D&M 3 NDNP 864
Midterm Study Guide

Week 1: Early child development notes (chapter 6):

Toddler: 12-24 months
Preschoolers: 2-5 years old

WHO growth charts should be used to measure weight and length for children less than 24 months
CDC weight and length charts used for children older than 24 months

Average 24 month weighs 26 lbs, length 33.5 in and HC 18.5 in
Most have no palpable fontanelle by 12 months
Ant fontanelle closes by 18-19 months
3-6 yrs weight gain expectation is 4.5-6.5 lbs/year
3-6 yrs height gain expectation is 2.5-3.5 inches/yr
4 yrs length at birth has doubled
4-5 years old legs grow faster than rest of the body

Use of dominant hand may appear as early as 8-12 months generally emerges 2-4 years old; handedness established at 5yrs

May develop bowel and bladder control by age 3, but many will not. Boys usually take longer than girls to maintain bedtime bladder control.

Articulation:
-24 months- 25% is understood by a stranger
-24m-36m- 66% is understood by a stranger
-3 years old- 90% should be understood by a stranger
3 and 4-year-old have a normal hesitance or show stuttering, considered abnormal if beyond 5 years of age

Speech problems often can be from lack of stimulation, hearing problems, ear infections, developmental delay. Early detection important.

Lexicon:
girls typically say their first word between 8-11 months; boys by 14 months

2 year olds: have more than 200 words in their vocabulary
3 years old: 900 words in vocabulary
3-4 yrs old: able to follow simple commands, talks incessantly
4-5 year olds: add at least 50 new words a month; 1500-2100 words in vocabulary (including names, coins, colors, knows days of the week)
5 year olds: should be able to define certain words with other words (cup: something you drink with)

Syntax:
8 months: develop receptive language- they understand what a word means before they are able to use it themselves
12-28 months: use holophrases (single words) to express whole ideas
18 months: use telegraphic speech (get milk, go bye-bye)
2 years old: short sentences
3 years old: add plurals, 3-4 word sentences
4 years old: past tense
5 years old: syntax is close to adult style, 5-6 word sentences

Peer relationships:
Toddler: parallel play
Preschoolers: more interactive and social, imaginary play

Body image:
Masturbation starts around 3-4 years old

Theories:

Erikson	<u>Industry</u> team sports/cooperation Master social studies, math and reading sense of competence and accomplishment	<u>Inferiority</u> children must learn that they will not be able to master every skill they attempt Criticism detrimental at this age

	Development of a of "superego" or conscious develops during preschool age	
Piaget	<u>Concrete operations</u> More tolerant and perceptive of other's viewpoint Children are able to use thought processes to experience events and actions Judgments made based on reason (conceptual)	**Ages 2-4**-Starting to realize world outside their own, realizing they can make things happen (shift from egocentric. Belief in "magical" power of words. **Ages 4-7-** Preoperational intuitive thought- starting to understand time concept but limited. Example may understand "after lunch" instead of in 2 hours.
Kohlberg (moral development)	Judge an act based on consequences of reward and punishment They know the rules and behaviors expected of this, but do not understand the reasons behind them	Can accept the concept of treating others as they would want to be treated. Judge an act based on intention not just consequences

Piaget: Preoperational thinking (2-4yrs) - problem solving based on what they see directly
egocentrism - only about them
Centration - Focus only on 1 thing at a time
Animism - things around them are alive
Magical thinking - thoughts are all powerful - their thoughts can cause things to happen

Developmental Assessment:
BP starts at 3 years old or if at high risk
Hearing and Vision at 4-5 years old
Dentist: first tooth eruption or before 12 months; eruption of permanent teeth start at 5 yrs

3 years: Draw circle, cross and vertical/horizontal lines
4-5 years: Trace cross & copy a square, ties shoelaces
5-6 years: Draw a person, copies a diamond and triangle, can print name

2-4 yrs: Animism and magical thinking
Magical thinking continues into 4-7 years

Screening Tools:
Ages and stages Questionnaire: helps with evaluating fine and gross motor development
M-CHAT: evaluates for autism (used for children 16-30 months)
Early language milestone (ELM): brief screening for speech intelligibility (3-4 years old)

Preschool decision: parents should select a preschool with a play based learning curriculum

Immediate referral is required for children who stop eating, demonstrate cruelty to animals or other people, are self- harmful, start fires, or talk of harming themselves, their peers or others

Children with scores below 85 on intelligence scales predictably have more difficulty in school

Language development is the best indicator of cognitive development, language delays may indicate serious issues that require developmental and educational intervention

Vision screening 5y, 6y, 8y, 10y, 12y. Referral with acuity less than 20/40 (aap guidelines)
Hearing screening 5y, 6y, 8y, 10y. (aap guidelines)

Immunization:
Hep Bx3: NB, 1-2 mths, 6mths
Hib x4: 1-2 mths, 4 mths, 6 mths, 12-15 mths
Rotavirus x3: 1-2 mths, 4 mths, 6 mths
PCV x4: 1-2 mths, 4 mths, 6 mths, 12-15 mths
DTaP x5: 1-2 mths, 4 mths, 6 mths, 15-18 mths, 4yr
Polio x4: 1-2 mths, 4 mths, 6 mths, 4-6y
MMR x2: 12-15mths, 4yr

Varicella x2: 12-15mths, 4yr

Older child

Tdap x 1: 11-14yr

Meningitis x2: 11yr, 17yr

HPV x2 (6mths apart): 11-13yrs

Hep A x2 (6 mths apart): between 12-23mths, recommended before middle school if not had earlier

Safety

Helmets, seat belts, still keep cleaning supplies out of reach/locked up.

Gross Motor Development

3 years

•Rides a tricycle

•Walks on tiptoes

•Stands on 1 foot for a few seconds

•Broad Jump

4 years

•Catches a ball

•Hops & skips on one foot

•Walks up and down stairs using alternate feet

5 years

•Jumps rope, begins to skate and swim

•Walks backwards heel to toe

•Skips and hops (alternate feet)

Sleep

12 hours at night, no naps but quiet time

Nightmares - During REM sleep, fully awakes, able to be reassured, occurs at end of the night

Night terrors - No during REM, not aware of others, partial arousal, no memory of dream, earlier in the night

Child Aggression: Not necessarily the behavior itself that is the issue but the frequency, severity, timing. Frustration is the biggest reason they act out. Can also happen if parent is depressed, child is neglected, etc.

School Age Children

Age 5-12 years
Early Childhood (5 to 7 years)
Middle (8 to 10 yrs)
Late (11 to 12 yrs)
Small amount of breast tissue in males normal during puberty-gynecomastia
Encourage sports activities

Growth and Development
Building self-esteem- praise important
Check immunizations at sick visits- no immunizations if fever within past 24 hours
Get them to talk to you during the visit
No shots until age 11 after 4 year old ones
Age 7 cholesterol (guidelines between 7 and 11)
If BMI >95%, obesity panel- A1c
Vision and hearing often done in school
Important to ask about friends and peer groups

Physical development: strength coordination increase, growth spurts occur, cerebral cortex/frontal lobe develop
Motor skills: run, jump, skip, hop, overhand motion, balance coordination improves
Fine motor skills: improve dexterity, use scissors, writing tools, hand-eye coordination improves

Psychosocial development: Erikson. Industry vs Inferiority. Industry: Development of formal skills, extrinsic rewards important like grades, cooperation, competition and coping leads to sense of accomplishment. Inferiority: ▪Danger during this period, especially for those with physical and mental limitations

* No child is able to do everything well, and children must learn that they will not be able to master every skill they attempt

Conceptual vs perceptual thinking: based on reason (conceptual) rather than what you see (perceptual). 95210 plan might be important, encourage reading.

Communication and language development: Improved communication skills, 8-9 year olds can understand jokes, meanings, stuttering should resolve by school age. 10-12 year olds understand metaphors, ambiguities of language, speech and language disorders among the most developmental delays.

Language development:
6-7 years: 2000 words, trouble with s, l, and r
7-8 years: should not have reversal of letters
8-9 years: can recognize and correct spelling and grammar
12 years: 4000 words, can correct syntax and semantics

Social/Emotional: Social cognition results from parent child relationship
Gain impulse control/manage emotions, learning to interpret social cues, parent should be parent, no friend
Through peer relationships children learn that the world is somewhat different from their own. They learn how to deal with dominance and hostility, to relate to people in leadership and authority positions, and explore different ideas.
-"Best Friends": Important to the foundation of relationships in adulthood. They share secrets, private jokes, adventures, and come to each other's aid in times of trouble. They also fight, break-up, and re-unite.
-Clubs and Peer Groups: Rules and selection of joining.
-Bullying: "Any recurring activity that intends to cause harm, distress, or control towards another in which there is a perceived imbalance of power between the aggressor and the victim" (Lamb, Pepler, and Craig, 2009).
-Bullies are usually defiant towards adults, antisocial, and likely to break school rules. Victims often experience social distress such as worry, sadness, anxiety, depression, and nightmares.
Gender: Early school-age – few gender differences; Older school-age – tend to associate with own gender
Rules: Part of the enjoyment of the game is knowing the rules
"Chants and Taunts": Sense of power and pleasure with saying them. "Last one is the rotten egg!" "Step on a crack, you'll break your mothers back!"
Collections:
Early School Age- odd assortment of things, messy
Later School Age- more organized and selective
Games: Adhering to the rules is a must!
Reading: Newly acquired skill becomes increasingly satisfying. Never tire of stories (hearing or reading).
Also enjoy creative and physical activities such as sewing, cooking, painting, swimming, soccer, or dance.

Common fears: fear of the dark, self-consciousness, excessive worrying about past behavior.

Symptoms of stress / fear: recurring stomach pains or headache, aggressive or stubborn behavior, regression to earlier behaviors such as thumb sucking, reluctance to participate, sleep problems, changes in eating, bed-wetting.
Must provide reassurance to the child that they are safe, have honest and open communication, encourage them to express their feelings, and provide time for structured play.
Just a noted about self-consciousness: school-age children generally have an accurate and positive self-perception. The more confidence that can be built during this period the better – it will carry forward into the future.

May respond to pain with muscular rigidity:

Anticipatory guidance: discuss sources of iron, calcium, vitamin c, vitamin d. Discuss prevention of obesity, exercise.

Physical characteristics: ▪Slowed growth
▪2 inches per year
▪4-6 pounds per year
Average 6 year old: 45 inches and 46 pounds
Average 12 year old: 59 inches and 88 pounds
▪Pre-pubescence
▪From middle-childhood until 13 yrs old
▪Secondary characteristics
Body image & Self concept

Dental: ▪Permanent adult teeth development, Lose 4 teeth per year, Begin with eruption of 6 year molars

▪Attention to dental hygiene and caries is important

The first physiological signs appear around 9 years of age (especially in girls) and are usually evident clearly visible in 11 to 12 year olds.
Generally puberty begins at age 10 in girls and 12 in boys, but it can be normal for either sex after the age of 8 years.

Nutrition: avoid empty calories, develop a new taste. Caloric needs for 6-12 year olds: boys 16-17 kcal/cm. girls: 13-14 kcal/cm.

Sleep: start good habits such as no tablets in bed. ▪Highly individualized, Rarely takes naps
Average 5 year old: 11 hours per night

Average 12 year old: 9 hours per night
▪Bedtime resistance peaks from 8-11 years

Safety: The most common cause of severe injury and death in the school-age child is motor vehicle accidents (MVA), either as a pedestrian or passenger.
*The rear seat is the safest place for children less than 14 with booster seats until 80 pounds of 8 years of age.

