Developmental Hip Dysplasia

- Wide spectrum of hip disorders ranging from complete dislocation to subtle instability or subluxation of the hip. Can present at a wide age range.
"Dislocated" - femoral head outside the acetabulum (reducible vs. irreducible)

"Dislocatable" - head inside acetabulum, but able to be completely displaced by gentle force

"Subluxatable" – head glides with gentle force, but remains within the acetabulum
In order for normal development of the femoral head and acetabulum to occur the femoral head must be centered in the acetabulum

Therefore instability leads to abnormal development of both of these structures
Developmental Hip Dysplasia

- So why do you need to treat DDH?
So why do you need to treat DDH?

To prevent the development of early onset hip DJD in the young adult!
Etiology

- 1 in 1000 children born with a dislocated hip
- 10 in 1000 children born with hip subluxation or dysplasia
- More commonly seen in Native Americans and Laplanders
- Rarely seen in Africans
Etiology

- Risk Factors
  - First born infants
  - Female infants
  - Family history of DDH
  - Intrauterine position
  - Postnatal positioning
Etiology

Risk Factors

- First born infants
  - Affected twice as often as subsequent siblings
  - Most likely secondary to tighter uterine and abdominal musculature
  - Also increased with oligohydramnios
Risk Factors

- Female infants
  - Increased sensitivity to maternal hormones causing increased ligamentous laxity
  - Also respond to estrogen produced by infant uterus
    - Resolves spontaneously
  - Females twice as likely to present in breech position
Risk Factors

- Family history of DDH

  Probabilities of having child with DDH
  - 6% if normal parents and one affected child
  - 12% if affected parent but no child
  - 36% if one affected parent and child
Etiology

Risk Factors

- Intrauterine position
  - More often in breech position
    - Regardless of vaginal or csection delivery
    - Most likely secondary to position of hip flexion with knee extension
  - More often involves left hip
    - 60% of children
    - Secondary to left hip being adducted against the lumbosacral spine in left occiput anterior position
Etiology

- Risk Factors
  - Postnatal positioning
  - Cultural factors can lead to DDH
    - Positioning in cradle board with hip and knees extended and adducted leads to increase of DDH seen in Native American populations
Etiology

- Risk Factors
- Increased prevalence of DDH with
  - Torticollis
  - Other congenital joint dislocations
  - Lower extremity deformity
    - MTA, clubfeet
  - Ligamentous laxity
Observation

- Asymmetric skin folds
  - Inguinal or thigh
Galeazzi sign

Unequal knee heights with the hips and knees flexed 90 degrees
**Ortolani Test**
- Grasp thigh with middle or ring finger over greater trochanter and thumb over lesser trochanter
- Stabilize opposite hip in abduction
- Abduct thigh and direct greater trochanter anteriorly
- Palpable “clunk” signifies a dislocated but reducible hip
Barlow Test

- Thumb over distal medial thigh
- Gentle lateral-posterior force attempts to dislocate the hip
- If femoral head displaces from the acetabulum then hip is “dislocatable”
- Feel subtle sliding motion
Ortolani and Barlow maneuvers will only be positive for 8-12 weeks and will be normal on an irreducible hip dislocation.
Soft tissue clicks felt while adducting or abducting the hip in the absence of other abnormal findings are considered benign.
Physical Exam

- Hip abduction
  - Should be symmetric
  - An infant with unilateral hip dislocation will eventually show limited hip abduction on that side
    - May not be present for several months
      - Hallmark in older infants and children
    - Infants with bilateral dislocations will have symmetric hip abduction
Imaging

- Routine X-rays
- Ultrasound
- CT scan
Imaging

- Routine X-rays
  - Static and do not rule out instability
  - Ossific nucleus of femoral head not present for 3-7 months
    - Not recommended until 3-6 months of age
Imaging

- Routine X-rays
  - Hilgenreiner’s Line (Y-Line)
  - Perkin’s Line
  - Shenton’s Line
  - Acetabular Index
  - Four Quadrant Grid
Imaging

Line of Ombrédanne and Perkins

Hilgenreiner's line

Quadrants for the diagnosis of hip dislocation
Hilgenreiner’s Line

ACETABULAR INDEX

Y LINE

45°

20°

Center of Triradiate cartilage

Ossified lateral edge of acetabulum

PERKIN’S LINE

SHENTON’S LINE
Acetabular index
- Averages
- > 32° for girls and > 30° for boys at 3 months suggests dysplasia (Mean + 2 SD)

