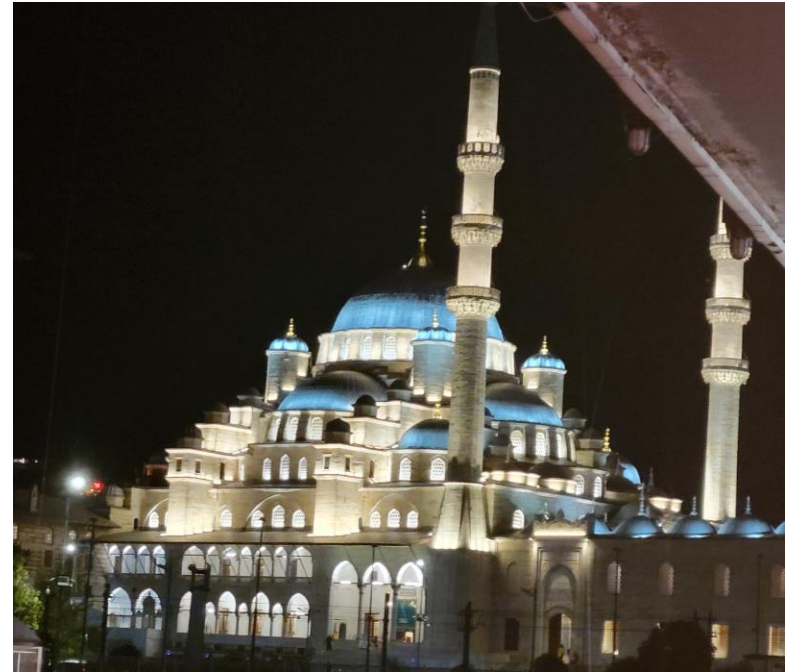


The Orthopaedic Newborn Exam

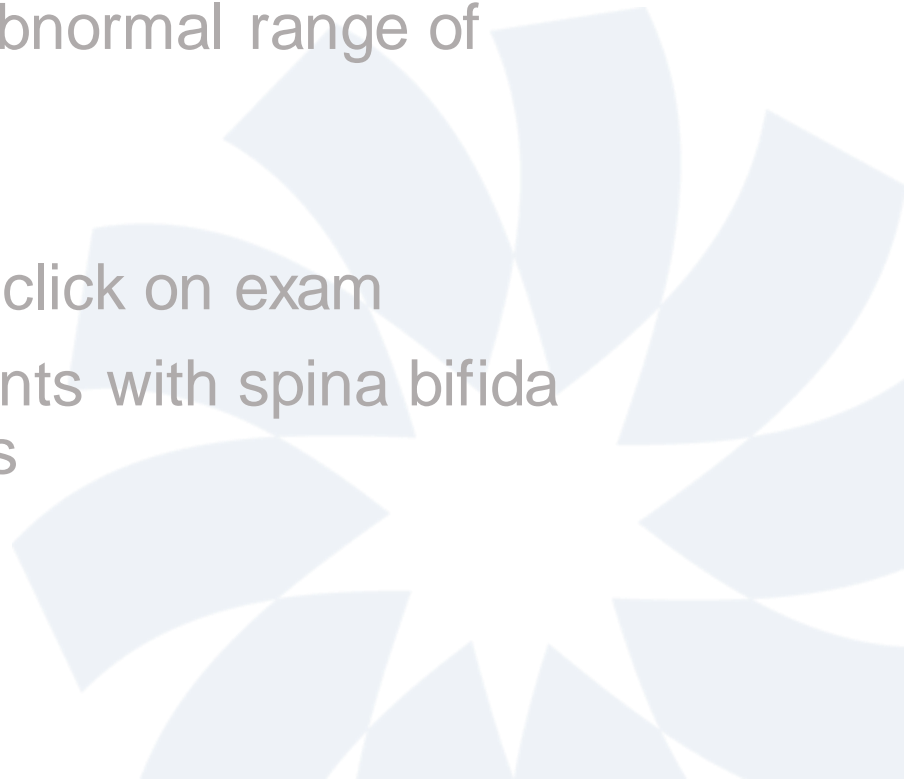


Claire F. Beimesch, MD, FAAOS FAOA
Associate Division Chief, Pediatric Orthopaedics
Dayton Children's Hospital
Dayton, OH



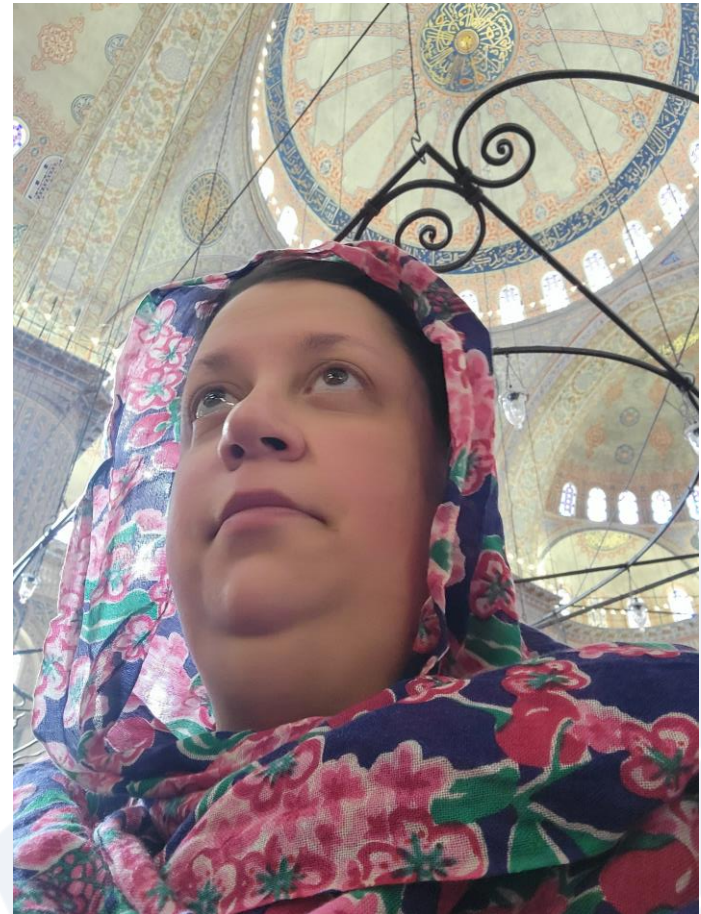
I have nothing to disclose...except I went to Istanbul and all the pictures in this talk are from my super awesome trip.

