Developmental Dysplasia of the Hip

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Disclosures

- Member of SRS Education Resource Committee
- Chair of POSNA QSVI-Trauma Committee
- Practicing pediatric orthopædic surgeon

Objectives

- Describe the clinical and radiographic findings associated with developmental dysplasia of the hip
- Describe the management approaches and indications for each to treat developmental dysplasia of the hip
- Describe the risk factors and natural history of developmental dysplasia of the hip

Definition

- A hip joint that is unstable, subluxated or dislocated that has manifested at birth or subsequently

Epidemiology

- Genetic & Ethnic factors
  - High incidence in Lapps and Native Americans
  - Family history is positive in 1/8-1/3 of patients

Risk Factors

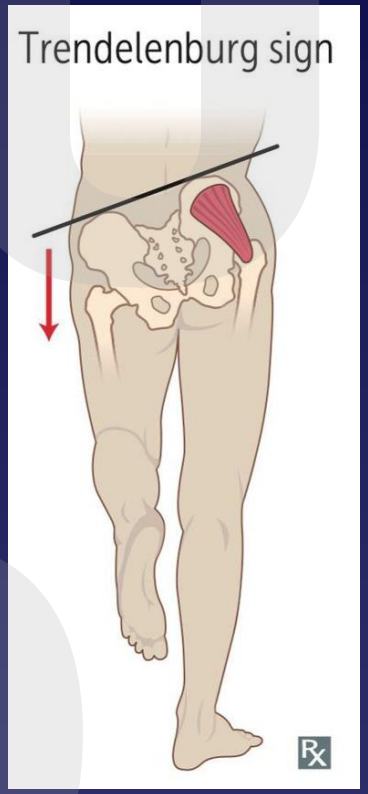
- Intrauterine
  - Breech positioning
  - Myelomeningocele
  - First-born child
  - Female
  - Oligohydramnios

Risk Factors

- Extrauterine
  - Papoose swaddling; hips extended and adducted
  - Ligamentous laxity
  - Acetabular dysplasia

Natural History

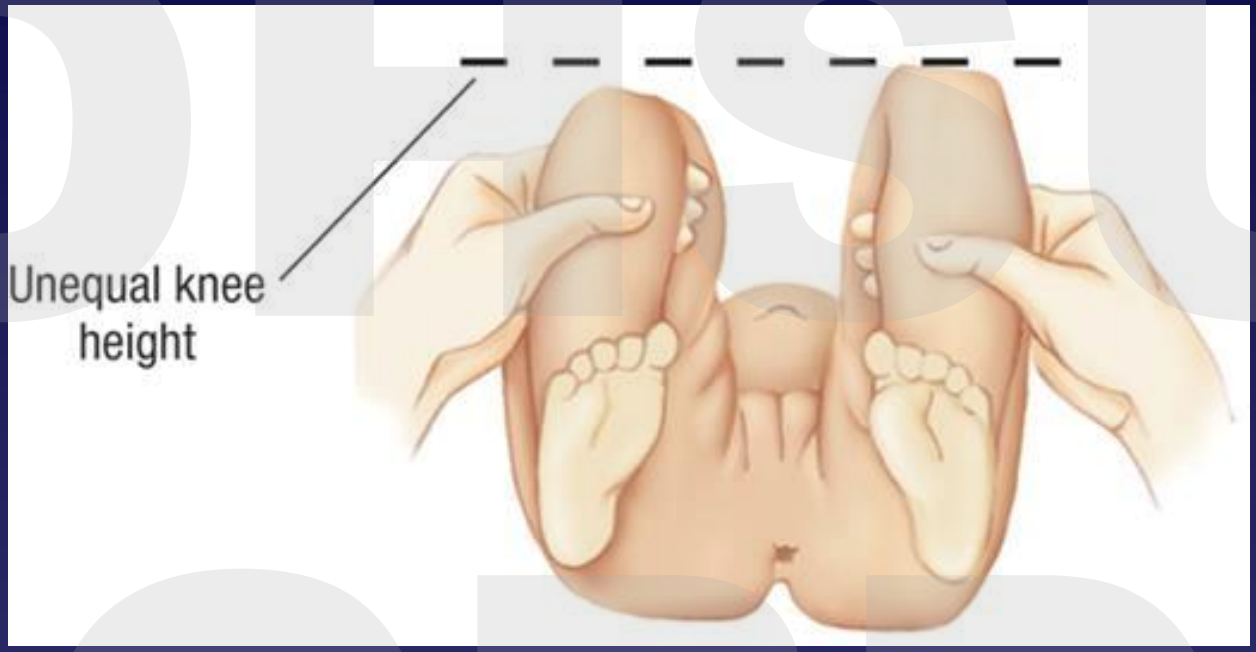
- Painless limp
  - Unilateral toe-walking
- Stiffness
- Trendelenburg lurch, limping
- Decreased speed and endurance
- Arthritis



