting edema; cirrhosis, RHF

Hyponatremia hypertonic loss TBNa: dehydration; loop diuretic, Addison's, 11-hydroxylase deficiency

Hypertonic state: hypernatremia or hyperglycemia; ICF contraction

Hypermotremia hypertonic gain TBNa: pitting edema; sodium bicarbonate

Hypermotremia hypotonic loss water: diabetes insipidus

Hypermotremia hypotonic loss TBNa and TBW: osmotic diuresis, sweat, baby diarrhea

Acidosis: potential for hyperkalemia (shift out of ICF)

Alkalosis: potential for hypokalemia (shift into ICF)

Hypokalemia: loop and thiazide diuretics MCC; alkalosis, albuterol/insulin; U wave

Hyperkalemia: renal failure MCC; acidosis, β-blocker, digitalis toxicity; peaked T wave

Rx hyperkalemia: calcium gluconate → insulin with glucose → loop diuretic

Respiratory acidosis: PaCO₂ > 45 mm Hg; compensation metabolic alkalosis

Respiratory acidosis: chronic bronchitis, ARDS, barbiturate poisoning, paralysis diaphragms

Respiratory alkalosis: PaCO₂ < 33 mm Hg; compensation metabolic acidosis

Respiratory alkalosis: pulmonary embolus, anxiety, early bronchial asthma, restrictive lung disease

Metabolic alkalosis: HCO₃⁻ > 28 mEq/L; compensation respiratory acidosis
Metabolic alkalosis: loop/thiazide diuretics, vomiting, primary aldosteronism  
Metabolic acidosis: HCO₃⁻ < 22 mEq/L; compensation respiratory alkalosis  
↑ AG metabolic acidosis: add anions of acid to extracellular fluid  
↑ AG metabolic acidosis: lactate, AcAc, β-OHB, salicylate, oxalate (ethylene glycol), formate (methyl alcohol, phosphate/sulfate (renal failure)  
Ethylene glycol, methyl alcohol: compete with alcohol for alcohol dehydrogenase  
Ethylene glycol poisoning: antifreeze; converted to oxalic acid; renal failure  
Methyl alcohol poisoning: window wiper fluid; converted to formic acid; blindness  
Normal AG metabolic acidosis: lose HCO₃⁻; e.g., diarrhea, proximal/distal renal tubular acidosis