WEEK 2 : chapter 8

Adolescent

13 years is the age of consent in MD
The common question on the minds of most adolescents: Am I normal?
Adolescence: refers to the psychosocial and emotional transition from childhood to adulthood

Physiologic Changes of the Adolescent

- Increased size and strength of heart
- Lungs increase in size
- Continued brain development
- Muscle & Fat changes
- RR dec, HR dec, BP increases

Tanner stages:
Tanner 1: no growth of pubic hair
Tanner 2: initial, scarcely pigmented straight hair
Tanner 3: sparse, dark visibly pigmented curly hair
Tanner 4: hair coarse and curly, abundant, but less than adult
Tanner 5: lateral spreading; type and triangle spread of adult hair to medial surface of thighs
Tanner 6: further extension laterally, upward, or dispersed (occurs in only 10% of women)

Female stages: females enter puberty earlier than males do, following pattern:
-ovaries increase in size, no visible changes occur

-breast budding between 9-10 years old, and initial breast development at 12, breast buds approximately 6 months before the appearance of pubic hair, the timing of the onset of breast development in females has no relationship to breast size at the completion of puberty
-95% of females reach peak height velocity (PHV) between the ages of 10 and 14 years old, and most girls experience PHV about 6-12 months before menarche, generally by 11-12 years
-appearance of pubic hair - about 11.5 years old
-first menstrual period- about 12.5 years old, it may be 18-24 months after menarche before females establish regular ovulatory cycles, first menstrual cycle typically consistent with tanner stage 3
Initial breast development usually begins as a unilateral disk-like subareolar swelling, and many are concerned with breast tumors
-girls often have asymmetric breasts and need assurance that breasts become more or less the same size within a few years after the onset of breast budding

They enter puberty with approximately 80% lean body weight and 20% body fat. By the time puberty ends, lean body mass drops to about 75%

Male stages: the initial sign of male puberty is testicular enlargement on average at 11 years:
-growth of the testes occurs approximately 6 months before the development of pubic hair in most males, once puberty begins, the left testis hangs lower than the right
-pubic hair development happens similar to a girls (tanner stage)
-first release of spermatozoa: occurs between 13.5-14.5 years old
-growth spurt: occurs between 12-16, males can continue to grow, although minimally well beyond their teenage years
-change in the male voice coincides with PHV (peak height velocity)

Concerns for delayed puberty when there is no enlargement of the testes by age 13.5-14 years of age
The taller the boy the more delayed onset of puberty

In contrast to females, males increase in muscle mass and decrease fat
Up to 65% of males experience gynecomastia especially within a year of achieving PHV, generally lasts 12-18 months and resolves on its own

Acne starts in early puberty, and by mid puberty many males have moderate to severe acne

Adolescents have formal operational thinking

Egocentrism of adolescents: four major types of egocentrism:
-imaginary audience: Everyone is thinking about them
-personal fable: they are special
-overthinking: they make things more complicated than they are
-apparent hypocrisy: rules apply differently to them than others

Principles and approaches to assessment:
-teens must be evaluated independently from parents
-should be reassured the information they share will be confidential (there are limits, providers are required to report information that puts the child or others in danger: physical or sexual abuse, some states require teen sexual activity, even if consensual, if an age difference of 3 or more years exist between the couple)

Physical Assessment:
- should have height, weight, BMI, and BP measured at each health maintenance visit
-tanner stage should be recorded at each visit to evaluate progression
-testicular growth can be directly assessed by palpation of the testes in the scrotum and comparison of their size with a standardized orchidometer
-varicocele or enlarged veins palpable in the scrotum may develop at sexual maturity and are not cause for alarm unless a discrepancy in testicular size is noted
-note gynecomastia
-check for scoliosis
-thyroid gland should be assessed
-question attitudes regarding physical growth and development

Cognitive development:
-should include questions about school attendance, school performance, and educational/career goals

Phases of adolescence:
<u>Early adolescence (11-14 years old): most difficult period</u>
-Physical development: tanner stage 3 or 4, some can be at 2 until 14
-Cognitive development: daydream frequently, set idealistic goals that change frequently, some experience a drop in academic performance in junior high school, which is related to motivation rather than ability

-Social and emotional development: anti-adult, like their friends more
-Health supervision: immunizations for HPV, diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP), influenza, Hep A, and meningococcal meningitis is recommended (before middle school and before college), serum lipoprotein analysis should be done if not done earlier in childhood
-Anticipatory Guidance: increase iron and calcium intake is needed when menstruation begins, and during periods of rapid growth
Red flag if boys do not increase testicle size by age 13.5-14

Middle Adolescence (15-17 years old): stand out for their unique appearance
-Physical development: physical development is nearing completion, less concern about body changes more interest in being physically attractive
-Cognitive development: school and extracurricular activities are often the focus
-Social and emotional development: tend to be more non-adult than anti-adult, a characteristic of early adolescents, sexual drive emerges and middle adolescents begin to explore their ability to attract a partner
-Health supervision: influenza, developmental surveillance, and assessment of social and academic progress, quality of interpersonal relationships, school performance, and emotional wellness , screening for STIs if sexually active, PAP smears no longer recommended until after age 21 regardless of sexual status
-Anticipatory guidance: focuses on teens expanding physical, cognitive, and socioemotional capabilities, consolidating self-concept and identifying areas of continued growth and development

Late Adolescence (18 to 21 years old): autonomy
-Physical development: typically complete
-Cognitive development: adult level of reasoning
-Social and emotional development: usually relate to the family as adults
-Health supervision: influenza, screening STIs, PAP smear begins at 21, fasting lipoprotein analysis is recommended once during late adolescence, transition in providing medical records and referring the adolescent to an adult health care provider
-Anticipatory guidance: centers on transition from being a teenager to taking on the responsibility and role of an adult

Risk behavior assessment:
-HEEADSS (Home, Education and employment, Eating, Activities, Drugs, Sexulaity, Suicide/Depression, and Safety)
-Tobacco use: direct questioning is the best way to assess smoking patterns
-Self-Injurious Behaviors: history should include focused questions about present and past experiences with self-injury, description and mental and emotional responses; the most common locations include the arms, legs, and front of the torso
-Social media use: have open discussions regarding social media use, approach teens non-judgmentally to bring up usage concerns

Sexual Activity
average age of initiation is 17 yrs

Nutritional Needs
Increased!
Female: 9-13 years - sedentary- 1400-1600 cal/day, Moderately active - 1600-2000 cal/day, Active - 1800-2200 cal/day
14-18 years - sedentary - 1800 cal/day, Moderately active - 2000 cal/day, Active - 2400 cal/day
Male: 9-13 years - sedentary - 1600-2000 cal/day, Moderately active - 1800-2200 cal/day, Active - 2000-2600 cal/day
14-18 years - sedentary - 2000-2400 cal/day, Mod active - 2600-2800 cal/day, Active 2800-3200 cal/day
Adolescent interviewing
Respect and understand the psychological stage of the adolescent
Empower them to take ownership of their health and well being
Establish trust

Week 5: Pediatric Orthopedics 3/1/2018

Condition	Manifestation	Prevalent age	H & P	Dx test	Treatment	Teaching
Nursemaid Elbow	Immediate pain, whiny, not moving arm	1-5yrs	Pain on palpation, no increase in pain over the supracondylar region, no swelling or deformity, Classic sign is subluxation		Reduction maneuver (Only attempt the reduction after checking NV status and supracondylar region)	
Distal radius buckle fx	Hx of outstretched hand fall		Pain at distal radius, with grip and flexion, swelling. No	x-ray	Splint, can be for 4-14 day before able to see ortho,	Return to play with full strength and

			initial deformity		short arm cast 4-6wks	ROM
Non-accidental traumas	Assess for abuse. Red flags: inconsistent hx, tx delayed, multiple fx			xray ER will do xray of skull and skeletal survey	Avoid judgement, team approach. Tactfully send to ED, work up will be done there	5-10% increased r/o death if unrecognized and sent home
Growing pains	Leg pain (usu. bilateral), usu. at night	more common in boys 2-5yrs and tweens, during growth spurt	rare to have fever, wt loss and malaise	No xray, pain usu. in thighs & lower legs	reassure, mild analgesic (Ibuprofen cos is an anti inflammatory), gentle massage.	
Clavicle Fx	Bony point tenderness over clavicle, skin tenting, necrosis possible		visible deformity, increased pain, point tenderness at clavicle. Palpate Acromioclavicular joint & Sternoclavicular joint. Skin tenting can progress to pressure necrosis- open fracture!	xray	Refer to ED immediately, risk of frozen shoulder and necrosis of the socket. Immobilize 4-6 weeks in a sling . PE: bony point tenderness over clavicle, must palpate AC and SC. Must check for abrasions or lacerations- open fx! Want to prevent frozen shoulder and necrosis of joint.	No contact sports 8 weeks Gradual return to play, must have full ROM and strength to return to play

					Narcotic pain often required, consult ortho if open, significant angulation, lateral third fracture, or significant shortening. Must assess need for immobilization vs immobilization and reduction.	
Osgood-Schlatter disease	Osteochondritis of the tibial tuberosity. Increasing knee pain, Overuse injury or repetitive stress of the quadriceps muscle	Common in girls & boys ages 10-15 years participating in competitive sports but > in boys	Soft tissue edema over proximal tibial tuberosity Tenderness to palpation of proximal tibial tuberosity. Sharp bump over the shin called tibial tubercle. Pain with knee extension against resistance Absence of effusion, pain of anterior knee		NSAIDS, ice, restrict activity, PT, May not need to refer but refer to ortho if does not improve.	Pain subsides with rest and activity modification, may last for awhile, restrict activities
Sever's disease	results from inflammation of the growth plate in the heel. higher risk in pronated	growing children, also during growth spurt of adolescent	painful heel. Difficulty walking, discomfort when heel is squeezed, stiffness upon	xray may not be necessary unless condition persists after tx	NSAIDS, ice baths, heel pads, heel stretching, calf strengthening. May refer to PT	Symptoms worse during or after activity, better with rest, progression to

	foot, flat or high arches, short leg syndrome & overwt . AKA calcaneal apophysitis, most common etiology of heel pain in growing children, pain in Sever disease is believed to be repetitive trauma to the weaker structure of the apophysitis induced by pull of the Achilles on its insertion	children	awakening, toe-walking, limping.		and OT if no improvement	activity as tolerated
Legg calves - perthes	Avascular necrosis of the femoral head. Insidious onset, painful limp, hip pain then groin, thigh and knee pain, < hip motion. Can be bilateral, self-limiting	3-12 yrs, > in boys **age is a big factor in determining outcomes (early identification is key)	Afebrile, Trendelenburg and assess gait, **leg length discrepancy**, **antalgic (avoid pain)** gait, thigh atrophy, decreased abduction and internal rotation of hip.	xray showing There is a flattening and fragmentation of the femoral head. Bone scan can ID avascular necrosis	Refer, self limiting, limp can last 2-4yrs, stretching, bedrest, casting, NSAIDS, Pelvic/femoral osteotomy to contain femoral head. crutches & bracing	Goal: to prevent hip from dislocating
Slipped capital	fx of the growth plate which leads	Overwt and association	usually **complains of thigh or knee**	xray +ve	Pinning of the joint, child should	Place on crutches or

femoral epiphysis	to the slipping of the femoral epiphysis off the femoral neck	with hypo-thyroidism and endocrine disorders; seen in preteens and teens	**pain and holds the extremity externally rotated**. Resists internal rotation. **knee pain is hip pain unless proven otherwise,** can have groin pain radiating to the knee, worsening pain		be admitted to the hospital immediately and placed on bed rest. Refer immediately to ortho surgeon.	wheelchair, non-weight bearing needs to be emphasized.
Transient synovitis	acute onset of atraumatic groin or hip/thigh pain that is unilateral and a limp or unwillingness to bear weight	2-8 yrs	acute onset, Sudden pain, r/o bacterial infection of joint or bone. US IDs effusion seen in TS and septic arthritis. Xray can show medial joint space widening & can exclude SCFE & Fx.	**WBC, ESR, CRP are norm or slightly elevated.** Xray is norm unless effusion is present. Bone scan can differentiate TS and SA from osteomyelitis	association of preceding **viral illness 2wks-1mth prior with n/v, diarrhea and cold symptoms**	Plain radiographs exclude SCFE and fracture, x-ray may show medial joint space widening, lab work would be WBC, ESR, CRP, and if normal likelys TS, if elevated can still be that so MRI or aspiration of the fluid present on hip. Bone scan can differentiate between septic arthritis or TS from osteomyelitis

Oesteomylitis	Infection of the bone. Mostly long bone. May have hx of trauma. Most common organism is S. aureus		Fever and ill appearing, limp or refusal to stand, point tenderness. **Acute:** Fever that may be abrupt. Irritability or lethargy in young children. Pain, swelling, warmth and redness at the area of the infection **Chronic**: Chronic fatigue, pain, swelling, warmth, drainage. May have fever	**Elevated ESR, CRP and WBC.** Needle aspiration of fluid. Bone scan. Need BCx too	IV antibx long term 4-6mths	
Septic Arthritis	Microbial agent in the joint space. **Ortho emergency,** delay will lead to irreversible damage		Pseudoparalysis due to pain, unable to perform ROM, severe pain and acute inflammation	US can ID effusion, If the US is positive for an effusion it should be followed up by lab work (CBC with diff, CRP, ESR). elevated WBC, ESR CRP may indicate SA or osteomyelitis, confirm with MRI or an		

				aspiration of fluid		
Lyme's arthritis	Arthritis is Initial sign of lyme's disease in children. targets large joints		symptoms mimic SA			
Scoliosis	spinal curvature occurring in normal healthy patients	more freq in females	Adam's forward bending test. perform neuro exam. assess for hairy patches, dimple, nevi, muscle weakness, neuro abnormalities	Scoliometer MRI, CT scan	Exercise, brace >25-40 degrees for 20-22 hrs/day, Spinal fusion for >45-50 degrees	

Ortho emergencies and urgencies: septic arthritis, neurovascular compromise, compartment syndrome, unstable slipped capital femoral

Bowed legs- blount's disease, should be corrected by 4
In-toeing -18 mths start to straighten out usu done by 3 or 4y
Out-toeing
Toe-walking – may be seen with autism, may be out of habit
Concern with kids with rickets, will see bowed legs at 4 – vit D levels, calcium

Where is the source of pain and what is the condition?
Hip - SCIFE
Thigh - Femur condition
Knee -
Leg - tibia
Ankle joint - MG
Foot - Tarsals & metatarsals

Age and likelihood of disorder
Newborns and infants (< 1 yr)
Toddlers (1-3 yr)
Older children (4-10 yr)
Pre-teens and teens (> 10 yrs)

Obtaining hx
What is the specific concern?