Diagnosis

- Newborn, neonate and infant examination
  - Exams performed with the pelvis leveled
  - Inspection
    - Thigh folds
    - Galeazzi sign
  - Motion
    - Abduction in flexion
  - Instability
    - Barlow/Ortolani tests

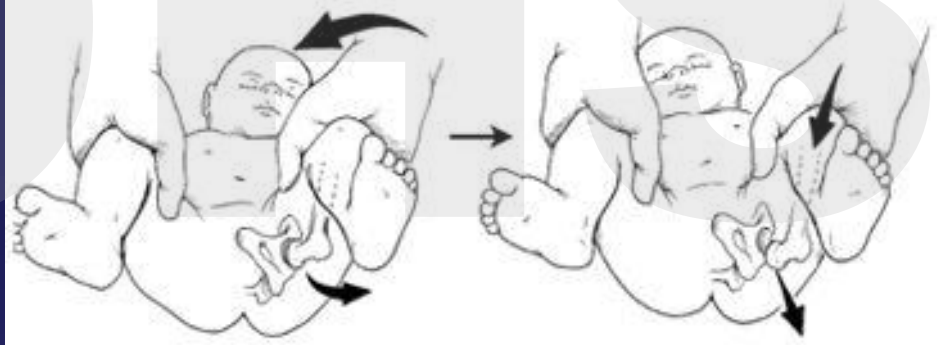
Galeazzi Sign



Boneandspine.com

Barlow Sign

Barlow's Test



1. Flex and ADDuct the hips
(by bringing thighs towards the midline)

2. While applying light pressure on the knee and direct the force posteriorly

POSITIVE TEST

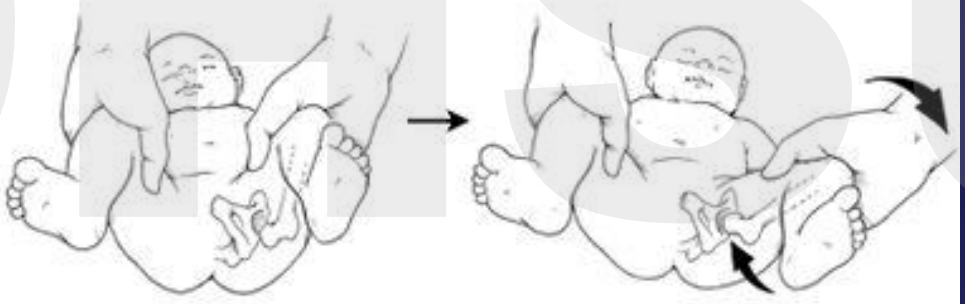
Femoral head dislocates posteriorly from the acetabulum

Dislocation is palpable as head slips out of acetabulum

Diagnosis is confirm with Ortolani's test

Ortolani Sign

Ortolani's Test



1. Hips are examined one at a time

2. Flex hips and knees to 90 degrees

3. Thigh is gently ABducted
(bringing femoral head from its dislocated posterior position from the Barlow test)

POSITIVE TEST
Femoral head reduces into the acetabulum
A palpable an audible clunk as hip reduces

Hip abduction

- After 6 months of age signs of instability are no longer sensitive
- Limited to evaluation of Galeazzi sign and decrease hip abduction

Pediatrics. 2019;143(1). doi:10.1542/peds.2018-1147

Keys to Physical Exam

- Relaxed baby
- Level pelvis
- Increased index of suspicion
  - Risk factors
  - Family complaints