Why do we do an orthopaedic newborn exam?

- NICU/Nursery Evaluation for non accidental trauma or infection
 - Birth Fracture
 - Referral from PT regarding abnormal range of motion of neck or extremities
 - Concern for clubfoot
 - Family history of DDH or hip click on exam
 - Establish a baseline for patients with spina bifida or other congenital anomalies
- 

Why am I giving you this lecture today?

- Helps everyone understand when you refer a patient to us, what are we looking for and what are we seeing?
- Gives a framework for the day's lectures
- Addresses remaining topics not covered by today's lectures
- My practice involves a lot of newborns



Challenges

- Kids are not little adults
- Thus, newborns are not just little kids
- Premature newborn versus term newborn
- NICU/Newborn nursery setting
- Birth-3 months
- Parents or caregivers will be historians
- NICU staff can give additional information



History


- Gestational age
- Birth weight
- Problems during pregnancy
- Breech presentation
- C/S versus vaginal delivery (“Regular”)
- Reason for C/S delivery
- Time in the NICU
- O2 required?
- Known complications? (ROP, NEC, IVH)



Physical Exam

- Skin condition
- Joint ROM
 - Neck
- Palpate extremities for fracture
 - Failure to move arm
 - Shake the limb gently to assess pain
- Hip assessment for DDH
 - Barlow
 - Ortolani
- Foot assessment
- Check spine alignment, presence of a sacral dimple

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A Comprehensive Newborn Examination

289 Newborn Examination: General, Head and Neck, Cardiopulmonary	278 AAFP News: AFP Edition
297 Newborn Examination: Skin, Trunk, Extremities, Neurologic	282 Editorials: Electronic Cigarettes
303 Autosomal Dominant Polycystic Kidney Disease	285 Cochrane for Clinicians
312 Management of External Genital Warts	319 Photo Quiz
	326 POEMs
	338 Practice Guidelines
	280 CME Quiz is worth 3.75 credits.

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Review Article
Orthopaedic Conditions in the Newborn

Abstract
The occasional consultation on a neonate can be unfamiliar territory for many orthopaedic surgeons. Just as children are not little adults, newborns are not just little children; rather, they have a unique physiology that affects the presentation of their orthopaedic concerns. Careful physical examination with appropriate understanding of neonatal development is essential to making the proper diagnosis. A fall extremity in the newborn is most commonly attributed to fracture or brachial plexus palsy; however, infection must also be considered and ruled out to prevent long-term morbidity. Metatarsus adductus is the most common foot abnormality, but clubfoot, calcaneovagus deformity, and congenital vertical talus may also be encountered. Joint contractures that spontaneously improve are normal in the newborn, but it is important to identify and institute proper treatment for early developmental dysplasia of the hip, congenital knee dislocation, and torticollis. Clavicular pseudarthrosis and periosteal reactions may be discovered on radiographic examination. A basic understanding of the relevant conditions will help the orthopaedist with the initial diagnosis and management of orthopaedic issues in the newborn.

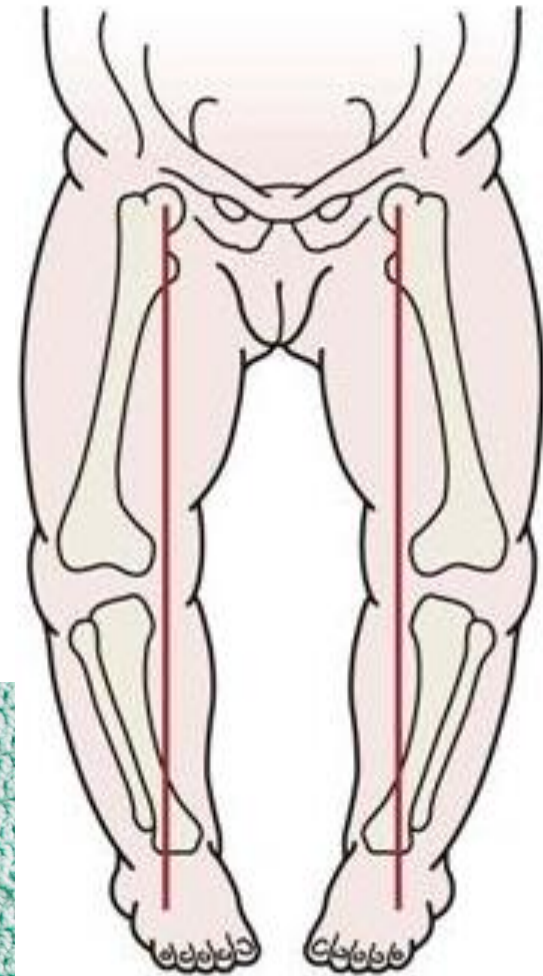
Dr. Sankar is Fellow, Children's Hospital Los Angeles, Los Angeles, CA. Dr. Skaggs is Associate Professor, Children's Hospital Los Angeles. Dr. Weiss is Assistant Professor, Children's Hospital Los Angeles.

