Hip Dysplasia Across the Decades: From Pavlik to PAO

Suzanne Hilt RN, MS, CPNP
Golisano Children’s Hospital
Pediatric Orthopaedics
Rochester NY

Disclosures
None

Objectives
- Describe the causes of hip dysplasia and how anatomy drives the treatments in a growing child
- Understand how the skeletally mature pelvis changes the treatment for hip dysplasia
- Understand how other hip diagnoses in childhood cause hip deformities that need surgical intervention in late childhood and adulthood
- Review concept of a Hip Preservation Program
What is Hip Dysplasia?

- Dysplasia = bad formation
- Developmental malformation of the hip joint – hip socket (acetabulum) is abnormally formed

- Other names
  - Developmental Dysplasia of the Hip (DDH)
  - Acetabular dysplasia
  - Congenital Dysplasia of the Hip (CDH) – rarely now

Spectrum of Hip Dysplasia

- Spectrum = Ranges from barely detectable to severely malformed or dislocated
  - Shallow or maldirected acetabulum
  - Unstable or subluxable hip
  - Subluxed hip
  - Dislocated hip

- Spectrum of the disease makes quantifying incidence difficult

“Statistics”

- Females > Males 7:5:1
- Approximately 45% left, 30% right, and 25% bilateral
- Low incidence in African American; highest incidence in native American Indian
“Statistics”

- Spectrum of DDH make quantifying the incidence difficult
- 0.6 – 17 per 1000 infants

Multifactorial etiology – DDH

- Hereditary predisposition
- Position in utero
- Postnatal position
- Intrinsic DDH versus ligamentous laxity?
- Much is unclear

Risk Factors – 4 Fs

- FRANK breech or foot first
- FEMALE
- FIRST born
- FAMILY history
Risk Factors

FRANK breech or FOOT first
Cephalic Presentation 0.7%
Footling breech (One or both hips extended, foot presenting) 2%
Frank breech (Hips flexed, knees extended “pike”) 20%

FEMALE
Laxity due to mother’s/endogenous estrogens

First Born
FB are more often breech
Tighter uterus/abdominal contents – "packaging disorder"

Family History
If a child has DDH, the risk of another child having it is 6%
If a parent has DDH, the risk of a child having it is 12%
If a parent and a child have DDH, the risk of a subsequent child having DDH is 36%

Associated w other “Packaging Disorders”
- Congenital Muscular Torticollis
- Congenital dislocation of the knee
- Foot deformities – metatarsus adductus
### Newborns & Infants – Physical Exam

**Findings suggestive of DDH in infants**
- + Ortolani sign
- + Barlow sign
- Limited or asymmetric hip abduction
- + Galeazzi sign
- Asymmetric thigh creases

**Normal**
- Hip click

**Findings suggestive of DDH in walking children**
- Abnormal gait
- Lumbar lordosis (bilateral)

---

### Infant Physical Exam

You need a relaxed infant
- Full tummy
- Pacifier & sugar water

Gentle exam technique
- Raw egg

Ortolani & Barlow – up to age 3-6 months

Hip Abduction – 3-12 months

---

### Infant Exam - Barlow

- **Barlow** = move a located femoral head **back** out of socket
- With adduction of the hip, the head of the femur moves out of the acetabulum
- Done with a gentle or no posterior force
- Positive in a subluxable hip – one that is in the socket but able to be moved out

---
Infant Exam - Ortolani

- Ortolani = hip that is out and you are putting it back in the socket
- With abduction and anterior translation of the hip, the head of the femur moves into the acetabulum
- Positive in a dislocated hip that is able to be reduced back into the acetabulum
- A teratologic or prolonged dislocated hip may be "Ortolani negative" despite being dislocated – contracture resists this maneuver

Infant Exam - Hip Abduction

Asymmetric hip abduction and hip abduction less than 60 degrees is concerning

<table>
<thead>
<tr>
<th>Max abduction</th>
<th>% normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 degrees</td>
<td>0%</td>
</tr>
<tr>
<td>60 degrees</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>75 degrees</td>
<td>45%</td>
</tr>
<tr>
<td>90 degrees</td>
<td>99%</td>
</tr>
</tbody>
</table>

Infant Exam - Galeazzi Sign

- Posterior displacement of the dislocated hip creates a limb length discrepancy that is seen as different knee heights with the child supine
- May not be apparent with bilateral dislocations