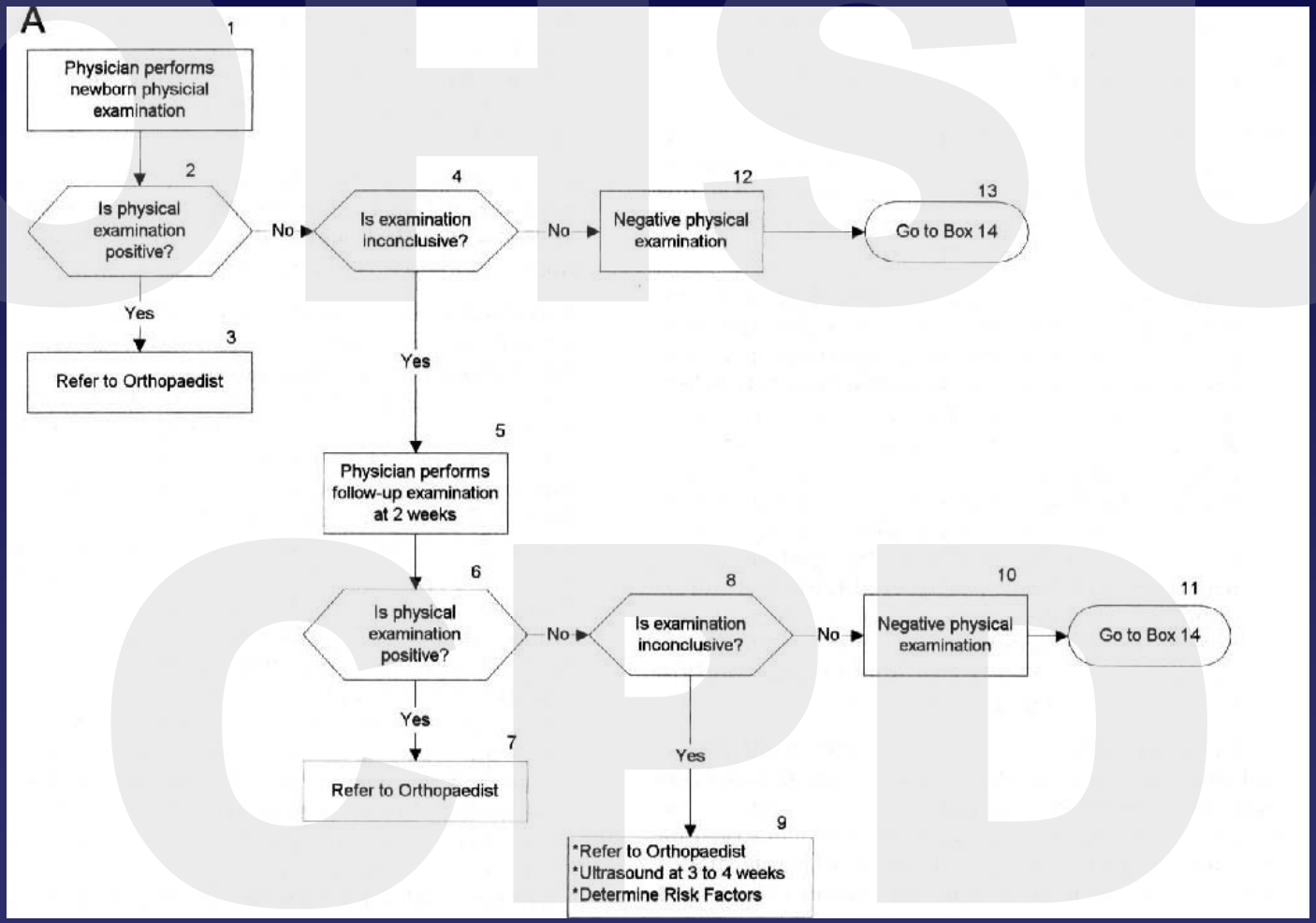
What about the Hip “Click”

- Misnomer
  - When the hip moves from a located to a dislocated position there is a “palpable” clunk, but there is rarely, if ever, an audible click
- If you hear a ”click” with hip movement, this is likely secondary to tendons sliding over a bony prominence rather than a sign of dysplasia
  - Continued monitoring of this finding is reasonable
  - Consider screening U/S at 6 weeks if still extant