- Pain/tenderness, limp, trauma/injury, or overuse, swelling, ability to bear weight, ROM…where? UE, LE, groin, foot/ankle, back…

Who is concerned?
When does it manifest? Daytime, nighttime, activity, jumping, walking up & down stairs?
Characteristics?
Duration?
Improving or worsening?

Any witnessed trauma
Swelling without trauma - is more worrisome
Swelling with trauma
Warmth or erythema
Swelling and erythema- thinking of cellulitis
Systemic symptoms- fever, rash, foreign body, mass (could be sarcoma with mass)
Ask for ROM
Unable to walk

With shoulder breaks, would check pain control, blood flow (circulation checks), compartment syndrome

Assess for fluid with bulge sign and ballottement sign. Thomas test is for hip flexion if contracture is suspected
24 hour creatine-creatinine ratio to test for muscle disease
Urine Uric acid –24 hr specimen for gout
Urine Tests – creatine-creatinine ratio for test presence of muscle disease;
Urine deoxypyridinolie – assess bone resorption process

A **Bone scan** can differentiate septic arthritis or TS from osteomyelitis. In more chronic case it can be used to identify avascular necrosis or Legg-Calve-Perthes disease earlier in the course than can a plain radiograph. Bone scan can also help diagnose tumors and myelodysplastic disease

Sprains
Overstretching or tear
Ligament injury (Excessive stretching of a ligament)
Twisting motion
Grade I—mild bleeding and inflammation
Grade II—severe stretching and some tearing and inflammation and hematoma
Grade III—complete tearing of ligament
Grade IV—bony attachment of ligament broken away

Treatment of sprains:
first-degree: rest, ice for 24 to 48 hr, compression bandage, and elevation
second-degree: immobilization, partial weight bearing as tear heals
third-degree: immobilization for 4 to 6 weeks, possible surgery

<u>Nursing care for sprains</u>
R- rest
I- ice
C- compression
E- elevation

Strain
Microscopic tear in the muscle
May cause bleeding
"Pulled muscle"
Inappropriate lifting or sudden acceleration-deceleration

Fractures

Random Case study in class
Mono- prolonged fever

Neuromuscular conditions

Cerebral Palsy

Cerebral Palsy is a brain disease causing paralysis
Can be caused prenatally: by infection, hypoxia, radiation, preexisting brain abnormalities OR
Can be caused postnatally: by infection, hypoxia, head trauma, meningitis, apgar scores <3 at 5mins, extreme preterm
Rarely caused by genetic complications
It is a non-progressive disease

Types of CP

1. Spastic- hypertonia, most common type, from lesion in upper motor neurons, adductor muscles constantly flexed, scissors gait, calves are flexed causing achilles tendon to pull up and leads to toe walking
2. Dykinetic- damage to the basal ganglia which inhibit and prevent movement, damage will lead to involuntary movements, nonspastic
    a. Athetoid- facial grimace, trouble swallowing, drooling, speech impairment, involuntary movement
    b. Dystonic

Ataxic (without order)- caused by damage to the cerebellum which controls coordination and precise movements, may seem clumsy, poor balance and muscle coordination, unsteady wide gait, nonspastic

Mixed type

6 mth old child who reaches for toy with right hand f/u assessment for CP
Will have increased reflexes due to spacisity.
Can get CP from having group B strep as young baby.

Diagnosis plan for CP
Developmental screen
Neurological examination
EEG
Neuroimaging
Cytogenic & metabolic studies to r/o other causes

Problems associated with CP
Delayed and decreased gross motor development, decreased coordination
Problems sucking, feeding, swallowing
Mental retardation seen in 18-50%
Learning disabilities
Seizures

Sensory deficits - speech, vision and hearing

Signs of possible CP
Persistent primitive reflexes
Arching back
Poor head control at 3mths
Fisting after 3 mths
No smiling at 3 mths
Unable to sit without support at 8 mths
Rigidity or floppiness
Excessive irritability
Feeding difficulty - tongue thrusting past 1yr, freq gagging or choking while feeding

Goals for CP
Establish mobility, communication and self help skills
Correct associated defects as effectively as possible
Gain optimal appearance and integration of motor fns
Provide adapted educational opportunities
Promote socialization with other affected and non affected individuals

Treatment
Not curable but treated to improve quality of life
Interdisciplinary team. Referral to neurologist, rehabilitation - PT, ST (infants and toddlers), OT
Physical Therapist help to improve strength and walking ability, stretching to reduce contractures
Medications

- Muscle relaxants - diazepam and baclofen pump
- botulism can be given to reduce hypertonicity
- Antispasmodics- Botox
- Analgesia
- Antiepileptics (with seizures)

Braces and supportive devices
Surgery to loosen muscles, cut nerves to reduce movements or spasms and straighten bones
Dental care

Well child care
School

- hearing aids and glasses
- OT to help with writing or keyboarding. May use bigger grip pencils, crayons, utensils

Social support

- stress management and community resources

Nutrition- esp. high fiber diet to prevent constipation
Safety
With an artificial urinary sphincter it may be possible to potty train

CP and IQ
Varies widely
70% with normal IQ
Rigid, atonic, and quadriparetic CP patients have the highest incidence of profound impairment (mentally)

Muscular dystrophies (MD)

Is a degenerative, genetic disease. progressive weakness and wasting of skeletal muscles; increasing disability and deformity. Is an X-linked disease.CPK and AST are high in first two years of life
Gowers signs to stand up, lordosis common

Duchenne Muscular Dystrophy

Most common and most severe MD
Family is a big factor, seen in 60% of new cases

Case Study: 15 yr old male, Dx with DMD at age 5, Wheelchair bound since age 9, Bipap at night, 5kg wt loss in 3 mths, now with complaints of difficulty swallowing,

- What diagnostic work-up is indicated? Swallow study (condition may cause aspiration), EMG (electromyography) to check muscles
- What is the prognosis for this condition (life span mid 20s)
- What tx/therapies are needed (thicken feeds, slow softer foods, feeding tube, speech, PT)
- What consult/referrals should be placed?

Characteristics
Early in life appropriate development or slight delay
Onset 3-7yrs
Notice hypertrophic calf muscles but weak
Death from respiratory or cardiac failure

Dx eval
Prenatal testing if have family hx
Clinical presentation
Blood test: PCR for dystrophin gene mutation
Confirm with EMG, muscle biopsy, and serum enzyme measurement
Serum CK, AST and ALT are elevated. CK will be >50 times the normal (37-430U/L)
Elevated CK and AST within first 2 yrs of age shows an inflammatory response can be an indication of DMD before s/s of weakness are expressed

Manifestation
Waddling gait, frequent falls, Gower sign
Lordosis (once they get to wheelchair bound)
Enlarged muscles, especially in the thighs and upper arms
Profound muscular atrophy in later stages
Mental deficiency is common

Management
Goal to keep unaffected muscles functional for as long as possible
keep as active as possible
Steroid use may delay wheelchair dependence (prednisone keeps them mobile longer)
ROM, bracing, surgery to release contractures, performance of activities of daily living
Bipap to help with respiratory health

Guillian-Barre syndrome (GBS)

Also known as infectious polyneuritis. Acute demyelinating polyneuropathy (damages the peripheral nervous system) with progressive paralysis. Immune-mediated disease. Often occurs 10 days after a viral infection. Has associated with some vaccine administration. HIgher incidence in children 4-10yrs, 16-17, young adulthood, > in males.

Inflammation and edema in the spinal column, progression from the cranial nerves to impaired nerve conduction then to partial and complete paralysis.

Case Study:

17 year old male, Hx influenza 2 wks ago, Ataxia, HA, blurred vision, Limping unable to stand on 1 foot, Denies fever, Labs norm CBC and electrolytes, What other studies would you do

Laboratory

Imaging: MRI or CT scan

Prognosis

The younger children have better outcomes, most patients with complete recovery.

Muscle function regained in 2 days to 2 weeks after onset of symptoms. Prolonged period of recovery. May be placed on ventilator.

Deaths are often due to respiratory failure.

Manifestation

Initially, muscle tenderness, paresthesia (burning or prickling sensation), muscle weakness. By the 3rd week, 90% of patients are at their weakest

Paralysis rapidly ascends from the lower extremities; may involve the trunk, arms, and face

Flaccid paralysis; loss of reflexes

Intercostal and phrenic nerve involvement (need ventilator)

Frequently have urinary incontinence or retention and constipation

Dx eval

Progressive paralysis and/or EMG

Normal lab values but elevated protein in CSF fluid

Bilateral, symmetric paralysis

Management

Treatment symptoms

Medications

- Steroids (controversial)
- IV immunoglobulin (IVIG), prefered to plasma exchange in the peds population cos plasma exchange is invasive and time consuming
- Heparin, stool softener, analgesics

Plasmapheresis
Respiratory support
Emotional support for the child and family

Supportive care with a multimember health care team
Assess for early signs of respiratory distress or difficulty swallowing, may need ICU care
Focus on prevention of complications
Skin, nutrition, and muscular support measures

Myasthenia Gravis (MG)

Is rare in childhood, autoimmune, autosomal recessive mutation disease; more common in oriental population. Presents with varying degrees of weakness and fatigue.

Case study (recommended reading):
2 y.o. girl presents with refusal to walk, symptoms started 3 wks ago with fever of 104 and difficulty bearing weight on both lower extremities. xray unremarkable at the time but was positive for AOM which was tx'd with amoxicillin. 1 wk later limp worsened, tx at a community clinic was NSAIDs and heating pads. Further progression brings her to the hospital; no hx of trauma or resp. s/s but 3 mths prior had bloody diarrhea +ve for E. coli and Shigella. Immunizations UTD.
PE: Afebrile, HR 100, RR 24 BP 84/60. full ROM bil. at hips and knees, no deep tendon reflexes in LE at both knees and ankles, limited dorsoflexion of the R foot, no swelling, erythema at any joints. other exam was normal.
Labs: CBC, CMP, CK, CRP, antinuclear antibodies WNL but ESR slightly elevated at 25mm/hr. LE xray and bone scan are -ve
What further test would you do? MRI and CSF

Neonatal MG: Born of mother with MG, Transplacental transfer of AchR antibodies, Self limiting

Juvenile MG: Born of a non-myasthenia gravis, can happen at anytime from birth to puberty and tends to be permanent

Manifestation
Ptosis and ocular symptoms
Generalized muscle weakness
Fatigue
Dysphonia (difficulty speaking)
Dysphagia

Proximal limb weakness
Transient Neonatal myasthenia

Dx eval
Symptoms- Ptosis and eye issues are number 1 symptom
Family history
Edrophonium (Tensilon) test- is a rapid-acting anticholinesterase drug of short duration that improves symptoms of myasthenia gravis by inhibiting the breakdown of ACh and increasing its concentration in the neuromuscular junction
Electrophysiology
DNA analysis
Muscle biopsy
Serology: AChR antibodies

Management
Multidisciplinary approach
Acetylcholinesterase Inhibitors (Pyridostigmine)
Thymectomy
Immunosuppressive therapies with steroid-sparing immunosuppressants
IVIG for short term improvement

Nursing Considerations: Vision, Safety, Speech, Swallowing, Respiratory

Week 4 (3/22) **Mental Health**

Psychiatric Disorders in Children –

Mental Health – Emotional Well-being, "balance", appropriate level of functioning in all aspects of life

Mental Illness – Some level of dysfunction, "imbalance", causing functional impairment. An impairment in thinking, mood, or behavior that affects functional ability.

- A syndrome characterized by clinically significant disturbance in an individual's cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological, or developmental processes underlying mental functioning.
- Usually associated with significant distress or disability in social, occupational, or other important activities.