Dr. Skaggs serves as board member, senior officer, or committee member for the Pediatric Orthopaedic Society of North America and the Societas Research Societas. Dr. Skaggs is a member of his immediate family has received research or institutional support from Medtronic Sofamor Danek and

Wadhav N. Sankar, MD
Jennifer Weiss, MD
David L. Skaggs, MD

Normal Neonatal Alignment

- Increased Femoral anteversion masked by hip external rotation contracture
- Genu varum
- Hip/knee flexion contractures
- Elbow flexion contractures



Newborn-
moderate genu varum

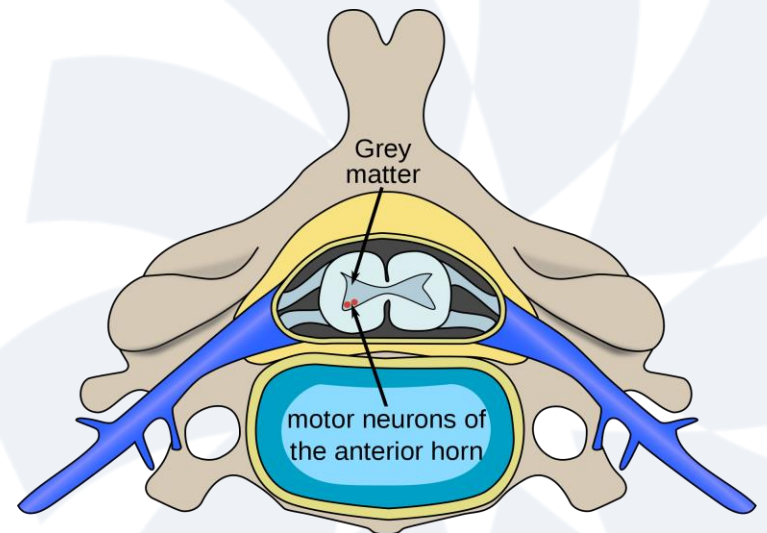
When are contractures concerning?

- Knee extension contractures or knee dislocations
- Multiple joint contractures
- Rigid non reducible hip dislocation at birth
- Muscle atrophy
- Lack of normal skin creases or landmarks
- Decreased fetal movement in utero or post delivery



Arthrogryposis multiplex congenita

- Congenital condition with multiple sites of joint contractures
- Possible autoimmune condition with maternal antibodies to fetal acetylcholine receptors
- Causes a decrease in anterior horn cells
- Can affect all 4 extremities or distal segments (distal arthrogryposis)
- Theory that clubfoot is a mild form of distal arthrogryposis
- Hip dislocation
- Clubfoot
- Scoliosis
- Knee dislocations
- Elbow extension contractures



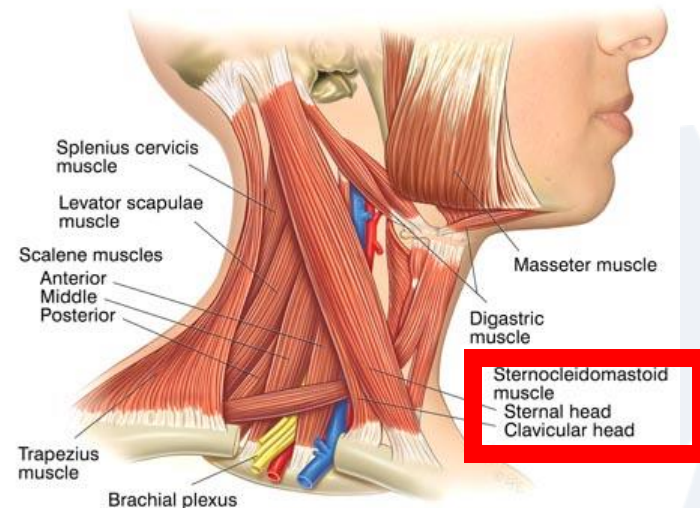
Skin assessment

- Nevi
- Café-au-lait spots
 - Tuberous sclerosis
 - Neurofibromatosis (coast of California)
 - Fibrous dysplasia (coast of Maine)



Congenital Muscular Torticollis

- Sternocleidomastoid muscle contracture
- Packaging disorder (assoc with DDH, MA, plagiocephaly)
- Possibly result of intrauterine compartment syndrome



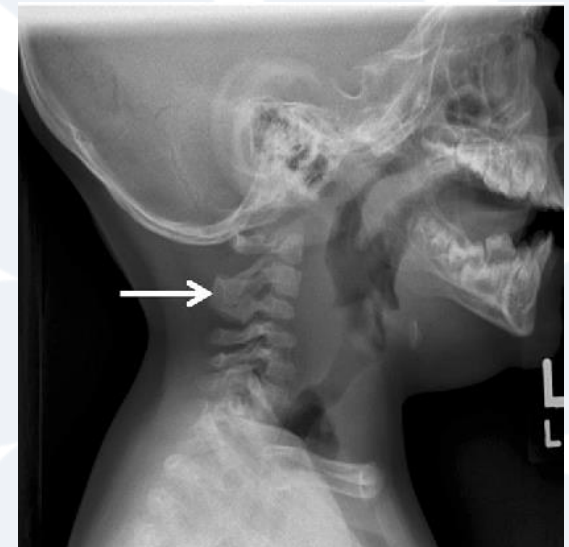
Congenital Muscular Torticollis

- Head tilted TOWARD affected side, chin rotated AWAY from affected side
- Can have palpable mass
- Treatment: stretching, 90% resolve with stretching