Infant Exam - Thigh Creases

- Asymmetry may be seen in long-term dislocations
- Not a strong indicator of DDH - can be seen in >50% of infants

Infant Exam - Hip Click

- Short-duration feeling without the sense of the femur moving in or out of the acetabulum
- Normal
International Hip Dysplasia Institute

STATEMENT ON SWADDLING
Swaddling infants with the hips and knees in an extended position increases the risk of hip dysplasia and dislocation. It is the recommendation of the International Hip Dysplasia Institute that infant hips should be positioned in slight flexion and abduction during swaddling. The knees should also be maintained in slight flexion. Additional free movement in the direction of hip flexion and abduction may have some benefit. Avoidance of forced or sustained passive hip extension and adduction in the first few months of life is essential for proper hip development.

Newborn Swaddling & Positioning

Treatment Principles in Growing Child
Femoral head and acetabulum need each other to grow properly
Large amount of growth occurs in first 4 years of life
Early detection = more time to promote normal growth
Treatments aim to keep femoral head located in acetabulum during early growth
Imaging

Ultrasound – under age 4-6 months

Radiographs

1. Acetabular angle
2. Hilgenreiner line & Perkin line
3. Femoral head ossification
4. Shenton line

DDH - Treatments

OBSERVATION

• “Time is wise” – especially with a young infant, hx of concern but normal exam in our office
• May be just immature hip of the newborn

PAVLIK HARNESS

• Infant abduction harness – generally up to 6 months
• Barlow/Ortolani + hips
• Parent teaching
• Risks
• Timing of ultrasound monitoring is variable
DDH - Treatments

ABDUCTION BRACES

• Older infants
• Can be used as a transition out of the Pavlik harness
• More wear time = better
• Risks

CLOSED REDUCTION/SPICA CAST

• 6-18 months of age
• Used if unable to get/keep hip(s) located with harness or brace
• Done under GA – arthrogram, adductor tenotomy
• If unsuccessful, may convert to open reduction same day
• Risks

DDH – SPICA Care

• Diapering
  • 2 diaper +/- sanitary pad
  • FREQUENT changes, esp. toddlers
• Assessing skin
  • Edges of cast, soiling
• Safe transportation
  • Car seats
• Positioning/activities
• Breastfeeding
• Clothing

DDH – Treatments

OPEN REDUCTION, OSTEOTOMY & SPICA CAST/BRACE

- Indicated for dislocated hip or significant dysplasia
- 18 months – 3 years; 6-18 months of age, if failed closed reduction
- >18 months: soft tissue procedure w/o osteotomy will not be enough to promote remodeling ~ Acetabular osteotomy +/- femoral osteotomy

Pelvic osteotomy:
- DeGa Osteotomy
- Soffer (innominate) Osteotomy

Always Follow over time with Growth
Older (walking) child exam - DDH

- Waddling gait
- Limb length inequality
- Hip flexion contracture
- Hyperlordosis of the lumbar spine
- Can be very challenging to discover if bilateral

DDH - Treatments

Older children - varies

- Age
- Amount of dysplasia
- Underlying NM disorder
- Subluxation or dislocation vs. in the joint but dysplastic
- Skeletal maturity of hip
  - Open vs. closed triradiate cartilage

DDH - Treatments

Acetabular osteotomy +/- femoral osteotomy
Skeletally Immature vs. Mature Pelvis

Late Hip Dysplasia
- May have been treated as a child - lost to follow-up, told no follow-up needed or had no issues.
- May not present with sx at all until adolescent or adulthood
- Instability and subluxation of the joint → soft tissue/cartilage damage around hip joint
- Mechanically overload the weight bearing portion of the acetabular cartilage → osteoarthritis

Late Presentation DDH
- Female > Male
- 13-40 years old
- Otherwise healthy
- Insidious onset of groin pain that gradually worsens
- May have popping, grating, feeling like hip giving out
- Often unsuccessful with non-operative treatments
  - PT
  - Meds
  - Injection
  - Activity modification
Why is it an issue?