Genetics

AFP: increased in open neural tube defects; decreased in Down syndrome  
PCR: uses DNA polymerase  
Barr body: inactive X chromosome on nuclear membrane; 1 Barr body in females  
Missense mutation: point mutation with different amino acid; sickle cell trait/disease, Marfan  
Nonsense mutation: point mutation producing stop codon; β-thalassemia major  
Frameshift mutation: insertion or deletion nucleotides alters reading frame; Tay-Sachs  
Trinucleotide repeat: disease worse in future generations (anticipation)  
Trinucleotide repeat disorders: fragile X (XR), Huntington's (AD), myotonic dystrophy (AD)  
Nondisjunction: meiosis; unequal numbers of chromosomes  
Robertsonian translocation: Down syndrome with 46 chromosomes  
Microdeletion syndrome: genomic imprinting; chromosome 15  
Paternal microdeletion: Prader-Willi; obese, mental retardation  
Maternal microdeletion: Angelman's syndrome; happy puppy syndrome, mental retardation  
Advanced maternal age: increased risk for trisomies  
Down syndrome: trisomy 21; leading cause mental retardation  
S/S: slanted eyes; simian crease; endocardial cushion defect; Alzheimer's  
Turner's syndrome: XO; no Barr bodies; short stature and primary amenorrhea; streak ovaries  
Klinefelter's syndrome: XXY; 1 Barr body; female secondary sex characteristics  
AR: homozygous (aa) for disease; heterozygotes (Aa) asymptomatic  
AR: most inborn errors metabolism, sickle cell, cystic fibrosis, hemochromatosis, Wilson's  
AD: homozygote (aa) or heterozygote (Aa) express disease  
AD: spherocytosis, Marfans, neurofibromatosis, von Willebrand, familial polyposis, polycystic kidney  
AD: delayed manifestation; penetrance; variable expressivity  
XR: male transmits to all daughters; female carrier transmits to 50% of sons  
XR: G6PD deficiency, Bruton, Lesch-Nyhan, testicular feminization, fragile X, hemophilia A/B  
Fragile X: mental retardation; macroorchidism at puberty; trinucleotide repeat  
Lesch Nyhan: XR; deficiency HGPRT; hyperuricemia; mental retardation  
Multifactorial inheritance: gout, type 2 diabetes, essential hypertension  
mtDNA disorder: maternal transmission to all children; no paternal transmission  
Y chromosome: determines genetic sex  
Testosterone: develops seminal vesicles, epididymis, vas deferens  
Dihydrotestosterone: develops prostate and male external genitalia  
Male pseudohermaphrodite: genetic male; phenotypically female  
Female pseudohermaphrodite: genetic female; phenotypically male  
Testicular feminization: XR; deficient androgen receptors; MCC male pseudohermaphrodite  
21-Hydroxylase deficiency: ↑ 17 KS, ↓ 17 OH, lose salt, hypotension; female pseudohermaphrodite  
11-Hydroxylase deficiency: ↑ 17 KS, ↑ 17 OH, retain salt, hypertension; female pseudohermaphrodite  
17-Hydroxylase deficiency: ↓ 17 KS, ↓ 17 OH, retain salt, hypertension; male pseudohermaphrodite
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Calculate prevalence: carrier rate 1:30; couples at risk: 1:900; prevalence: 1:900 x 1:4 = 1:3600
Calculate carrier rate: 1:3600; 3600 ÷ 4 = 900; √900 = 1:30
Malformation: intrinsic problem with morphogenesis
HOX gene: involved in embryogenesis
Alcohol: MCC of malformations; mental retardation; atrial septal defect
Isotretinoin acid: craniofacial and cardiac defects
Female with cystic acne needs Rx with retinoic acid: do pregnancy test before placing female on drug
DES: problem with mullerian development; clear cell carcinoma of vagina
Thalidomide: limb abnormalities
Vertical transmission: transplacental (MC), delivery, breast feeding
Congenital CMV: MC congenital infection; periventricular calcification; culture urine
Congenital toxoplasmosis: basal ganglia calcification; blindness; avoid cat litter in pregnancy
Congenital rubella: sensorineural hearing loss (MC); cataracts
Congenital syphilis: transplacental after 5–6 mths; saddle nose, rhagades, blindness, deformed teeth
Congenital herpes: contracted during delivery; encephalitis
Deformation: extrinsic problem in fetal development; oligohydramnios causing Potter's facies