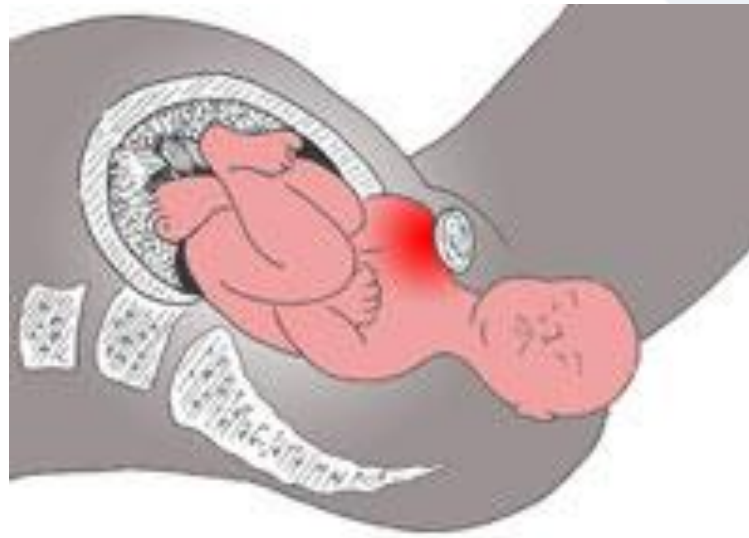
Klippel-Feil syndrome

- Low hairline
- Webbed neck
- Limited neck ROM
- Secondary to failure of cervical segmentation
- Fusion of one or more cervical vertebrae
- May be confused with torticollis
- Associated with scoliosis, Sprengel's deformity (failure of scapula to descend)



Brachial Plexus Birth Palsy

- 1/3000 births
- Risk Factors:
 - Macrosomia
 - Breech
 - Prolonged labor
 - Shoulder dystocia
 - Forceps birth



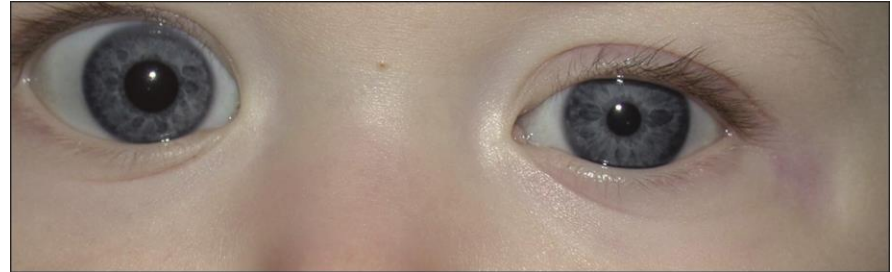
Erb's Palsy

- Erb's point C5
- Waiter's tip deformity
- Shoulder internal rotation, adduction
- Elbow pronation, extension
- Intact finger function



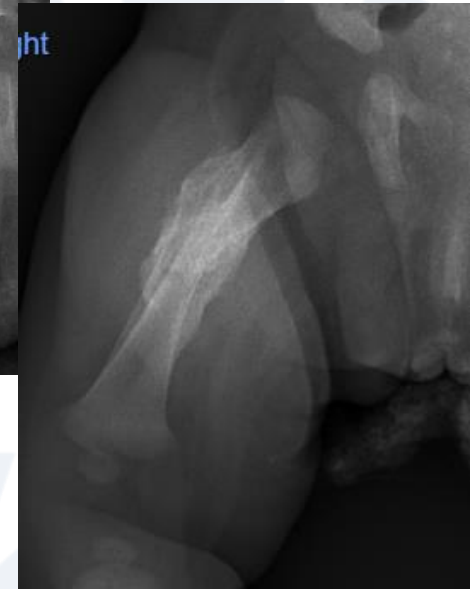
Horner's Syndrome

- Ptosis
- Miosis
- Anhidrosis
- Bad prognostic indicator for BPBP



Birth Fractures

- Clavicle
- Humerus
- Sometimes femur
- May have association with brachial plexus palsy
- Will heal quickly
- Pin the sleeve to shirt
- Tell parents about callus formation (they will feel a bump!)



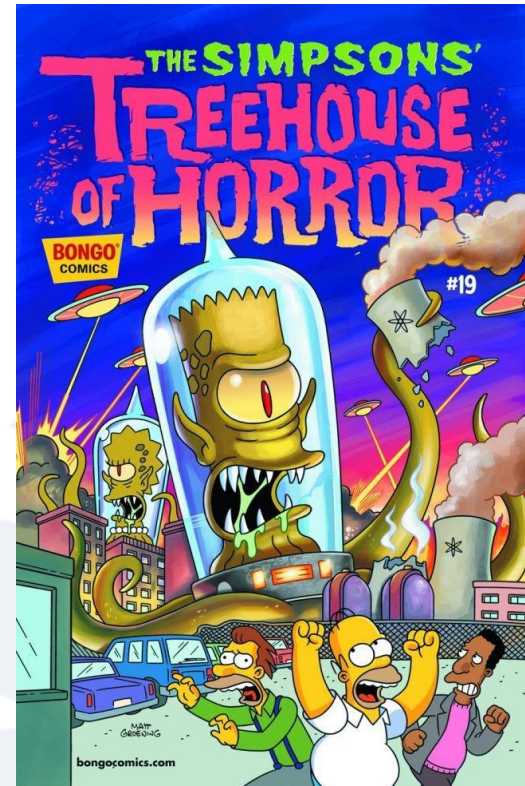
Congenital Pseudoarthrosis of the Clavicle