Neuron· Basic unit of the brain

- Transmission of electrical impulses to other cells
- Communication occurs at the synapse
- Neurotransmitters released from one neuron are received at the other, after crossing the synaptic cleft

Neuroplasticity: The brains ability to change in response to experiences related to the amount of effort such change requires. Children have great neuroplasticity. As person ages the brain has less and less ability to change in response to experiences and it takes more and more energy for it to do so.

Stress Diathesis Model: How physiological disorders occur

- Diathesis – predisposing factors, directly impact vulnerability to psychologic d/o (or how stress is handled)
  - Genes
  - Abnormalities of brain structures
  - Neurotransmitters
- Stressors – external factors, triggers
  - Noxious physical stressors
  - Trauma, abuse, neglect
  - Relationships – loss, turbulence
  - Culture related stressors

Assessment of potential psychiatric disorder

- Major Rule-outs:
  - Organic
  - Developmental
  - Environmental
  - Substance, medications, or toxin-induced origin
- Consider multi-factorial causes
- Consider Developmental stage
  - Behavior congruent
  - Hormonal changes
- Diagnostic evaluation:
  - CBC, CMP, thyroid panel, LFT's, blood glucose, lipid profile, tox screen (if substance abuse is suspected)
  - EKG

    - EEG – seizure activity ?
- DSM-5 Cross-cutting symptoms – symptoms can appear across disorders
    - Check list of 25 items to assist in narrowing potential diagnosis (12 psychiatric domains)
    - Measures symptoms in past 2 weeks
    - Initial diagnostic guidance or presentation over time

General Risk Factors – **weighted heavily on heredity -** parental mental d/o, absence/death of either parent, abuse/neglect, insecure attachment, parental unemployment or financial problems, teenage mother, low parental involvement, poor self-esteem, poor physical health, peer rejection, poor attachment to school/school failure, socio-economic disadvantage, neighborhood violence & crime

General Protective Factors – **strengthen mental health –** good family/social support, strong family norms, economic security, good coping skills, social competence, positive self-esteem, above average intelligence, moral beliefs/values, good physical health, positive school climate/belonging, connectedness to community, support from adults other than parents

Mental Status Evaluation

- Physical Appearance
    - Grooming, facial expressions, mannerisms
- Parent-child interaction
    - Waiting area, exam room
- Separation and Reunion
    - Lack of affect or severe distress
- Orientation – timing, place, person
- Speech and Language
    - Age appropriate; hearing loss
- Mood
    - Visible expression/behavior, verbal
- Affect
    - Range of emotion, lability, **congruence with mood** (reported mood doesn't jive with what is being seen in office or stated as seen at home)
- Thought Process and Content
    - Age appropriate; suicidality, psychoses
- Social Relatedness
    - General interactions; self-esteem, family/peer relationships
- Motor Behavior

- Coordination, activity level, involuntary movements
- Cognition
  - Intellectual function, problem solving
- Memory
  - 3 objects after 5 min's; 5 digits forward, 3 backward
- Judgement and insight
  - Age appropriate understanding

Common Pediatric Psych Diagnoses

- **Anxiety D/O** – Anxiety is normal! – Becomes D/O when excessive fear or excessive anxiety impact daily functioning
  - **Separation Anxiety Disorder –** Normal (developmentally appropriate): infants, loss or parent (death or separation), involved in event (witnessed sibling loss, lost in store, kidnapped). Should resolve and normalize with counseling. May continue to experience when related events occur.
    - § Developmentally inappropriate when the following occurs for **more than 4 weeks (children/adolescents)**
      - Recurrent excessive distress in anticipation or when experiencing separation
      - Excessive worry about losing attachment figures
      - Excessive worry about adverse event (getting lost, kidnapped, illness, ect. Causing separation)
      - Reluctance to leave attachment figures
      - Nightmares
      - Somatic symptoms
    - § Potential DD – other anxiety d/o, panic d/o, depression or mood d/o, conduct d/o, oppositional defiant d/o, personality d/o
    - § Treatment – Cognitive Behavior Therapy (CBT) – talk therapy with processing component or play therapy – based on age
    - § Refer for therapy
    - § Prognosis – EXCELLENT – may continue w/excessive trauma, usually experience periods of exacerbation and remission, but typically resolves by adulthood
  - **Phobia –** Marked fear or anxiety r/t specific object or situation. Fear may be expressed by crying, tantrums, freezing or clinging. Object almost always provokes immediate distress and is likely avoided at all cost. **Symptoms must last ≥ 6 months for diagnosis**
    - § Potential DD – Separation anxiety d/o, social anxiety d/o, panic d/o, OCD, agoraphobia (fear of crowds, public places, open areas) don't want to leave the home.

- § Stastics – 5% of children affected (typically have underlying psych component), **60% greater risk of suicide** (potentially r/t comorbidity
- § Treatment – CBT/desensitization
- § Prognosis – Favorable – except r/t traumatic event (fire)

o **Social Anxiety D/O -**Excessive fear or anxiety of being scrutinized in social situations; fear of appearing anxious and being humiliated, embarrassed or rejected; exhibited by crying, tantrums, freezing, clinging, or selective mutism. Associated with somatic symptoms.

- § Potential DD – Normal shyness, other anxiety d/o, panic d/o, depression or other mood d/o, autism spectrum d/o, personality d/o
- § Refer for evaluation and individual and or group therapy (group therapy very effective is child is ready).
- § Treatment – SSRI – consider risk vs. benefit – start low – go slow
- § Prognosis – 30% remission w/in one year, 50% remission w/in a few years, 60% of individuals w/out treatment do not show improvement for several years or much longer

o **Panic Disorder** – Recurrent unexpected panic attacks (palpitations, rapid heart rate, sweating and/or chills, shaking, SOB, dizziness, nausea, numbness, light-headed, fear of dying). Severe anxiety causing physical symptoms that can not be controlled by the individual affected.

- § DX: at least 1 attack must be followed by 1 month of: persistent fear of having another panic attack OR a maladaptive change in behavior r/t the attacks. Important to identify between "panic attack" and severe anxiety, must exhibit physical uncontrollable symptoms.
- § DD's – other anxiety d/o, substance induced anxiety d/o
- § Treatment – Refer for evaluation and individual therapy, tx w/SSRI may be beneficial – weigh risk vs. benefit – start low, go slow

o **Generalized Anxiety D/O** – Persistently on edge, "worry wart", their worry is typically much more serious than their age or developmental level should express.

- § Present w/ : Excessive anxiety or worry more days than not; Difficult to control; restlessness, keyed up, on edge; easily fatigued; poor concentration; irritable; muscle tension; sleep disturbance; may have been referred for attention issues.
- § DD's – other anxiety d/o, OCD, PTSD, adjustment d/o, depressive d/o
- § Tx: Refer for CBT; tx with SSRI may be beneficial – consider risk vs. benefit. Start low, go slow
- § Prognosis – 3% prevalence. Often long-term and difficult to treat

o **Adjustment D/O with Anxiety** – something unusual or negative happens (event triggers mental health issues), develop psych symptoms as result. i.e. move, new sibling, parent w/health issues.

- § Symptoms occur as result of event. Move triggers anxiety **– Diagnose Adjustment D/O w/anxiety.**

        - § If anxious w/out trigger – **Diagnose Anxiety D/O**
    - o **Selective Mutism** – Consistent failure to speak in situation where there is an expectation for speaking, speaking in other situations, **interferes with education and social communication, Duration ≥ 1 month**
        - § Prevalence – Very Rare (0.03% - 1% of population)
        - § DD's – communication d/o, neurodevelopmental d/o, social anxiety d/o, trauma d/o
        - § Prognosis – Generally "outgrown" but other anxiety symptoms may continue to adulthood
        - § Treatment – Refer for CBT, SSRI might be beneficial – consider risk vs. benefit, start low and go slow
- **Obsessive-Compulsive D/O** – 2 key components
    - o Obsessions – intrusive and unwanted, recurrent and persistent thoughts, urges or images, that cause marked anxiety or distress
    - o Compulsions – repetitive behaviors aimed at preventing or reducing anxiety or preventing a dreaded event. The behaviors are excessive and not connected in a realistic way with what they are expected to prevent. Result aimed at preventing anxiety r/t obsession
        - § DD's – Anxiety d/o, depression or other mood d/o, trauma disorder
        - § Treatment – Refer for CBT, SSRI may be beneficial, start low and go slow, risk vs. benefit

Prognosis – Long term chronic illness w/ periods of exacerbation alternating with periods of improvement, complete remission of symptoms is unusual, some improvement with treatment

- **Mood Disorders**
    - o **Major Depressive D/O (MDD)** – Overwhelmingly Depressed mood most of the day most days (may be expressed as irritability). Decreased interest/pleasure. Appetite changes (dec or inc, with or w/out loss or gain). Sleep changes (insomnia or hypersomnia). Fatigue/decreased energy. Guild/feeling worthless/hopeless. Attention/concentration difficulty. Thoughts of death or suicidal thoughts w/ or w/out plan
        - § Watch for: doesn't like to have fun anymore, parent describes isolation
        - § DD's – Adjustment d/o w/ depressed mood, other depressive d/o, bipolar d/o, ADHD, disruptive mood d/o
        - § Treatment – Refer for individual/family therapy, SSRI may be beneficial – consider risk vs benefit, start low, go slow
        - § Prognosis – 10% recover spontaneously w/in 3 months, 40% recover w/in 1st year, at 12 months 50% remain clinically depressed – w/out treatment. Risk of suicide 3% over 10 years. 30% of cases have recurrences w/in 5 years. With each successive depressive episode, the patency of psychosocial factors necessary to trigger new episode decreases, suggesting that repeated depressions do in fact increase a person's vulnerability to become depressed. With each episode the r/o another episode increases.

- **Persistent Depressive D/O** (Dysthymia) – Depressed mood most of the day, most days, **for at least 1 year.** Same symptoms as listed under MDD but lasting more than 1 year. VERY difficult to treat, almost engrained in their personality "Eeyore"
  - § DD's – MDD, Bipolar D/O
  - § Tx – Refer for individual/family therapy, SSRI may be beneficial, consider risk vs. benefit, start low – go slow. Can help a little but never really completely resolves.
  - § Prognosis – Long-term symptoms impacting social and functional ability in up to 80%. Incidence of suicide in 3-12%.
  - § Double depression possible – persistent depressive d/o w/ accompanying major depression

Treating Depression & SSRI use from readings

- Pediatric Depression should be treated in an integrated fashion seeking help of therapists, social workers, and/or case managers when possible.
- Psychotherapy and psychoeducation, regular exercise, healthy diet, and good sleep hygiene, as well as family therapy and support organizations can be paramount in helping adolescents conquer depression
- **SSRI's** are 1st line in pharmacology treatment (see chart below)
  - **ONLY SSRI FDA approved for pediatric patients are Fluoxetine (Prozac) and Escitalopram (Lexapro) with Fluoxetine being used more frequently.**
    - § Fluoxetine – start at 5-10mg daily and titrate up at 2-week intervals based on clinical response, up to target range of 20-80mg dialy.
  - **Citalopram (Celexia) and Sertraline (Zoloft) are also frequently used off label in pediatrics with good effect.**

Once starting SSRI check in monthly to screen for S/E's and check for efficacy of current dose.

Common S/E's: gastrointestinal symptoms (loose stools or constipation, change in appetite, nausea, belly pain), dry mouth, sweating, sleep disturbance, headache, rash, and sexual dysfunction.

SSRI's can be activating – tend to increase energy, however may cause symptoms of agitation and restlessness.

Black Box warning with regard to increasing SI related to "disinhibition" with regard to risk-taking behaviors or increased impulsivity. **SI must be assessed at every follow-up visit.**

Discontinuation syndrome can occur with abrupt discontinuation of SSRI's, titration off the medication is imperative!

- **Bipolar D/O – Not typically diagnosed in patient under 18 yo**
  - § **Bipolar 1 D/O –** presence of manic episode, does not need to have identified depressive episode.

- Manic episode - distinct period of abnormally and persistently elevated, expansive, or irritable mood and abnormally and persistently increased activity or energy, lasting at least 1 week and present most of the day, nearly every day (or any duration if hospitalization is necessary).
- Hypomanic episode - same as above (manic) lasting 4 or more days

§ **Bipolar 2 D/O –** Current or past hypomanic episode and current or past major depressive episode

o **Disruptive Mood Dysregulation D/O – New diagnosis in DSM 5** Bipolar in children less than 18yo (look bipolar but don't want to "label" them yet). Severe recurrent temper outbursts, three or more times a week (verbal or physical), **symptoms begin before age 10** – intensity may change but presence noted. **Symptoms are present for at least a year.** Sad, irritable or angry mood between outbursts. Occurs in multitude of settings – not just at home. Should not be diagnosed before age 6 or after 18.