Environmental pathology

Tobacco: leading cause premature death and cancer in United States
Nicotine: most addictive substance; attaches to nicotinic cholinergic receptors
Tobacco induced cancers: lung, oropharynx, larynx, pancreas, kidney, bladder
Alcohol: CNS depressant (cortex, limbic system); legally drunk 80-100 mg/dL
Alcohol: induces SER hyperplasia; increases alcohol metabolism
Alcohol MCC of: folate/thiamine deficiency; sideroblastic anemia; liver fatty change; pancreatitis
Alcohol: hypoglycemia; lactic/ketoacidosis;↑ triglyceride; AST > ALT; increased GGT
Ketoacidosis in alcoholic: β-hydroxybutyric acid
Heroin: poppy plant; non-cardiogenic pulmonary edema; focal segmental glomerulosclerosis
MPTP: meperidine derivative; produces parkinsonism
Cocaine: blocks uptake of dopamine/norepinephrine; mydriasis; AMI, CNS infarction
Marijuana: tetrahydrocannabinol binds basal ganglia receptors; delayed reaction time; red conjunctiva
Intravenous drug abuse: HBV hepatitis MC systemic disease
Acetaminophen toxicity: damage by FR acetaminophen; liver cell necrosis; renal papillary necrosis
Rx acetaminophen toxicity: N-acetylcysteine (increases synthesis of glutathione)
Salicylate toxicity: metabolic acidosis + respiratory alkalosis; hyperthermia; tinnitus, vertigo
Estrogen risks: thromboembolism; cholestasis; endometrial/breast cancer
Oral contraceptives: cholestasis, thrombosis, folate deficiency, hypertension, hepatic adenoma
Hemolytic anemia: penicillin, methyldopa, quinidine
Aplastic anemia: benzene, chloramphenicol
Qualitative platelet dysfunction: non-steroids
Thrombocytopenia: heparin, quinidine
Macrocytic anemia: methotrexate, 5-fluorouracil, phenytoin, OC, alcohol
Congestive cardiomyopathy: doxorubicin, daunorubicin
Interstitial fibrosis: bleomycin, methotrexate
Hemorrhagic gastritis: iron toxicity, nonsteroidals
Liver necrosis: acetaminophen, isoniazid, salicylates, halothane, isotretinoin acid
Cholestasis: anabolic steroids, OC
Fatty change in liver: amiodarone, tetracycline, alcohol
Photosensitive rash: tetracycline
SLE: procainamide, hydralazine
Isopropyl alcohol: ↑ acetone; CNS dysfunction
Lead: microcytic anemia, nephrotoxic ATN (proximal tubule), gout, encephalopathy, neuropathy
Mercury: fish (tuna, salmon); nephrotoxic ATN; constricted visual fields
Organophosphates: blocks acetylcholine esterase; miosis; paralysis; Rx: atropine, pralidoxime
Polyvinyl chloride: plastic pipes; angiosarcoma of liver
Scorpion sting: paralysis, hypertension, pancreatitis
Crotaline bite: rattlesnakes, water moccasin, copperhead; DIC; serum sickness
Coral snake bite: neurotoxin; binds to presynaptic nerve terminals and acetylcholine receptors
Contact gunshot wound: soot + gunpowder (foiling)
Intermediate gunshot wound: powder tattooing
Distant gunshot wound: no powder tattooing; exit wound larger than entrance
Motor vehicle accidents: leading cause accidental death between 1–39 yrs of age
Burns: Pseudomonas aeruginosa sepsis MC COD
First degree burn: painful; complete healing
Second degree burn: painful; blister; complete healing
Third degree burn: painless; scarring
Frostbite: painless; ice crystallization in cells
Electrical injury: AC worse than DC; decreasing resistance (wet skin) increases current
House fires: carbon monoxide and cyanide poisoning
Heat exhaustion: fever and sweating
Heat stroke: fever and anhidrosis
Near drowning: survival following asphyxia due to submersion
Wet drowning: initial laryngospasm then relaxation and water into lungs
Dry drowning: intense laryngospasm without aspiration
Cold water drowning: shunts blood from periphery to central core
Drowning: hypoxemia key COD
Acute mountain sickness: headache MC; non-cardiogenic pulmonary edema (immediate descent)
High altitude: normal %O2; decreased barometric pressure; respiratory alkalosis; ↑ 2,3 BPG
Ionizing radiation: DNA most susceptible protein
Ionizing radiation: lymphoid tissue most radiosensitive; bone least radiosensitive
Ionizing radiation cancers: leukemia (most common); thyroid cancer; osteogenic sarcoma
UVB-related cancers: basal cell carcinoma (most common); squamous cancer; melanoma