- Medial and Lateral clavicle ossification centers fail to fuse
- Smooth rounded edges of bone on X-ray
- Right side most common, bilateral 10%
- Etiology-pulsatile effect of subclavian artery?
- Asymptomatic, may have mass
- Observation if asymptomatic
- May need surgery if becomes painful or limiting



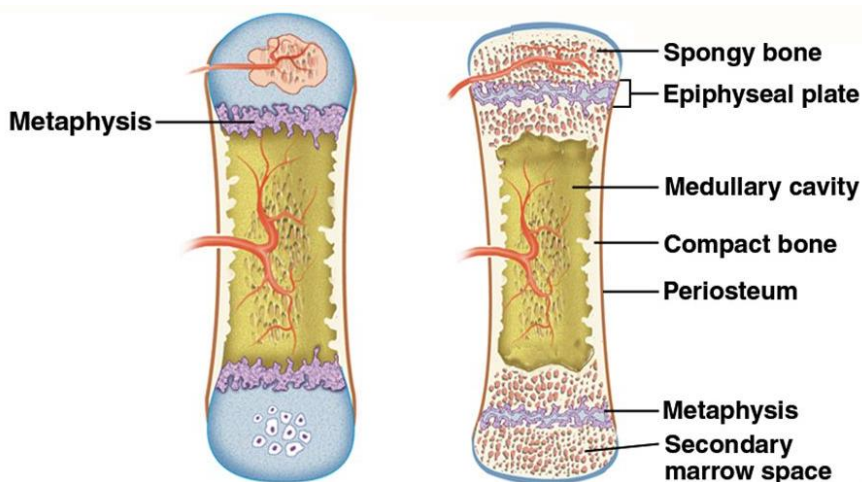
Musculoskeletal Infections

- Osteomyelitis-bone infection
- Septic arthritis-joint infection
- Pyomyositis-muscle infection
- Common in all age groups, but organisms differ by age group



Infant metaphyseal blood supply

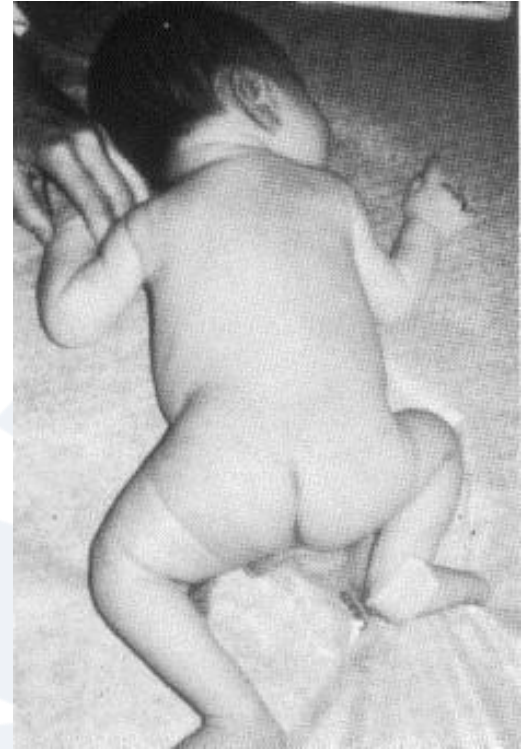
- In infants, metaphyseal vessels supply epiphysis with blood



- Formation of the secondary ossification center causes separation of the epiphyseal and metaphyseal blood supply
- Therefore, prior to formation of the secondary ossification center, infection can spread from the diaphysis/metaphysis across to the epiphysis

Septic Arthritis

- Overlap with osteomyelitis
- Joint appears red, swollen, and is warm
- Fever in infants is unreliable, can be hypothermic
- Refusal to use extremity
- Hip held in position of comfort-flexion, abduction, external rotation (maximizes joint volume)
- Multiple joints can be involved, especially in NICU babies
- CRP has a high negative predictive value (if it's negative, 95% chance no infection is present)



Organisms



Septic Arthritis Antibiotic Treatment		
Age	Organism	Antibiotics
<12 mos	<i>staphylococcus</i> sp., group B streptococci , and gram-negative bacilli	1st generation cephalosporin
6 mos-5 yrs	<i>S. aureus</i> , <i>S. pneumoniae</i> , group A streptococci, <i>H. influenzae</i> , <i>K. kingae</i>	2nd or 3rd generation cephalosporin
5-12 yrs	<i>S. aureus</i> , <i>K. kingae</i>	1st generation cephalosporin
12-18 yrs	<i>N. gonorrhoeae</i> , <i>S. aureus</i>	oxacillin/cephalosporin

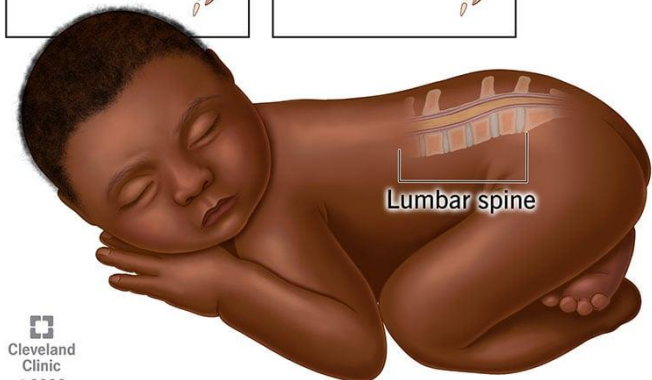
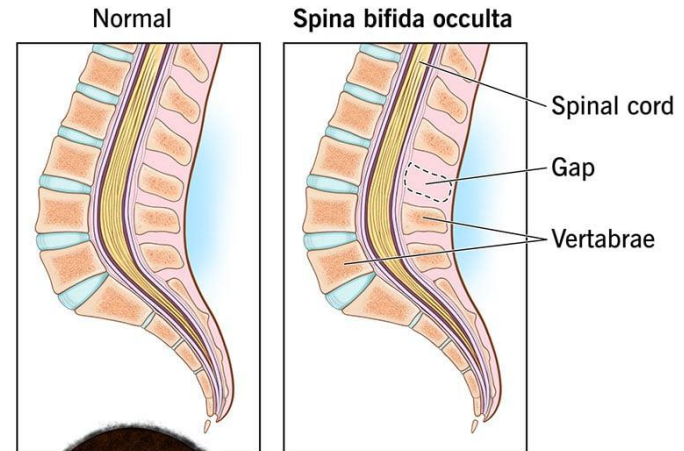
The institutional biogram may differ from these universal recommendations!