§ DD's – other depressive d/o, bipolar d/o, oppositional defiant d/o, intermittent explosive disorder

§ Tx – refer for individual/family therapy, SSRI may be beneficial (with heightened caution – SSRI may precipitate a manic episode). Carefully weigh risk vs. benefit, start low – go slow

§ Prognosis – limited studies

- **Conductive D/O –**

o **Oppositional Defiant D/O (ODD) –** characterized by a persistent pattern of disobedience, argumentativeness, angry outbursts, low tolerance for frustration, and a tendency to blame others for misfortunes, large and small (trouble making friends, conflict with adults)

o **Conduct D/O (CD)–** Serious violations of social norms, including aggressive behavior, destruction of property, and cruelty to animals (truancy, runaway, robbery, assault) Serious and persistent patterns of disturbed conduct and antisocial behavior; no appreciation for welfare of another; Little guilt or remorse about harming others; impulsive or bullying behaviors possible; established during primary school years, increased after puberty. Predominantly affect boys; May begin as ODD (childhood) and progress to CD if not treated & over 40% of children with CD may progress to antisocial personality D/O as adults.

§ **Treatment –** Vigorous early intervention, assessment and management needed:

- Parent management therapy
- Multisystem therapy
- Multidimensional foster care model
- Cognitive problem-solving skills training
- Anger control training
- Possibly medication

§ **Prognosis -**Poor without treatment; Currently 50% of children with conduct D/O continue to have mental health problems into adulthood.

- **Trauma D/O**
  - **Reactive Attachment D/O** – Consistent pattern of inhibited emotionally withdrawn behavior toward adult caregivers; seen in children of orphanages or where primary caregiver changes frequently
    - Rarely/minimally seeks comfort when distressed
    - Rarely/minimally responds to comfort when distressed
    - Persistent social and emotional disturbance characterized by
      - Minimal social/emotional responsiveness to others
      - Limited positive affect
      - Episodes of unexplained irritability, sadness, or fearfulness
    - Child has experience a pattern of extremes of insufficient care as evidenced by (at least 1)
      - Social neglect or deprivation – basic emotional needs of comfort, stimulation, and affection
      - Repeated changes of primary caregivers
      - Rearing in unusual settings (institutions)
    - Care inconsistencies are responsible for symptoms
    - **Symptoms present before age 5**
    - Developmental age of at least 9 months
    - **Treatment –** No standard treatment – but should involve both the child and the parents or primary caregiver. Goals of treatment are to ensure that the child:
      - **Has a safe and stable living situation – or unable to treat**
      - Develop positive interactions and strengthens the attachment with parents and caregivers
      - Strategies include:
        - Encouraging the child's development by being nurturing, responsive and caring
        - Providing consistent caregivers to encourage a stable attachment for the child
        - Providing a positive, stimulating and interactive environment for the child
        - Addressing the child's medical, safety and housing needs
  - **PTSD (acute stress disorder) –** Exposure to actual or threatened death, serious injury or sexual violation by:
    - Direct experience
    - Witnessing experience in person
    - Learning of the experience of close family member or friend
  - Acute Stress Disorder – symptoms last 3 days to 1 month after the event:
    - Involuntary, intrusive memories, dreams &/or flashbacks; efforts to avoid distressing memories; efforts to avoid reminders that trigger memories; inability to experience positive feelings; unable to remember event;

sleep problems; irritable behavior, anger, or aggression toward others; hypervigilance/exaggerated startle response; memory/concentration difficulty

- PTSD – Symptoms as above – lasting longer than 1 month
  - § Child specific symptoms – Bedwetting, after being toilet trained; forgetting how or being unable to talk; acting out the event during playtime; being unusually clingy with a parent or other adult; may have disconnect amnesia yet be acting out in play, or being thinking about event constantly and be acting out with same symptoms
  - § Referral to Mental Health Provider ASAP – don't wait
  - § Prognosis – with sensitivity and support of families and appropriate professionals, children with PTSD can learn to cope with the memories of trauma and go on to lead healthy and productive lives.
- **Adjustment D/O – see w/depression & w/anxiety (above)**

· **Neurodevelopmental D/O – skipped to ADHD, nothing in readings mentioned**

- **Intellectual Disabilities**
- **Communication D/O**
- **ADHD** – A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development
  - § Symptoms:
    - · **Inattentive**: poor attention/careless errors; poor attention; doesn't listen; no follow-through on instructions; poor organization; Avoids/dislikes demanding tasks; loses/misplaces items; distractible; forgetful
    - · **Hyperactive-Impulsive:** Fidgets, squirms; won't remain seated; running/climbing excessively, extreme restlessness; difficulty staying quiet during activities; acting/feeling as if driven by motor; excessively talking; blurts out answers; can't take turns; intrudes or interrupts
    - · **Combined –** symptoms from both categories above
    - · **Diagnosis –** Symptoms begin in childhood, must be present before age 12. May not be diagnosed until much later; symptoms must be present in more than one setting – home and school; using multiple informants helpful (what do others see subjectively); Strong family history; Connors scale useful; more prevalent in males; Females tend to be less hyperactive; if not stratforward don't start on meds without psych consult.
    - · **Comorbidities –** learning/language difficulties; ODD or CD; Anxiety and or depression; Mood disorders; psychotic disorders; mental retardation/ low-level functioning; pervasive developmental disorders; smoking/substance abuse; Tic disorder; poor peer relationships; risk for injuries

- **Differentiating – Attention issues range among a wide range of d/o's.** Why now? Age appropriate behaviors; hearing or vision problems; substance use; life stressors; anxiety; depression; other mood or pysch d/o; if complex REFER
    - **DD's –** ODD, intermittent explosive D/O, other neurodevelopmental d/o, specific learning d/o, intellectual disability, autism, reactive attachement d/o, anxiety d/o, depressive d/o, bipolar, disruptive mood dysregulation d/o, substance use, personality d/o
- **Treatment – Only if symptoms are impairing function or development**
    - Chronic condition – educate parents and patients, develop partnership with family, develop management plan with targeted goals, include teachers if possible, requires ongoing monitoring and anticipation of developmental changes.
    - **Medication – Always start low and go slow (will add more from readings)**
    - Behavioral therapy

ADHD Medication Management - from readings

3 Classes of Meds FDA approved for ADHD

- Stimulants – greatest affect- initial medication of choice, short and long acting options
    - Methylphenidate
    - Amphetamine

Start low, give 3days to 1 week before increasing dose, schedule monthly F/U to monitor S/E's and track weight, height, pulse, and BP. Until effective dose is found. Then can go to quarterly or by yearly.

Preschool-age – Children 3-5yrs with severe ADHD- methylphenidate was effective but in lower dose (2.5mg twice a day) but titrate more slowly and in slower increments than with older children.

Adolescents – if substance abuse is present it should be treated before starting ADHD meds. If not achievable then use nonstimulant options (mentioned below). Even if no hx of substance abuse is noted, monitor this age group for misuse

Common Side Effects – appetite suppression, weight loss, insomnia, headaches, and abdominal pain.

- Atomoxetine (Selective norepinephrine reuptake inhibitor) – should be 1st line of treatment for the following:
    - Children with co-occurring anxiety
    - Youth with ongoing substance abuse, possible in house or parental med abuse, or at risk for performance enhancement use

- Children whom do not respond to stimulant or experience intolerable side effects on stimulants (extreme irritability or increased/impairing tics)

Twice daily dosing may increase tolerability and improve symptom coverage throughout day.
Common Side Effects – nausea, decreased appetite, dizziness, sleep disturbance, headache, and fatigue.
Black Box warning for increase in suicidal ideation
Monitor for Jaundice – hepatic failure
Full therapeutic effect may take up to 6 weeks.

- Alpha-adrenergic agonists – extended-release guanfacine and clonidine
  - Monotherapy or Adjunctive therapy (augment to stimulants) in ADHD tx

Full therapeutic effect may take up to 4 weeks
Side Effects – somnolence, headache, fatigue, dizziness, abdominal pain, and hypotension
Dose prior to bed to help with sleep issues
Monitor BP routinely – rebound HTN can occur with abrupt D/C

See "Assessment and Treatment of Attention-Deficit/Hyperactivity Disorder Part2" pg 163 & 165 for grid of frequently used meds and dosing.

Take Away:

- **Always Rule out Somatic etiology FIRST**
- **Rule out substance use (consider diet pills, OTC's, caffeine pills, tobacco, inhalants)**
- **Rule out medication related symptoms**

AND

- **When in doubt – REFER to neurology or psychiatry**

Pediatric Ophthalmic Conditions

Simple Ophthalmic Conditions		
Conjunctivitis An inflammation of the palpebral and occasionally the bulbar conjunctiva		

	Viral	Bacterial	Allergic
Causes	Adenoviruses, HSV, herpes zoster and varicella (lasts longer)	H. influenzae, S. pneumoniae, M. catarrhalis (easier to cure)	Exposure to allergens (can be difficult to control)
Assessment	• Most common in spring and fall • More common in children over 6 years • Itchy, red conjunctiva • Swollen eyelids • Tearing, profuse clear watery discharge • May be accompanied by fever, headache, anorexia, malaise, URI symptoms • May have pharyngitis, conjunctivitis, fever triad with enlarged preauricular nodes • If HSV, may see vesicles on eyelid margins or conjunctivae or cornea	• Most common in winter • More common in toddlers and preschoolers • Very contagious • Crusty, photophobia, petechiae on the conjunctiva, normal condition • Routine cx not necessary • Always give drops cos wont be allowed back in school unless drainage is done	• Occurs in childhood and after adolescence • Seasonal allergens are the cause and may be associated with rhinitis, eczema, and asthma • Severe itching, tearing • Redness, swelling of conjunctivae or eyelid or both • Stringy, mucoid discharge • Bilateral involvement • Cobblestone appearance in tarsal conjunctiva
Management	• Good hygiene • Self-limiting, resolves in 7-14 days • Warm or cool compresses • If HSV infection is suspected, immediate	• Self-limiting in 8-10 days but improve more quickly with topical antibiotics • Choose broad spectrum coverage for ophthalmic drops: Trimethoprim sulfate plus polymixin B – 1-2 drops 4X a day for 5-7 days Azithromycin drops – 1 drop twice a day	• Avoidance of allergens • Mild cases do well with saline solution • Cool compresses • Topical decongestants – Naphazoline (1-2 drops q 3-4 h) • Oral or topical antihistamines - Pataday (mast cell stabilizer and antihistamine)

	ophthalmic referral	for 2 days, then 1 drop once a day for 5 days (only if > 12 months old) Fluoroquinolone ophthalmic drops – 1-2 drops 4X a day for 5-7 days (only if >12 months old) Erythromycin 0.5% ointment – ½ inch ribbon 4 X a day for 7 days (patients with sulfa allergy or infants)	• Topical mast cell stabilizers – Cromolyn sodium 4%: 1-2 drops q 4-6 h if > 4years old; Nedocromil sodium 2%: 1-2 drops two times daily • Topical steroids – do not use without ophthalmology consult • Topical NSAIDS – Ketorolac 0.5% 1 drop 4 X a day for 1 week if > 12 years old

	Presentation	Management
Blepharitis	• Bilateral inflammation and erythema of eyelash follicles or meibomian sebaceous glands of the eyelids • Flaky, scaly debris over eyelid margins • Gritty, burning feeling in eyes • Mild bulbar conjunctival injection • Ulcerative form caused by S. Aureus • Nonulcerative form may be seen in children with psoriasis, seborrhea, eczema, allergies	• May be chronic or relapsing • Scrub eyelashes and eyelids with weak solution of no tears shampoo • Warm compresses (if cant do scrub) • If due to contaminated makeup or contact lens, discard makeup and sterilize lens • Do not wear contact lens until clear • Erythromycin 0.5% ointment – 0.25-0.5 inch in each eye 3-4 X daily for at least 1 week
Hordeolum	• S. Aureus infection of sebaceous glands, eyelids or the meibomian glands of the eyelid (comes to a head) • Tender, red furuncle • Complaint of FB sensation • Rupture occurs spontaneously to resolve	• Warm compresses • Erythromycin 0.5% ointment - 0.25-0.5 inch into each eye 3-4 X a day until 2-3 days after resolution • Refer if does not resolve