Nutrition

Carbohydrates: digestion begins in mouth
Fats: digestion begins in small intestine
Essential fatty acid deficiency: dermatitis, hair loss, poor wound healing
Proteins: digestion begins in stomach
Kwashiorkor: ↓ protein intake; ↓ visceral protein; ↓ albumin (pitting edema); fatty liver
Marasmus: total calorie deprivation; ↓ somatic protein; broomstick extremities
Anorexia nervosa: starvation; secondary amenorrhea (↓ GnRH); osteoporosis; ventricular MC COD
Bulimia nervosa: binging with vomiting; hypokalemic metabolic alkalosis; ventricular MC COD
Body mass index (BMI): weight in kg/height in m²
Obesity: hypertension (MC), cholecystitis, osteoarthritis, type 2 DM, endometrial/breast cancer
Leptin: obesity gene product released from adipose; maintains energy balance
All-trans retinoic acid: Rx acute promyelocytic leukemia; matures blasts to neutrophils
Vitamin A: maintain visual purple, prevent squamous metaplasia, growth
Vitamin A deficiency: night blindness; blindness; squamous metaplasia
Vitamin A toxicity: ↑ intracerebral pressure; papilledema; hepatic necrosis
Vitamin D: maintain ionized Ca\(^{2+}\); mineralization of bone
Vitamin D metabolism: skin photoconversion or reabsorb in gut → 1st hydroxylation liver →
Vitamin D metabolism: 2nd hydroxylation proximal tubule (1-\(\alpha\)-hydroxylase)
Vitamin D deficiency: ↓ mineralization; pathologic fractures; rickets children; osteomalacia adults
Causes: renal failure MCC; malabsorption; liver disease; ↓ sunlight
Lab: ↓ Ca\(^{2+}\), ↓ phosphate (malabsorption), ↑ phosphate renal failure, ↑ PTH
Hypervitaminosis D: ↑ Ca\(^{2+}\), renal stones
Vitamin E: prevents FR damage of cell membrane
Vitamin E deficiency: hemolytic anemia; posterior column/spinocerebellar tract degeneration
Vitamin E toxicity: ↓ synthesis vitamin K-dependent procoagulation factors; anticoagulated
Vitamin K: \(\gamma\)-carboxylates vitamin K-dependent factors: prothrombin, VII, IX, X, protein C/S
Vitamin K deficiency: ↓ epoxide reductase activity (↓ function vitamin K); hemorrhagic diathesis; ↑ PT
Warfarin: inhibits epoxide reductase
Causes vitamin K deficiency: antibiotics MC, newborn, malabsorption, warfarin
Thiamine functions: transketolase; dehydrogenase reactions (NADH for ATP synthesis)
Example of dehydrogenase reaction: pyruvate → acetyl CoA; pyruvate dehydrogenase
Thiamine deficiency: alcohol MCC; ↓ ATP synthesis
S/S: dry beriberi—Wernicke's, Korsakoff's, peripheral neuropathy; wet beriberi—cardiomyopathy
Niacin: oxidation reduction reactions; NAD, NADP
Niacin deficiency: pellagra; dermatitis, diarrhea, dementia
Tryptophan: synthesis niacin, serotonin
Tryptophan deficiency: Hartnup's disease (↓ reabsorption neutral amino acids); carcinoid syndrome
S/S niacin deficiency: diarrhea, dermatitis, dementia
Corn: deficient in niacin and tryptophan
Pyridoxine: heme synthesis, transamination, neurotransmitter synthesis
Cause: taking isoniazid
Pyridoxine (B\(_6\)) deficiency: sideroblastic anemia; convulsions; peripheral neuropathy
Vitamin B\(_{12}\)/folate: DNA maturation, odd chain fatty acid metabolism (propionyl CoA)
Vitamin B\(_{12}\)/folate deficiency: macrocytic anemia
Biotin: carboxylase reactions (pyruvate → oxaloacetate)
Cause: eating raw eggs (avidin binds vitamin)
S/S: alopecia, dermatitis
Vitamin C: antioxidant, reduce ferric iron, hydroxylation proline/lysine, dopamine → norepinephrine
Vitamin C deficiency: scurvy; hemorrhagic diathesis; poor wound healing
Alkalotic state: lowers ionized Ca\(^{2+}\); producing tetany; total Ca\(^{2+}\) normal
Hypalbuminemia: lowers total Ca\(^{2+}\); no tetany
Hypophosphatemia: decreased ATP; myoglobinuria
Hypomagnesemia: causes hypocalcemia by inhibiting PTH synthesis/release
Zinc deficiency: poor wound healing; dysgeusia (cannot taste); anosmia; perioral rash
Copper deficiency: iron deficiency; poor wound healing (cofactor lysyl oxidase); aortic dissection
Iodine deficiency: produces goiter and hypothyroidism
Chromium deficiency: glucose intolerance
Selenium: antioxidant that neutralizes peroxide
Fluoride deficiency: dental caries