Spine Exam

- Assess for any deep sacral dimples or pits at the gluteal cleft
- May require a ultrasound at the sacrum to evaluate for spina bifida occulta

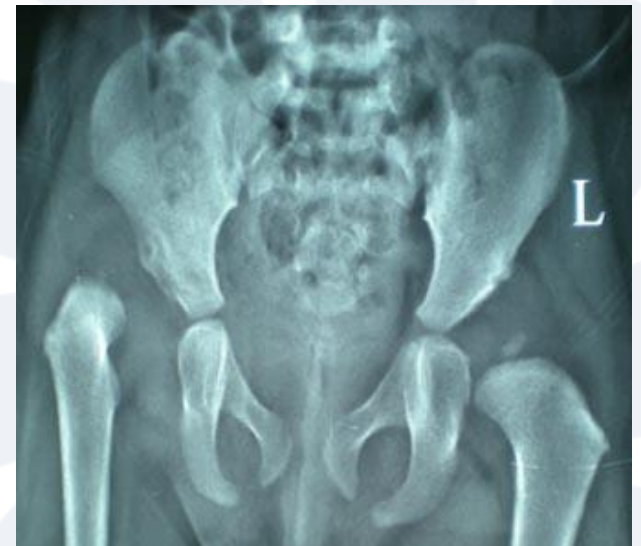


Spina Bifida Occulta



Developmental Dysplasia of the Hip

- Most common orthopaedic newborn disorder
- Hip dysplasia 1%
- Hip dislocation 0.1%
- Continuum from acetabular dysplasia with located hip to dislocated rigid hip associated with teratologic conditions (arthrogryposis, CP, etc.)



Developmental Dysplasia of the Hip

- Higher incidence in Native Americans
- Swaddling pPosition Statement from POSNA
- “Hip healthy swaddling”
- Prevent forced hip and knee extension
- Sleep sacks are a good choice!



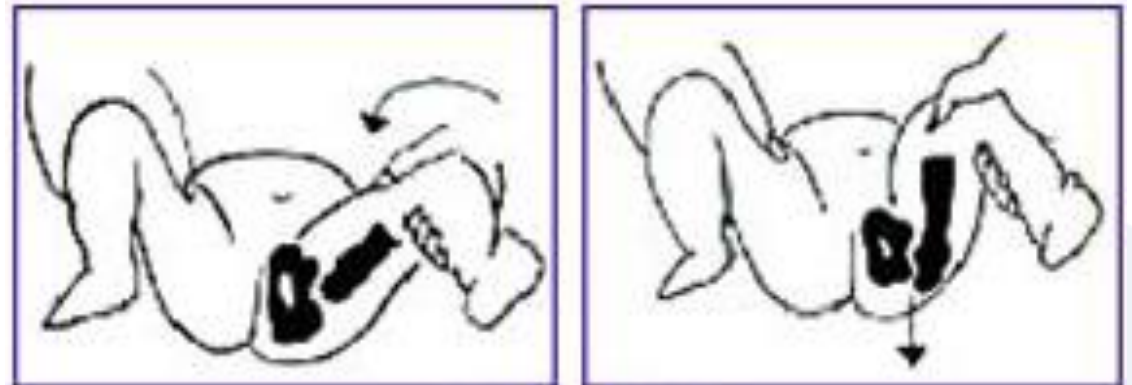


Developmental Dysplasia of the Hip

- Is the hip dislocatable? (Barlow maneuver)*
- Is the hip reducible? (Ortolani maneuver)*
- Is the hip fully dislocated? (Galeazzi sign)
- *Past 3 months, the hip becomes stiffer and these tests become not useful