Chalazion	• Chronic sterile inflammation of eyelid (meibomian glands) (doesn't come to a head at the lid and rupture) • Deeper than hordeolum • Mild erythema with slow growing round painless mass • Can last a long time	• Warm compresses • Refer if does not resolve
Corneal Abrasion	• Teary eye with severe pain and photophobia • Sensation of foreign body • Decreased vision (in affected eye) • Conjunctival erythema • Exam: With penlight you will see disrupted tear film (hard to see) Fluorescein staining with superficial uptake (can see with this)	• Topical antibiotics 4 X daily, no longer patch • Important to keep lubricated • Recheck in 24-36 hours
Subconjunctival Hemorrhage	• Stchy bulbar conjunctival redness • Occurs due to coughing, sneezing, straining (vomiting) or trauma that results in bursting of conjunctival vessels • Painless	• Spontaneously resolve in 2-3 weeks • No treatment • Refer if pain, vision loss, or photophobia
Complex ophthalmic conditions		
Foreign Body	• Pain with foreign body sensation • Foreign Body visible in conjunctival sac • Tearing • Inflammation • Photophobia • Rare: opaque lens, irregular shaped	• Visualize the superior tarsal conjunctiva • May need topical anesthetic for exam • If not visualized, irrigate with NSS or sterile eye irrigant

	pupil or perforating wound to cornea or iris • Fluorescein staining needs to be done to assess • US and CT scan	• If visualized , use moistened Qtip to remove or irrigate • After removal of FB, Fluorescein staining to check for abrasion and visual acuity check • Recheck in 24 hours
Retinal Detachment	• Blurry vision which is worsening • Dark cloud in one visual field • Flashing lights • Shower of floaters • Darkening of retinal vessels on fundoscopic exam • Gray elevation at site of detachment	• Management is immediate referral to ophthalmology

	Hyphema	Periorbital cellulitis
Definition/ Etiology	• Accumulation of visible blood or blood products in the anterior chamber of the eye as a result of trauma	• Inflammation of tissues surrounding the eye • Spread from URI or middle ear infections • May be secondary to paranasal sinusitis • Bacteria most often responsible are Streptococcal H influenzae B- Purplish hue to eye
Presentation	• Dark red fluid level between the cornea and iris on gross examination or a hazy iris • Unable to detect a bilateral red light reflex • Pain, Photophobia and Tearing • Impaired vision • Abnormal pupillary reflex • (usu trauma, air bag, blow to eye, SS pts,	• Fever • Swelling and erythema of tissues surrounding the eyes • Deep red eyelid • Symptoms of bacteremia or sinusitis • Orbital discomfort or pain • Paralysis of extraocular muscles • Proptosis

	immediate refer to ophthalmologist or ER)	
assessment	• Visual acuity • Pupil mobility • Corneal examination • Red light reflex • If somnolence occurs, consider ICP increase	Diagnosis • CBC with differential • Blood cultures and cultures of purulent wounds near eye • CT scan to rule out sinusitis, orbital cellulitis or abscess • Visual acuity, extraocular movements and pupillary exam
Management	• Immediate referral to ophthalmology (needs slit lamp exam) • Restrict oral intake until seen by ophthalmology • Perforated eye shield to prevent additional trauma • Tylenol for pain; avoid NSAIDS • Surgery may be necessary (ophthalmologist will grade and decide)	• Referral to ophthalmology if proptosis, changes in visual acuity • Hospitalization if moderate to severe, poor response to outpatient management, younger than 1 year or a purulent wound near eye
Treatment	<u>Grade 1: Outpatient</u> • Elevate HOB 30 degrees • Eye shield • BR with bathroom privileges for 5 days • No strenuous activity for 10 days • Daily eye exams • Cycloplegic drops • F/U with ophthalmology long term <u>Grade 2 and 3: Inpatient</u> • Sickle cell patients • Increase in IOP • May require surgery • to remove trapped blood	• Outpatient Management consists of: 7-14 day course of Amoxicillin (high dose), Augmentin or Cefixime If MRSA is suspected: Clindamycin or combo regimen of Bactrim plus Amoxicillin Warm soaks every 2-4 hours Follow up in 24 hours (make sure it doesn't spread or get worse)

	• to prevent corneal staining in sickle cell patients • to decrease IOP • if clot is pressing on corneal epithelium if there is no clearing of hyphema with at home measures in 4 days F/U with ophthalmology long term	

	Keratitis and Corneal Ulcers	Uveitis
Definition/ Etiology	• Keratitis is inflammation of the cornea that can progress to corneal ulcerations and blindness • Corneal ulcers are well defined infiltration at the center or edge of the corneal • **Medical emergency** • causative agents are viral, bacterial or protozoan • Also caused by allergic rxn, improper fitted or extended wear of contact lenses, improper contact lens hygiene, chemical toxins, use of corticosteroids, • Usu. unilateral	• Inflammation of the uveal tract • May be acute or chronic • May be anterior or posterior • Etiology includes viral or bacterial infections, allergy, malignancy, ocular trauma, systemic diseases
Presentation	• Hx of eye trauma, extended contact lens wear, foreign body, conjunctivitis • Sensation of foreign body • Photophobia • Tearing, erythema, spasm of the eyelid • Severe pain • Blurred vision	• Acute onset of pain • Tearing • Blurred vision • Photophobia • Eyelid edema • Red eye • Cloudy appearance of the eye, bulging iris, irregular fixed pupils • Hypopyon (leukocytic exudate, seen in the anterior chamber of the eye)

		• Conjunctival erythema • Circumcorneal injection
Assessment	• Fluorescein green staining • White lesions on cornea • Corneal opacifications • Vesicles	• Slit lamp for exam
Management	• Immediate referral to ophthalmology • Antibx drops • Antivirals if herpes is suspect • Never use steroids • Everyday f/u with ophthalmology	• Immediate referral to ophthalmology for definitive diagnosis by slit lamp for exam • Topical or systemic corticosteroids • Cycloplegics (is a paralytic agent of the ciliary muscle of the eye, resulting in a loss of accommodation) • Mydriatics (is an agent that induces dilation of the pupil)

Pediatric Surgery 2/22/18

Polonidal cyst/abscess: Typical occurrence in white hairy teenage boy. Starts with pain in sacral region, cyst develops around clogged hair follicle then may develop an abscess. Typically treated with antibiotic such as Clindamycin or Bactrim and warm compress. It is drained, surgically removed. If it reoccurs then medical hair removal is indicated. Difficult to get the wound to heal.

Pyloric stenosis: Presents in first weeks of life. Cardinal findings: Non-bilious emesis, projectile vomiting, always appears hungry and agitated. Late problems are: hypokalemia, hypochloremia, dehydration. "Olive sign" in which you can feel a mass that feels like an olive, typically see this when child is dehydrated. Which is why early recognition is important. Pathophysiology: Hypertrophy and hyperplasia in part of pylorus which is the circular longitudinal muscle. If length is <15mm, and width <7mm, it is stenosis. Typically, width < 3mm to require surgery. After pylorus is repaired may still have some vomiting which is normal but should not be as significant and should clear up in 3-5 days. May need long term macrolides such as chalrythromicin, azythromicin, and erythromycin for GI motility and gut protection.

Malrotation midgut volvulus: Diagnosed with upper GI and is a surgical emergency! More common in younger babies and not very common in older children. Hallmark sign is bilious emesis so any baby with green vomit needs an upper GI immediately. Intestines are not sitting inside abdomen correct way, small bowel on right side and large bowel on left side, not pinned down well. Malrotation

itself not an emergency but when it spins and volvulus develops, circulation is interfered and that becomes the emergency. This is the number one cause of short gut syndrome. **Ladds procedure**: rotate intestine to correct side, attach mesentery, appendectomy, creating wide mesenteric base for stability.

TE fistula: Symptom: Infant with vomiting, drooling, and poor weight gain. Upper GI is diagnostic. Will see an esophageal stricture- use US to assess how extreme then will get dilation based on this. They will continue to have reflux after repair and will need to remain on reflux meds such as PPI's.

I**ntussusception**: Most common abdominal emergency in younger than 3 years of age with belly pain (typically in RUQ). Symptoms: Currant jelly stools, intermittent colicky pain that recurs. Example, will be playing, then screaming, then become lethargic. Due to ischemic bowel so pain is profound. Diagnosed with ultrasound and air contrast enema is used to treat.

Gastroschisis: Usually occurs in full term infants with no other anomalies, associated with young white women who like to drink. Infant born with abdominal wall defect requires fluid resuscitation, abdominal wall surgery, and possible removal of part of the bowel. May end up requiring TPN (short gut similar). Preferred nutrition is breast milk then Elecare. If on TPN, feedings may be advanced slowly through Ngtube as tolerated to promote bowel stimulation. Complications include TPN associated cholecystasis from fats given IV and Central line infections.

Dehiscence of surgical wounds: We no longer use wet to dry, usually products with silver to promote healing and antimicrobial. Observe that fascia still intact and no organs coming out. Heal by secondary intention.

Incarcerated hernia: A hard, red, bulging, strangulated, hernia and is a surgical emergency. A "non emergent" hernia is a squishy loop of bowel, the bigger the hernia the worse, still refer to surgery, umbilical hernia repair should occur before school starts. Umbilical hernia unlikely to cause emergency. NICU baby gets fixed while inpatient. Will check both sides with telescope during surgery even if hernia present on one side.

Appendicitis: Most common in second decade of life 10-12 years. Rate of appendix perforation in children under 4 years- 70% and will present with stomach pain, vomiting, fever. To diagnose perform Psoas sign, rotate right hip and right side hurts, will also have rebound tenderness at McBurneys point. On US non-compressible tubular structure in RLQ wall thickness >2mm, diameter. If >6mm and free fluid in RLQ, thickening of mesentery and presence of calcified appendicolith, need surgery. US and MRI for diagnosis.

Hydrocele: May have scrotal pain. Differential diagnosis: inguinal hernia, tumor, testicular torsion. Hydrocele slips down and fluid is in front of testicle versus with an inguinal hernia, the intestine is behind testicle. To diagnose: transillumination (newborn shine light under scrotum to see if obstructive).

Testicular torsion: Will present as extremely inflamed and painful testicle, US confirms Pragmatic reflex- testicle pulls up when you brush thigh. Also look at position of testicles. Hanging like eggs or sideways. If swollen and discolored, do not attempt to reduce. Send to ER.

Foreign body ingestion: To tell if object is lodged in esphogus or trachea- xray will show round coin when lodge in esphogus vs flat side if in trachea. Surgical intervention only if blocking airway or a magnet, battery etc. Otherwise let it pass through bowels.

Hirschsprungs enterocolitis: Cause is from intestinal epithelium cells called peyers patches which slow down motility. Should be stool within 48 hours of birth. Symptoms are: no stool in first 48 hours, dark stool, constipation, since birth not pooped on their own without use of suppository. Must do a rectal exam, when you pull finger out there will be explosive poop. Sometimes child will have a viral illness before this occurs. Become septic if not recognized. Treatment: rectal irrigation, IV abx, pull through procedure. Transanal pull through if little or laproscopic assisted if larger. Part of the intestine is removed, still very prone to constipation and enterocolitis. Management will include stool softeners and suppositories if child doesn't stool for 2 days.