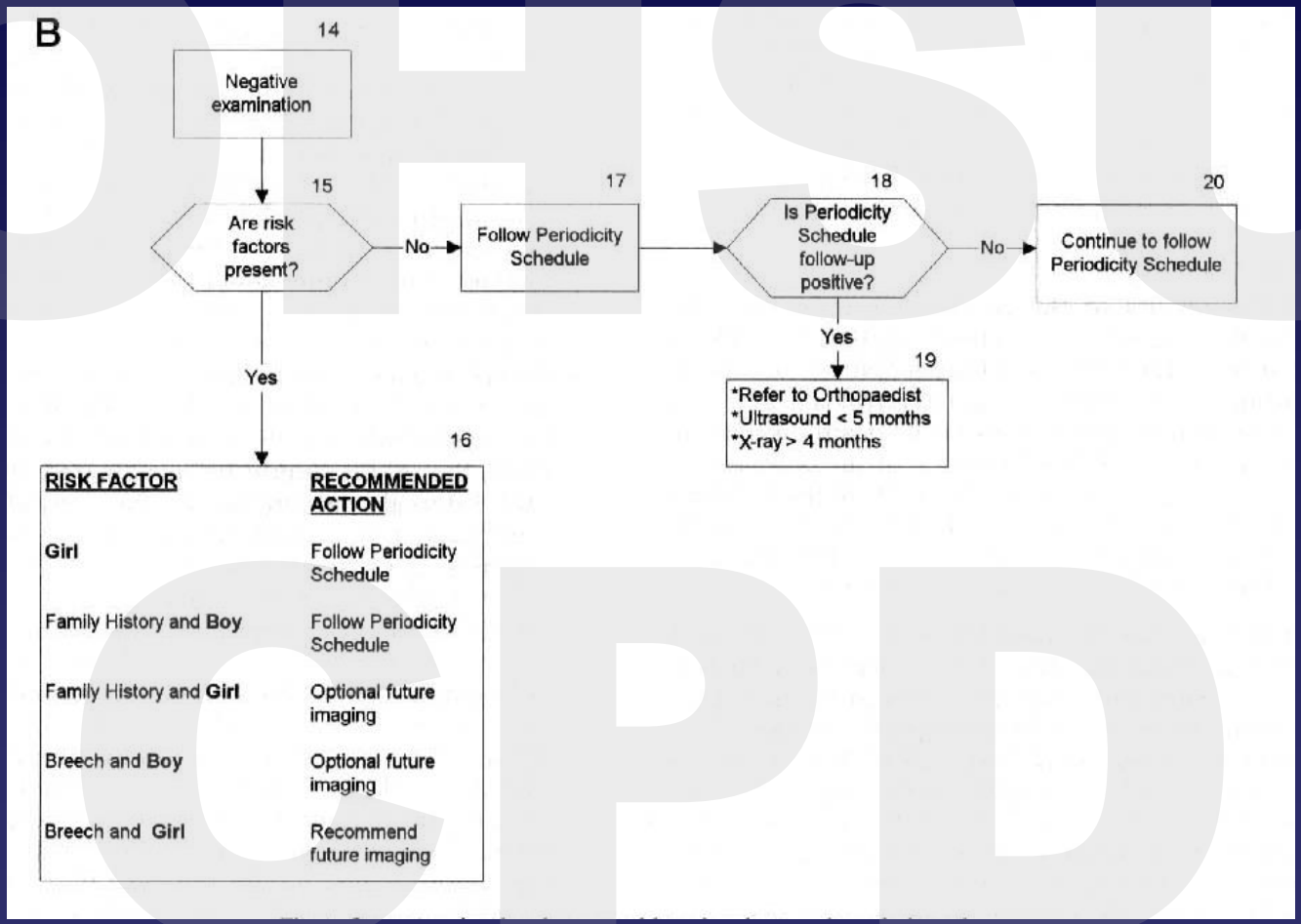
Clinical Practice Guideline

- Source: AAP - Committee on Quality Improvement – Subcommittee on Developmental Dysplasia of the Hip
- Published: Pediatrics Vol 105:4, April 2000
- State-of-the-Art Review published in Pediatrics vol 143:1, Jan 2019 by Yang, Zusman, Lieberman and Goldstein (OHSU)

Clinical Practice Guideline



Clinical Practice Guideline



Appropriate Use Criteria - AAOS

- Source: American Academy of Orthopedic Surgeons
- Published: JAAOS 2019 Vol 27:e356-9
- Website for AUC app for pediatricians:
  - https://aaos.webauthor.com/go/auc/auc.cfm?auc_id=225001
- Website for AUC app for orthopedists:
  - https://www.orthoguidelines.org/go/auc/auc.cfm?auc_id=225008

AUC - AAOS

- Writing Panel – 432 scenarios
  - Age
  - Physical exam
  - Risk factors
  - Ultrasonagraphy, <6 months
  - A/P pelvis x-ray, >4 months
- Treatments
  - Repeat clinical exam, U/S or x-ray (age dependent)
  - Abduction orthosis (includes repeat exam & U/S)
  - Surgical intervention (includes repeat exam & U/S or x-ray)
  - Obtain U/S
  - Cont routine well-baby care (Periodicity schedule)