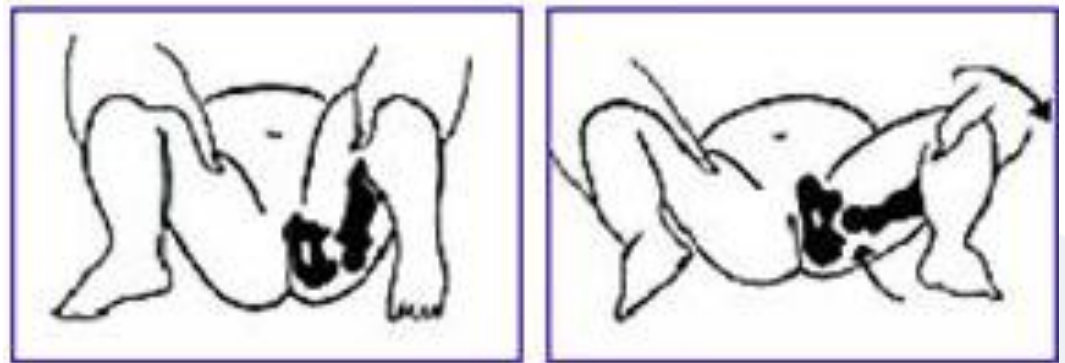
Developmental Dysplasia of the Hip

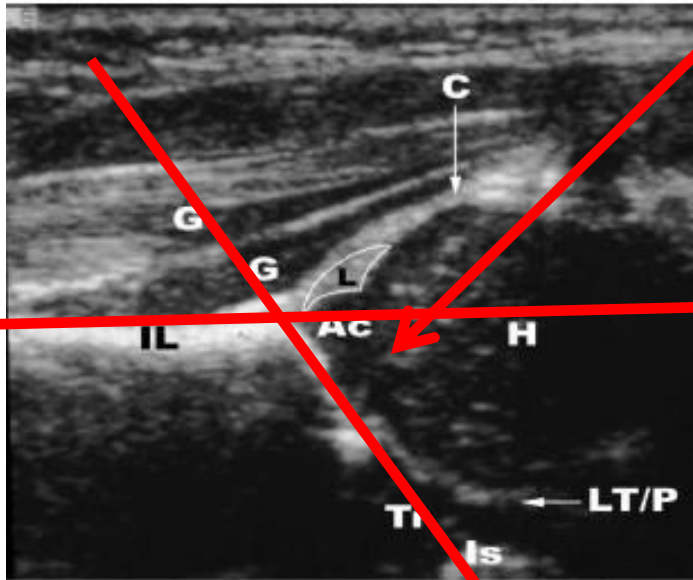
- Is the hip dislocatable?
- Barlow-adduction/push maneuver to dislocate the hip



Developmental Dysplasia of the Hip

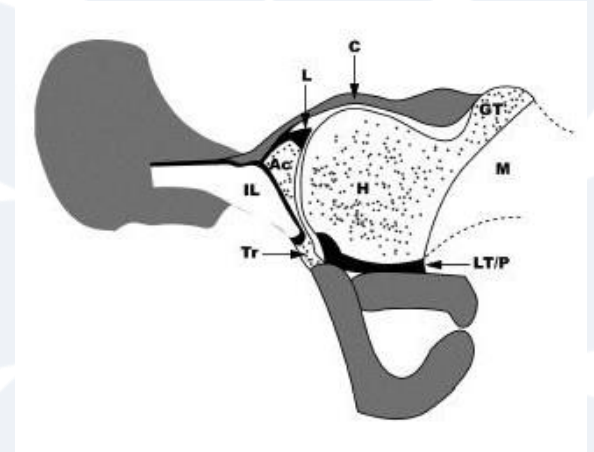
- Is the hip reducible?
- Ortolani-abduction/elevation maneuver to relocate a dislocated hip





- α (alpha) angle-angle between ilium and acetabulum on coronal ultrasound; goal is 60 degrees
- Femoral head coverage goal is >50%

DDH-ultrasound findings



Tibial Bowing: A Primer

- Anterolateral
 - congenital pseudoarthrosis of tibia
 - Fracture
 - NF-1
 - Tx: Clamshell brace pre-fracture



Tibial Bowing: A Primer

- Anteromedial bowing
 - Associated with fibular hemimelia/deficiency
 - Lateral ray deficiency, ACL absence
- Keep the foot if stable, amputate if not!

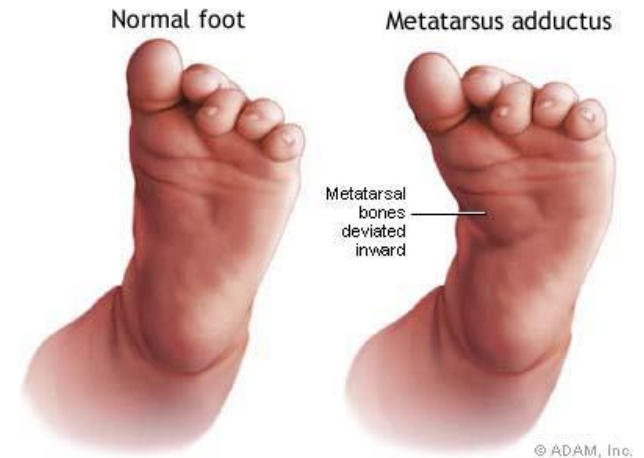


- Posteromedial bowing
 - Associated with calcaneovalgus foot
 - LLD of 3-4 cm
- Tends to resolve
- Treat LLD if necessary



Metatarsus Adductus

- Different from clubfoot
- Forefoot only deformity
- Bean shaped foot
- Usually resolves over time
- Tx: stretching, reassurance
- Most children resolve regardless of intervention



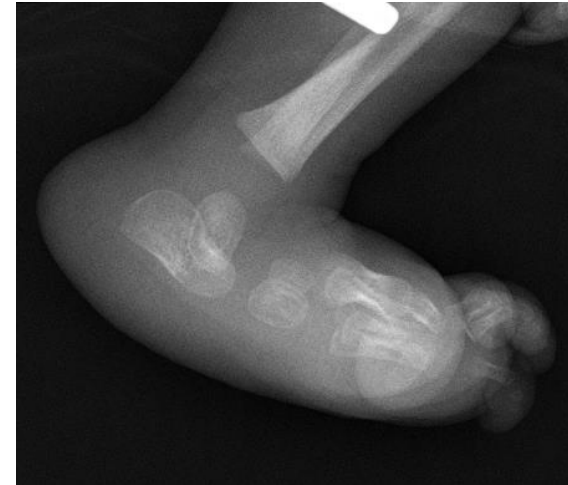
Congenital Talipes Equinovarus

- Boys > Girls
- Bilateral 10%
- Tx: Ponseti casting + percutaneous Tendo Achilles lengthening