• Hip subluxation ALWAYS leads to issues, generally within a decade
• Acetabular dysplasia leads to earlier DJD, but not usually as rapidly **
• Increased joint stress, labrum tears
• Pain, early osteoarthritis – severe arthritis makes Hip Preservation no longer an option

Measurements

• Center Edge Angle (CEA)
• Correlation with development of OA
• Normal 25-40
• Less than 20 = DDH
• Less than 10 has significantly higher risk for OA

Imaging Studies – MRI with arthrogram

• The labrum is a rim of soft tissue or fibrocartilage that surrounds the acetabulum (hip socket). It adds to the stability of the hip by deepening the socket and protects the joint surface
Imaging Studies – CT with 3D reconstruction

- Better image of femoral head – acetabulum relationship
- Anterior coverage
- Bony abnormalities – i.e. cam lesion

“Hip Preservation”

Goal is to maintain as much of your normal hip as possible to reduce/eliminate pain and improve function
Surgical interventions and non-operative interventions – injection, physical therapy
In most patients, goal is to prevent or postpone a hip replacement

Hip Scope/Periacetabular Osteotomy (PAO)

- Arthroscopy (Giordano): repair labrum and other damaged tissues, fix minor femoral head defects, impingement issues
- Periacetabular Osteotomy (~ PAO (Cook)): cut the pelvis and move the bones to create a better hip socket, improving the coverage of the femoral head within the joint
- Staged vs. “combo”
PAO - Animation

https://www.hss.edu/conditions
Periacetabular-Osteotomy-PAO.asp

Short-term Post-op

- Admitted 3-6 days
- TDWB on operative leg w crutches. OOB to chair and ambulating POD #1
- No active hip ROM exercises initially. No hip flexion >90 (after scope)
- Lovenox for DVT prophylaxis for 5 weeks – adults and teens w risk factors
- Foley catheter first night
- “Aggressive” pain protocol: MS contin 2x daily. PCA first night then PRN Norco/Percocet
- Bowel regimen. BM before DC home.

Long-term PT Post-op

- After 3 weeks, begin gentle ROM exercises
- 6-8 weeks of TDWB on crutches
- Begin PWB, early strengthening, ROM
- FWB with good radiographic healing ~6-12 weeks
- AAT 4-6 months
- No long term restrictions
Slipped Capital Femoral Epiphysis (SCFE)

Definition
- Displacement of proximal femoral diaphysis (neck) in relation to the position of the femoral head in the immature hip
- Due to imbalance of mechanical and/or endocrine factors

“Typical Patient” = overweight male with delayed maturation, complain of knee pain & limp

Epidemiology
- Age Peak Incidence 11-14 years
- Males > Females
- L hip > R
- 10 / 100,000

Legg-Calve-Perthes Disease

- Avascular necrosis of the femoral head – the bone of the femoral head dies due to an insult which interrupts the flow of blood to the femoral head
- Leads to collapse of the femoral head → incongruency within joint, osteoarthritis
Legg-Calve-Perthes Disease

- Boys 4x more than girls
- Most common 4-8 years old (2-12 years)
- Bilateral in 10-15% of cases
- Etiology unknown
  - Hereditary predisposition?
  - Abnormal clotting disorder?
  - Second hand smoke exposure?

Femoral Osteotomy

- Osteotomy of proximal femur to reposition femoral head/neck
- Correct valgus/varus deformity, treat subluxed/dislocated hip, create congruency between femoral head and acetabulum
- Post-= very similar to PAO, may WB a little sooner
Surgical Hip Dislocation

- Osteotomy of greater trochanter (muscle attachments) – allows safe hip dislocation while protecting blood vessels to femoral head
- Fully visualize hip joint and address/reshape femoral head deformity
- Reattach greater troch and stabilize with screws
- Differences post-op
  - CPM very important to prevent joint stiffness
  - Will need CPM after DC

Hip Preservation Program at UR

- Established 2012
- Hip pain/deformity in patients ages 13-50 (skeletally mature pelvis)
- Goal is to treat the hip issue with non-operative techniques +/- surgery to preserve the hip – prevent or delay needing a hip replacement
- 14 cases 2012 (6 months), 39 cases 2013  42 cases 2017 (8 months)
- Hip popping (IR band) with Ehlers-Danlos; athletes with hamstring avulsion, gluteus maximus tear

https://www.urmc.rochester.edu/orthopaedics/hip-preservation/index.cfm

Role of the NP in Hip Preservation

- Pre-op evaluation for surgical risks, readiness, social issues
- Education regarding procedures, post-op course, resources, physical rehab
- Development of protocols
  - Pre-op assessment
  - Surgical scheduling
  - Post-op management in-house
- Continuity of care