Pediatric Oncology

Morphologic Diagnosis

- Number

Polyploidy - extra chromosome in every cell in multiples of 23
Aneuploidy - missing copy of chromosome

- Structure – 3 possible structural defects
  - Translocation – exchange of genetic material
  - Deletion – loss of genetic material
  - Duplication – repetition of genetic material
- Molecular Diagnosis
  - Flow Cytometry – identifies antigen with a molecular defect
    - Classify and monitor ALL
    - Evaluates risk of recurrence after BMT

Leukemia

- Types
  - ALL – Acute Lymphoblastic Leukemia
    - Originates in lymphoid cells of B or T cell lineage
    - 75% of all childhood cancers
    - Most common 2-5yr
    - Fanconi anemia, trisomy 21, ataxia telangiectasia, Klinefelter syndrome, Shwachman-Diamond syndrome

- WBC <10K, hyperdiploidy = favorable
- Philadelphia chromosome, severe hypodiploidy = unfavorable

- AML – Acute Myeloid Leukemia
  - Originates in myeloid cells
  - 15-25% of leukemias
  - Slightly increased >10yr
  - Previous exposure to chemo, trisomy 21, Diamond-Blackfan Anemia, Fanconi anemia, Li-Fraumeni syndrome, paroxysmal noctural hemoglobinuria, neurofibromatosis
  - Trisomy 21, WBC <100K = favorable

CML – Chronic Myelogenous Leukemia

- <5% of leukemias
- Philadelphia chromosome
  - 9q34
  - Abnormal chromosome 22
- Initial chronic phase – leukocytosis, mild anemia, thrombocytosis
- May progress to accelerated phase with blast crisis
  - Resembles acute leukemia

Presentation

- Symptoms often vague
- AML more ill-appearing than ALL
  - Fevers
  - Fatigue
  - Anorexia
  - Weight loss
  - Infection
  - Lymphadenopathy
  - HSM
  - Pain
  - Pallor/Anemia
  - Petechiae
  - Ecchymoses
  - Bleeding
  - Chloromas

Work-Up

- CBC with differential
  - Anemia, thrombocytopenia, leukopenia or leukocytosis
- Peripheral blood smear
  - Presence of blasts
- Bone marrow biopsy & aspiration
  - >25% blasts
- Lumbar puncture
  - Determine CNS involvement
- CMP, uric acid, LDH
  - Kidney & liver function
  - Tumor lysis
- CXR
  - Mediastinal mass? (T-cell)

Treatment

- Refer to Oncology!
- Hospital Admission
  - PICU if WBC >100K or severe tumor lysis
- Serial electrolytes, CBCs
  - Hyperleukocytosis, TLS management
- Early identification of coagulopathies, sepsis
- Transfuse PRN
  - Avoid in hyperleukocytosis
- Chemotherapy, Steroids
- Potential radiation, BMT (allogeneic)

ALL

- 3 phases of treatment
  - Induction, Consolidation, Maintenance
- Chemo, Steroids
  - Agents determined by risk stratification
  - 2-3 years depending on risk, gender

AML

- Short, intense periods of multi-agent chemos

        - Prolonged marrow hypolasia, immunosuppression
    - May require BMT

CML

- PO Imatinib
- BMT

Lymphoma

- Malignancy arising from lymph nodes or lymph tissue
- 3rd most common type of pediatric cancer
- More prevalent in males
- Increased incidence with EBV, HIV, immunodeficiencies
- Types
    - Hodgkins

Hodgkin's Disease

- Malignancy of T/B cell lymphocyte origin
- Associated with EBV
- Peak 15-35yr
- Spreads more slowly and orderly
- "B symptoms" = poorer prognosis
- Presentation
    - Painless lymphadenopathy
    - Persistent non-productive cough
    - Splenomegaly
    - Pruritis
    - Fatigue
    - Anorexia, weight loss
    - SVC syndrome
    - B Symptoms
        - 10% weight loss, persistent fevers, night sweats in last 6 months

Non-hodgkins lymphoma

Malignant tumor of undifferentiated lymph cells

- Peak 5-15yr
- Rapidly dividing, unpredictable aggressive speed

- Lymphoblastic lymphoma, mature B-cell lymphoma (Burkitt, diffuse large B-cell, primary mediastinal B-cell), anaplastic large cell lymphoma
- Geographic, immunologic, viral & genetic factors
- Presentation
    - Lymphadenopathy
    - Abdominal pain, distention, mass
    - HSM
    - Facial/Neck swelling
    - Tonsillitis
    - Headache
    - Nausea/Vomiting
    - Irritability SVC syndrome
    - Chest pain
    - Snoring
    - Dysphagia
    - Fatigue
    - Fever
    - Malaise
    - Weight loss
    - Night Sweats
    - Pancytopenia

Lymphomas

- Work-up
    - PE
    - Biopsy
        - Presence of Reed-Sternberg cell = Hodgkins
    - CXR
        - ?mediastinal mass
    - CT – chest, abd, pelvis
    - CBC, T & B cell count, bone marrow aspirate
    - Serial electrolytes, LDH

- PET
- Bone Scan

Treatment

- Radiation
- Chemotherapy
- BMT

Neuroblastoma

- Small, round, blue cell neoplasm arising sympathetic nervous system
  - Primordial neural crest cells

Most common extracranial solid tumor of childhood

- Infants & young children
- 7-10% of malignancies in children <15y

Age >18 months, MYCN gene amplification, DNA index of 1 (hypodiploidy) = poorer prognosis

Presentation

- Palpable mass
  - Abdominal mass in 2/3 of cases
  - Thoracic, cervical, pelvic
- Constipation
- Hepatosplenomegaly
- Hypertension
- Bruising
- Fatigue
- Fever

Presentation

- Bone pain
- Pallor
- Lymphadenopathy
- Horner's syndrome – unilateral protosis, miosis and anhidrosis
  - Diarrhea
  - Hypertension
  - Flushing
- Opscolonus – 'dancing eye syndrome'

- Truncal ataxia

Myoclonus

Neuroblastoma

- Work up
    - CBC
    - Coags
    - CMP, LFTs
    - Urine VMA, HVA
    - BMA & Bx
    - CXR & AXR
    - CT
    - MRI

- MIBG

Biopsy

- Treatment
  - Induction
    - Chemo
    - Surgery
    - ± Radiation
  - Consolidation
    - BMT (autologous)
    - Radiation
  - Post consolidation
    - Immunotherapy

Wilms tumor

- Unilateral or bilateral solid tumor of kidneys, arising from embryonal nephroblastic cells
  - 4-5% bilateral

  Most common abdominal tumor of childhood
  - 2-3 yrs

  Increased incidence with Beckwith-Wiedemann, WAGR syndrome
  - *WT1* mutant gene (11p13)
  - Aniridia
  - GU abnormalities

Mental retardation

- Presentation
    - Abdominal mass
        - Often found by parents or family members
    - Pain
    - Hematuria
    - Malaise
    - Fever
    - Hypertension

Constipation

- Work-Up

- PE
- U/S
- CBC, Coags
- BMP
- UA
- CT-Chest, abd, pelvis

Treatment

- Nephrectomy
  - Full or partial resection
- Chemo
- Radiation

Osteosarcoma

Complex tumor of bone, arising from osteoblasts

- Most common bone malignancy of childhood
  - Peak around growth spurts
    - Female 12-15 yrs Male 15-19 yrs
    - Mutation at 17p13.1 or *TP53*

20% present with mets

- Lungs, bone, brain

Long bones

Distal femur, proximal tibia, humerus

- Presentation
  - Pain
    - Constant or intermittent
  - Swelling
    - Joints or bone
    - Usually at sites of growth
  - Systemic symptoms with mets
    - Fever, night sweats, weight loss,

Osteoscarcoma work up

- CBC, lytes, LFTs, LDH, blood cultures
- Xray
  - Lytic lesion

- MRI
- BMA, bx
    - Determines diagnosis (osteoblasts)
- CXR, CT-chest, PET scan, bone scan
    - Eval for mets

Treatment

- Chemo
- Surgery
    - Resection/Limb-salvage
- Cure Rates
    - 65-75% for non-mets
    - Very low after relapse

Ewing Sarcoma

- Tumor arising from primordial mesenchymal stem cells
    - *EWS* t(11:22) translocation

Can be extraosseous or osseous

- More commonly arises from diaphyseal bone

25% present with mets

- Bone, bone marrow, lungs

- Presentation
    - Pain
        - Constant or intermittent
    - Swelling
        - Joint or bone
    - Systemic symptoms if mets
        - Fever, night sweats, weight loss

Work-Up

- CBC, lytes, LFTs, LDH
- Xray
    - Lytic lesion
- MRI
- BMA, bx

        - Determines diagnosis
    - CXR, CT-chest, PET scan, bone scan

Eval for mets

- Treatment
    - Chemotherapy
    - Surgery
        - Resection/Limb-Salvage
    - Radiation

Retinoblastoma

- Retinal tumor, may be unilateral or bilateral
- Often genetic
- Rare
    - 3% of childhood cancers
    - 2/3 of cases <2yr
    - Often present at birth

95% diagnosed by 5 (no red reflex present)

- Presentation
    - Leukocoria
    - Strabismus
    - Heterochromia

- Work-Up
  - PE
  - Ophtho exam
  - CT/MRI
  - Biopsy

  Treatment
  - Surgical resection
  - Radiation
  - Chemo

- Enucleation
-

Rhabdosarcoma

- Tumor arising from primitive mesenchymal stem cells
  - Likely skeletal

3rd most common solid tumor of childhood
- Most common soft-tissue sarcoma (50%)
- 2/3 are <10yr

Increased incidence with RB mutation for retinoblastoma, NF type I, congenital abnormalities

Embryonal form most common
- Head, neck, orbits, GU system

Presentation
- Varies according to site
- Growth restrictions or masses
- Epistaxis
- Sinusitis
- Nasal obstruction
- CN palsy
- Ear drainage
- Hearing loss
- Urinary retention, straining, hematuria, vaginal bleeding

Work-Up
- Imaging of area and chest
  - U/S, XR, CT, MRI, PET
- Open biopsy
  - Confirms dx
- Eval for mets
- BMA

Treatment
- Chemo
- Surgery

- Radiation

Brain Tumors

- Types
  - Gliomas
    - Low grade – atrocytoma
    - High grade – anaplastic astrocytoma, glioblastoma multiforme
    - Diffuse Intrinsic Pontine Glioma
  - Medulloblastoma
  - Primary Neuroectodermal Tumor (PNET)
  - Atypical Teratoid Rhabdoid Tumor
  - Ependymoma

Germ Cell Tumor

Presentation of Brain Tumors

- Non-localizing
  - Headaches
  - Early morning vomiting
  - Behavior changes
  - Developmental delay
    - Loss of milestones
    - Change in school performance
  - Ataxia

  Increased ICP
  - Increased head circumference
  - Bulging fontanelle
  - Head tilt
  - "Setting sun"
  - Lethargy
  - Vomiting

  Localizing symptoms
  - Cranial neuropathies
  - Cranial nerve deficits

- Confusion
- Fatigue
- Seizures
- Change in handedness
- Sensory loss/complaints
- Hemiparesis
- Bowel/Bladder dysfunction
- Hyperreflexia

Work-Up

- History, PE, Full Neuro Exam
- CT Scan!!!
  - Detects ~95% of brain tumors
  - Fast, no sedation required
- MRI of brain and spine
  - More sensitive than CT
  - Determine location, tumor characteristics, evidence of mets
- LP?
  - Cytology
  - Studies dependent on type

Treatment

- Dependent on type & location
- Surgery
  - Goal = complete resection
- Chemo
- Radiation
  - Avoid in very young
  - May require craniospinal prophylaxis
- Steroids
- Anticonvulsant medications
- VP Shunt

Cancer Treatment

- Novel therapies Target cancer cell only – hybrid *bcr abl*

- Tyrosine kinase (TK) regulate cell functions - proliferation, differentiation, anti-apoptotic signals & growth
    - Prevents ATP from entering the hybrid pocket and makes the protein inactive
    - Inhibit enzyme activity

Imatinib/Gleevec

Post consolidation immunotherapy

- Monoclonal antibodies
- NB therapy
    - Dinutusimab - Monoclonal antibody
    - Aldesleukin (IL 2)
    - GM-CSF
        - Concurrently administered with IL2 & GM-CSF to stimulate an immune response
    - Isotretinoin
        - Induces maturation of neuroblastoma cells

Tumor vaccines

Adoptive therapies using T cells

- Chimeric antigen receptors (CAR-T cells)

Radiation

- Use of high-energy particles/ to destroy cancer cells
    - Breaks strands of DNA to prevent cell replication
    - Goal = deliver therapeutic dose of radiation to tumor cells while sparing surrounding tissues
    - Types:
    - External beam, brachytherapy, conformal, intensity-modulated, intra-operative, proton, stereotactic radiosurgery

Complications of Radiation

- Immediate
    - Nausea, vomiting, headache, cerebral edema
    - Drowsiness, fatigue, cognitive problems
    - Manage with steroids

Late

- Cognitive impairment – loss of white matter
- Site dependent – may have dental or vision issues

Bone Marrow Transplant

- AKA hematopoietic stem cell transplant
- Bone marrow cells from patient (autograft) or a donor (allograft) are infused
    - Autologous BMT – patient receives own cells that were previously harvested, following course of HD chemo
    - Allogeneic BMT – cells from matched family members, partially matched family members, or matched unrelated donors
    - Cord blood – limited # of cells
    - Peripheral SCT

Donor primed with GCSF

Post-transplant

- Monitor for complications, side effects, opportunistic infections
    - GVHD, pneumonitis, infections (bacterial, viral, fungal), SOS
- Management of cGVHD
- Immunosuppressants
    - Prednisolone Methotrexate
- Symptom management
    - Rehab medicine consult
    - Dental

  Nutrition
- Graft vs Host Disease
    - Transplanted cells recognize host as foreign and attack
    - 1st 100 days, acute or chronic
    - Multisystem involvement
        - Skin, mucosa/GI (“gut”), liver, pulmonary
    - Supportive care, immunosuppressants

GVHD Staging

Sinusoidal Obstructive Syndrome (SOS)

- Previously called Veno-Occlusive Disease (VOD)
- Obstructive vasculitis of liver
- Due to preparative regimen
    - Risks = certain chemos (busulfan), previous BMT, abd radiation, pre-existing liver disease, HLA mismatch or MUD,
- Hepatomegaly, RUQ pain, weight gain, increased abd circumference, ascites, jaundice (ñbili), thrombocytopenia
- High morbidity and mortality
- U/S of liver and vasculature
- Treatment = Supportive care, fluid restriction, diuretics, Defibrotide