Congenital Vertical Talus

- Navicular dorsally dislocated on talus
- Rigid deformity
- Normal newborn foot lacks a longitudinal arch
- Rockerbottom foot
- Treatment
 - Casting to stretch out dorsal soft tissues
 - Open reduction and pinning TN joint



Congenital Amputations

- Can happen in any extremity
- Amniotic bands
- Vascular injury
- May be found on ultrasounds in OB-GYN clinic



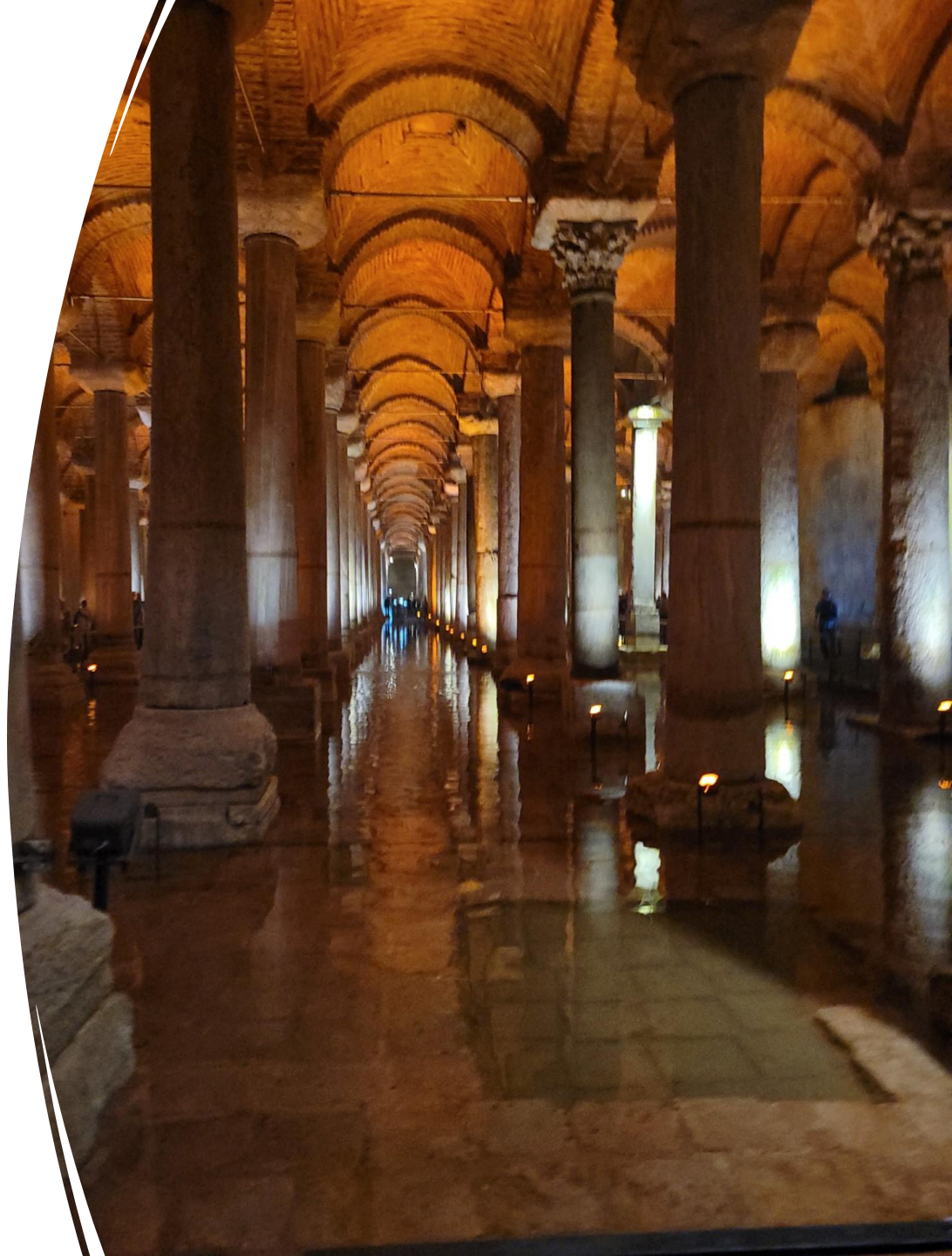
Polydactyly

- Most common inherited deformity
- Can be preaxial (radial sided or thumb duplication) or postaxial (ulnar sided)
- May have soft tissue bridge (simple) or bony bridge (complex)
- Traditionally tied off in newborn nursery, but prominence of soft tissue can remain and be unsightly or irritating, requiring formal surgery



Primitive Reflexes

- May persist in infants with CP or other neurologic disorders
- Adults may show reappearance of primitive reflexes



Moro Reflex

- Startle reflex
- Disappears around 3-4 months
- Arms spread
- Arms retract
- Infant cries
- Absence in case of fracture, birth palsy, CP



Grasp Reflex

- Place an object in infant's hand or foot
- Grip response stimulated
- Hand reflex strongest at birth-2/4 months
- Plantar reflex lasts until 9-12 months
- Persistent grasp reflex may indicate CP
- Flaccid paralysis may indicate BPBP



Stepping Reflex

- Lasts until 6 weeks of age
- If held upright and feet placed onto ground, infant will attempt to reciprocate despite the fact that they cannot support their own weight
- Reappears at 8-12 months of age



Orthopaedic Newborn Exam Video

- <https://youtu.be/c5LBowvHNCc?si=c86jG54nyvj-n2lk>





Questions?