- Poorly defined lateral acetabular edge suggests dysplasia
Ultrasound

- Static study to confirm bony/cartilaginous morphology
  - angles of acetabular walls and amount of coverage of femoral head
- Dynamic study to determine instability
Ultrasound
- Can image soft tissues as well as bone
- Dynamic and static study
- Safe
- ? Variable reproducibility
  - Depends on institution and technologist
Ultrasound

- Hyaline cartilage → devoid of echoes (black)
- Bone and dense connective tissue → echogenic (white)
Ultrasound

α-angle

- Measures **osseous** development of the acetabular roof
- Most important
- > 60° normal developing acetabulum
Ultrasound

- Can detect instability not seen with physical exam
- Up to 6mm of posterior displacement can be seen in normal newborns
- Most minor instability resolves within 4-8 weeks
Ultrasound

- Early screening of newborns would most likely lead to significant over treatment
- Best used as an adjunct to physical exam
- Is useful to follow treatment
  - Ensure reduction of hip
  - Demonstrate improvement in stability
American Academy of Pediatrics

- All newborns to be screened with physical exam
  - If + Ortolani/Barlow sign refer to orthopaedist
    - Positive must be clunk
  - If exam equivocal then reexamine in 2 wks by PMD
    - Equivocal is click with – Ortolani/Barlow
  - U/S or Xray of newborns not recommended
Screening Recommendations

- American Academy of Pediatrics
- 2 week exam
  - + Ortolani/Barlow refer to orthopaedist
  - Negative O/B but physical findings suspicious then refer to ortho or obtain U/S at 4 wks of age
  - Findings – f/u regular scheduled well baby visits
Treatment

- Subluxation
  - Often corrects spontaneously
  - Triple diaper not shown to be better than no treatment
  - I treat subluxation immediately

- Dislocation requires immediate treatment
Treatment

- Pavlik Harness
- Closed Reduction and Casting
- Open Reduction and Casting
Pavlik Harness
- Introduced in Europe in 1944
- Dynamic positioning device
- Allows child free movement
- Used children <6 months of age

Anterior straps flex the hips

Posterior straps Prevent ADduction
(*Forced ABduction may cause AVN)
Treatment

- **Pavlik Harness**
  - Used with reducible hip in infants not yet attempting to stand
  - Positioning hips in flexion with limited adduction allows gradual “docking” of head
    - The “human position”
  - “Safe zone”
    - Difference between angle of maximal passive motion and angle at which femoral head displaces
    - Abduction (flexion, extension)
Pavlik Harness

- Initially need follow-up at weekly intervals
- Once stable on exam or ultrasound may change to 2 week intervals
- In general treatment extends 3 weeks beyond normal ultrasound
- Harness worn full time in the beginning, but may be weaned when stable
Closed Reduction and Spica Casting

- Children in whom a concentric reduction can not be obtained with simpler means
  - Failure of pavlik harness
- May be used primarily in situation of unreliable family or poor social situation
Treatment

- **Open reduction**
  - Used when concentric reduction cannot be obtained by closed methods
  - Anterior or medial approach
Complications

- Complications of closed treatment
  - Avascular Necrosis
  - Femoral nerve palsy
Complications

- Femoral nerve palsy
  - Secondary to extreme flexion in pavlik harness
    - Usually resolves over time but can be devastating
Complications

- AVN
  - Normal growth of the head impaired and may become flat, wide, or irregular
  - Secondary deformation of the acetabulum occurs and leads to early joint degeneration
  - May be complete or partial
  - Worst outcome possible
Key Points

- Screen every newborn
  - Extra suspicion if risk factors present
    - Firstborn female in breech position with family hx
- Key to diagnosis is physical exam
  - Imaging studies are confirmatory
  - After 8-12 weeks O/B will be negative, look for asymmetric abduction
Key Points

- No Xrays or ultrasound on newborns!!
  - Leads to over treatment and unnecessary torture of patients and parents
  - First ultrasound at 4-6 wks
  - First Xray at 6 months
- Follow pediatric academy guidelines
  - Very well thought out
Questions?