Oncology Emergencies

Tumor Lysis syndrome

- Massive tumor cell degradation/lysis with release of uric acid, phos, K
  - Inability of kidneys to excrete

  Associated with initial chemo for leukemia, lymphomas
  - Rapidly growing tumors and/or bulky disease

  Risk Factors
  - increase uric acid, increase tumor burden, Burkitt's lymphoma, T-cell lymphoma, hyperleukocytosis

  Presentation
  - May be asymptomatic
  - Muscle cramps, tetany, oliguria, hematuria, renal failure, dysrythmias, mental status changes, seizures, syncope, sudden death
  - Neutropenia, fever, abdominal mass, N/V/D, anorexia, lethargy

  Work-Up
  - Serial CMPs
    - increase K >5
    - increase Phos >4.1
    - decrease Ca < 8.5
    - increase uric acid >8.5
  - UA
  - CBC

  Treatment
  - Prevention!
  - Hydration
    - 2-3L/m2/day
    - Enhances uric acid & phosphate excretion
  - Frequent electrolytes (every 6-8 hrs)
  - Strict I/Os, urine dips
    - Spec grav, pH
  - Allopurinol, Rasburicase
  - Dialysis
    - If oliguria, azotemia, increase K, increase phos, increase uric acid

Hyperleukocytosis

- Presence of increased number of circulating leukemic blast cells
    - WBC >100K

  Interact with endothelium to form aggregates & thrombi
  Results in increased blood viscocity
  Neuro, Pulm, Cardiac sequelae
  Complications are more common in AML than ALL
  EMERGENCY!
  Presentation
    - Fever, lethargy, mental status changes, headache, seizure, coma, dyspnea, hypoxemia, acidosis, cor pulmonale, hemorrhage, DIC, renal failure

  Work-up
    - CBC
        - WBC >150-200K
    - CXR
        - Diffuse interstitial infiltrates
    - Head CT

      Eval for intracranial hemorrhages
- Treatment
    - Prevention
    - Aggressive Hydration
        - 2-4x maintenance
    - Leukopheresis/Exchange transfusion
    - Chemo, steroids
    - Close monitoring of electrolytes, BUN, Uric Acid
        - Correct metabolic disturbances
        - Allopurinol or rasburicase
    - Avoid diuretics, blood transfusions
    - Treat thromboyctopenia, coagulopathy
        - Platelets, Vit K, FFP, cryo

Fever and Neutropenia

- Bacterial infection

- Gram negative or positive

Causes
- Chemo-induced bone marrow suppression
- Immunotherapy
- Surgery
- Radiation
- Nutritional deficiencies
- CLABSI

Presentation
- Fever
- Neutropenia
- Mucositis
- Respiratory distress
- Lethargy
- Shock
- Renal failure

Work-up
- Blood cx
- CBC with differential
- CMP
- ABG

Risk Factors
- T > 39℃
- Dx with AML
- Sick contacts
- Relapsed malignancy
- Tumor obstruction
- Splenectomy

Management
- Good handwashing
- Mouth care
- Hygiene
- Daily CBC + diff

- CXR
- Fever work up
- Limit invasive procedures/exams

Mucositis

- Endothelial damage
- Presentation
    - Esophageal ulcerations
    - Bleeding
    - Pain
    - Wt loss
    - Dysphagia

  Risk Factors

- Radiation
- Chemotherapy

Management

- Oral care- ultra soft tooth brush
- Local anesthetic
- Soft diet – avoid sugars and spicy foods
- Acyclovir 5 mg/kg Q 8 hrs.
- Pain management
- Enteral feeds
- TPN
- Keratinocyte growth factor – palifermin

Typhlitis

- Neutropenic enterocolitis
- Inflammatory process of the GI tract
  - Cecum, ascending proximal colon
  - Associated with cytotoxic therapy

Presents with bowel wall thickening, inflammation, necrosis, & invasion of bacteria

C. diff, pseudomonas

May result in bowel obstruction or perforation

Presentation

- Acute abdominal pain
  - RLQ
- Neutropenia
- Fever
- Distension
- Guarding
- Peritoneal signs
- Vomiting/Anorexia
- Loose bloody stools
- Mucositis

Work-Up

- Serial abdominal X-rays

- CT
- US
- CBC, coags
- Blood, stool cx
- Lytes, CRP

Treatment

- Bowel rest
- TPN
- Broad-spectrum IV antibiotics
  - Gram positive, gram negative, and anaerobic coverage
- Fluid & Electrolyte replacement
- Supportive care
- Surgery

Superior Vena Cava Syndrome

- Result of obstruction/compression of SVC by malignancy/mass
- Compromises blood flow to the heart

Presentation

- Can be asymptomatic unless airway compromised by >50%
- Cough, dyspnea, tachypnea, hypoxia, SOB, orthopnea, stridor, cyanosis, distended neck veins, edema, anxiety, s/sx decreased CO
- Fever, weight loss

Work-Up

- CXR
- CT
- U/S
- PFTs
- ECHO
- Evaluate tracheal compression, ability to tolerate supine position

Treatment

Keep supine or left lat decub

Decrease pressure on vital organs

IV access

Oxygen support

Face mask, Non-invasive PEEP, heliox
Avoid sedated procedures
Steroids, Radiation, Chemo

Spinal Cord Compression

- Presentation
  - Back pain, weakness, sensory abnormalities, fecal incontinence, limping
  - Leads to muscle weakness, paraplegia, quadriplegia, shock
  - Any child with cancer and back pain should be considered to have until ruled-out

  Work up
  - MRI
  - Complete neuro exam
    - Level of spinal tenderness

  Treatment
  - Steroids (decadron)
  - Surgery
  - Chemo
  - Radiation

Cancer Treatment Side effects

- Long term
  - May need physical therapy, cognitive therapy, speech therapy
  - Routine neuropsych eval
    - Some effects not noted for years
  - Cardiomyopathy
  - Pulmonary fibrosis
  - Hearing loss
  - Infertility
    - Fertility preservation discussions prior to initiation of treatment

    Secondary malignancies

Cardiotoxicity

- Acute – changes in the ECG
  - Not dose related

- No indication to stop drug

Chronic – weeks to years after administration
- Non reversible cardiomyopathy
- QRS changes to ECG
- Myocardial dysfunction

Assessment
- Tachycardia,
- Non-productive cough,
- Dyspnea

Risk Factors
- Treatment prior to 4 years of age
- Genetics
- Pre-existing cardiac issues

Noninvasive monitoring of cardiac function
- ECG
- EF – change of > 5% or < 45%

Auscultation for abnormal heart sounds
- Gallop or third heart sound

Patient education for cardiomyopathy
- Managing fluid retention
- Energy conservation
- Limiting salt in diet
- Moderate exercise

Pulmonary Complications
- Sx: dyspnea, tachypnea, hypoxemia, acidosis, cor pulmonale
- CXR: diffuse interstitial infiltrates
- Pattern of pulmonary changes
  - Pulmonary edema Interstitial pneumonitis
  - Acute pneumonia ARDS

Late phase changes
- Pulmonary fibrosis

Presentation

- Dyspnea Dry cough
- Tachypnea Crackles

Pulmonary Infections

- Bacterial
  - α-hemolytic Strep
  - Staph. Aureus
  - Pseudomonas
  - Klebsiella
  - E coli
  - *Pneumocystis carinii*
  - *Mycoplasma pneumonia*
  - Fungal
  - Aspergillus
  - Candida
  - Viral
  - CMV
  - Herpes simplex
  - Varicella-zoster
  - Adenovirus

  Management
  - Prednisone
  - Early detection
    - Biopsy/diagnosis
    - Airway
  - Beclamethasone inhaler
  - Oxygen
  - Pulmonary rehab

Neurotoxicity

- Peripheral neuropathies

- Encephalopathy – drug related
    - Methotrexate

  Seizures
  Acute cerebral syndrome
  Methotrexate
  Increased cranial pressure
    - Related to obstructive flow of CSF
    - Symptoms
        - Seizures, headaches, and focal neurologic deficits depends on tumor location
        - Infants – inconsolable crying, vomiting, lethargy
        - Toddlers/school age – diplopia, headache, abn pupillary reactions
        - Leptomeningeal disease

Risks and Management

- Risks
    - Metastases from solid tumors
    - Chemotherapy
    - Radiation

  Management
    - Anti-convulsants
    - Pregabalin
    - Corticosteroids
    - Surgery
    - Radiation

Nephrotoxicity

- Presentation
    - Hemorrhagic cystitis
    - Difficulty voiding
    - Renal dysfunction

  Risks
    - Age < 5 yrs
    - Pre-exiting renal disease

- Chemotherapy
- Nephrectomy

Management

- Pre treatment 24 hr urine
- UA
- BP
- Serum lytes
- Prevention
    - Aggressive hydration
    - Bladder irrigation
    - Blood products as needed
    -

Guidelines for management of cancer survivors

- Multidisciplinary clinic
    - Cancer Treatment summary
        - Diagnosis
            - Date, stage, relapses
        - Treatment
            - All chemotherapy agents
            - Radiation – dose and site
            - Surgery – date and type
            - Transplant – date, type and complications
            - Completion date
        - Develop and individualized late effect profile
        - Develop an individualized surveillance plan

Long term and late effects

- Secondary Cancers
    - Myelodysplastic syndromes
    - Solid tumors
- Organ Damage
    - Pulmonary

        - CV
        - Renal
        - Neurocognitive
        - Reproductive/endocrine
        - Musculoskeletal
        - Psychosocial

    Pulmonary:
    - Risks – Bleomycin, radiation
    - History – Mantle radiation, HSCT
    - Presentation- cough, dyspnea with exercise, abnormal chest wall
    - Recommendations
        - PE yearly
        - Anticipatory guidance – no smoking
        - PFTs at entry and as indicated

    CV
    - Risks – anthracyclines, radiation, female, < 5yrs
    - History – cardiomyopathy, CHF
    - Presentation – SOB, dyspnea with exertion chest pain
    - Recommendations
        - Dexrazoxane – cardioprotectant
        - Reducing field for XRT
        - PE and ECHO (timing based on anthracycline dose)
        - EKG – evaluate for prolonged QT
        - Fasting glucose and/or Hgb A1C
        - Avoid isometric exercise
- Renal
    - Risks – ifosfamide, < 5 yrs, radiation + platinum
    - Presentation – hypertension, proteinuria, renal insufficiency
    - Recommendations
        - Monitor BP, UA, screening BUN & creatinine, electrolytes
        - Supplement if wasting electrolytes
        - Mono nephric – counsel for sports participation
- Neurocognitive

- Risks – whole brain radiation, younger age, female, intrathecal chemotherapy
- History – ALL, non Hodgkins Lymphoma, CNS tumors
- Presentation – difficulty with attention & concentration, executive functions, memory
- Recommendations
    - Evaluation for special education services especially in children diagnosed < 6 yrs
    - Referral to psychology, school counselor
    - Repeat testing as needed

- Ocular
    - Presentation – cataracts, glaucoma, double vision
    - Recommendations
        - Yearly examination
        - Referral to ophthalmology

Audiology
- Risks – platinum therapy, aminoglycosides, radiation, loop diruetics

Reproductive/Endocrine
- Female
    - Risks – pelvic radiation, alkylating agents
    - Presentation – early menopause, infertility
    - Recommendations – monitor FSH, Tanner staging, sexual function, counseling for early pregnancy
- Male
    - Risks – radiation to HPA axis, alkylating agents
    - Presentation – azoospermia
    - Recommendations – Tanner staging, education about fertility

Endocrine
- Risks – female, radiation dose, Hodgkin's disease
- Presentation – hypo or hyperthyroidism
    - weight gain or loss, cold or heat intolerance, dry skin
- Recommendations – TSH, T4, yearly exam

Musculoskeletal
- Risks – cranial radiation, corticosteroids, methotrexate
- Presentation – scoliosis, pain, change in ROM, growth hormone deficiency, AVN, osteoporosis
- Recommendations
    - DEXA scan Vitamin D (400IU)

- Refer to Ortho Weight bearing exercises

Psychosocial

- Risks – all diagnoses
- Presentation – depression, anxiety, PTSD neurocognitive problems
- Failure to achieve developmental milestones
    - Poor educational, employment, marriage and friendship outcomes
- Recommendations – Refer to psychology and school counseling

Revaccination

- Monitor vaccine titers
- Delay for 3 months post treatment (Live)
- HSCT – require re-vaccination