AAT, \(\alpha\)-1-antitrypsin deficiency; AcAc, acetocetate; ACE; angiotensin converting enzyme; AD, autosomal dominant; AFP, \(\alpha\)-fetoprotein; AG, anion gap; AIHA, autoimmune hemolytic anemia; ALL, acute lymphoblastic leukemia; ALT, alanine transferase; AMI, acute myocardial infarction; AML, acute myelogenous leukemia; AP, alkaline phosphatase; APL, acute promyelocytic leukemia; AR, autosomal recessive; ARDS, acute respiratory distress syndrome; ARF, acute renal failure; ASD, atrial septal defect;
AST, aspartate transferase; AT, antithrombin; ATN, acute tubular necrosis; BM, basement membrane; β-OHB, β-hydroxybutyrate; BPG, bisphosphoglycerate; CDI, central diabetes insipidus; CHF, congestive heart failure; CF, cystic fibrosis; CFTR, cystic fibrosis transmembrane regulator; CLL, chronic lymphocytic leukemia; CML, chronic myelogenous leukemia; CO, cardiac output; COD, cause of death; COX, cyclooxygenase; CRF, chronic renal failure; DHAP, dihydroxyacetone phosphate; DHT, dihydrotestosterone; DIC, disseminated intravascular coagulation; DIP, distal interphalangeal joint; DKA, diabetic ketoacidosis; DM, diabetes mellitus; DUB, dysfunctional uterine bleeding; ECM, extracellular matrix; EPO, erythropoietin; FAs, fatty acids; FCC, fibrocystic change; FEV₁, forced expiratory volume in 1 second; FR, free radical; FSH, follicle stimulating hormone; FVC, forced vital capacity; GBM, glioblastoma multiforme; G3P, glyceral 3-phosphate; GFR, glomerular filtration rate; G6PD, GGT, γ-glutamyl transferase; glucose 6-phosphate deficiency; GN, glomerulonephritis; GnRH, gonadotropin releasing factor; Hb, hemoglobin; HDN, hemolytic disease of newborn; HHV, human herpesvirus; HPTH, hyperparathyroidism; HTN, hypertension; HUS, hemolytic uremic syndrome; IC, immunocomplexes; IL, interleukin; IVDA, intravenous drug abuse; IVP, intravenous pyelogram; IVS, interventricular septum; 17 KS, 17-ketosteroids; LAD, left anterior descending; LH, luteinizing hormone; LHF, left-sided heart failure; LT, leukotriene; LVEDP, left ventricular end-diastolic pressure; LVH, left ventricular hypertrophy; MC, most common; MCA, middle cerebral artery; MCC, most common cause; MCP, metacarpophalangeal joint; MGUS, monoclonal gammopathy of undetermined significance; MLF, medial longitudinal fasciculus; MPD, myeloproliferative disease; MPGN, membranoproliferative glomerulonephritis; MVP, mitral valve prolapse; NDI, nephrogenic diabetes insipidus; 17 OH, 17-hydroxycorticoids; OC, oral contraceptives; PA, pernicious anemia; Pb, lead; PDA, patent ductus arteriosus; PID, pelvic inflammatory disease; PIP, proximal interphalangeal joint; POC, protooncogene; PRA, plasma renin activity; PSA, prostate specific antigen; PSS, progressive systemic sclerosis; PT, prothrombin time; PTH, parathyroid hormone; PTT, partial thromboplastin time; PUD, peptic ulcer disease; PVR, peripheral vascular resistance; RAA, renin-angiotensin-aldosterone system; RCA, right coronary artery; RDS, respiratory distress syndrome; RF, rheumatoid factor; RHF, right-sided heart failure; RV, residual volume; RVH, right ventricular hypertrophy; Rx, treatment; S/S, signs and symptoms; SLE, systemic lupus erythematosus; SMA, superior mesenteric artery; SMV, superior mesenteric vein; TE, tracheoesophageal fistula; TLC, total lung capacity; TNF, tumor necrosis factor; TTP, thrombotic thrombocytopenic purpura; TV, tidal volume; TX, thromboxane; UBG, urobilinogen; VC, vital capacity; VIP, vasointestinal peptide; VSD, ventricular septal defect; XD, X-linked dominant; XR, X-linked recessive
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