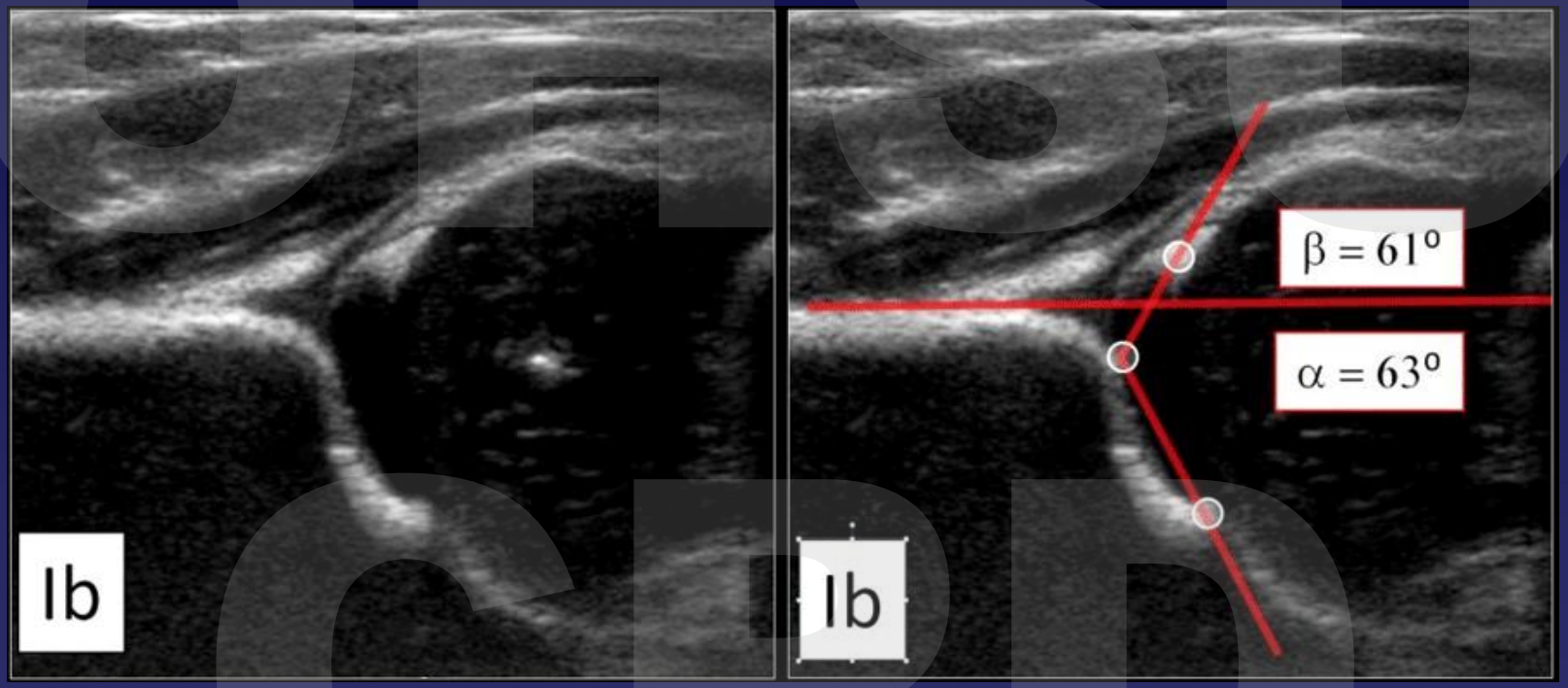
AUC – AAOS

- Voting panel determined appropriateness of each treatment for each scenario
  - Grades of recommendation
    - Appropriate with agreement
    - May be appropriate
    - Rarely appropriate
- Main warning: Breech presentation is felt to be a particularly strong risk factor for DDH even in the face of a normal physical exam. Recommendation is for screening ultrasound at 6 weeks AND a single AP pelvis radiograph at 6-12 months.

Radiographic Assessment

- Ultrasound
  - Assess depth of acetabulum - α angle
  - Assess position of femoral head
    - In neutral abduction/adduction
  - Assess stability
    - Femoral head coverage in adduction
  - Indications
    - History of breech presentation and/or positive exam findings (Barlow, Ortolani, Galeazzi)
    - Age < 6 months

U/S Angles



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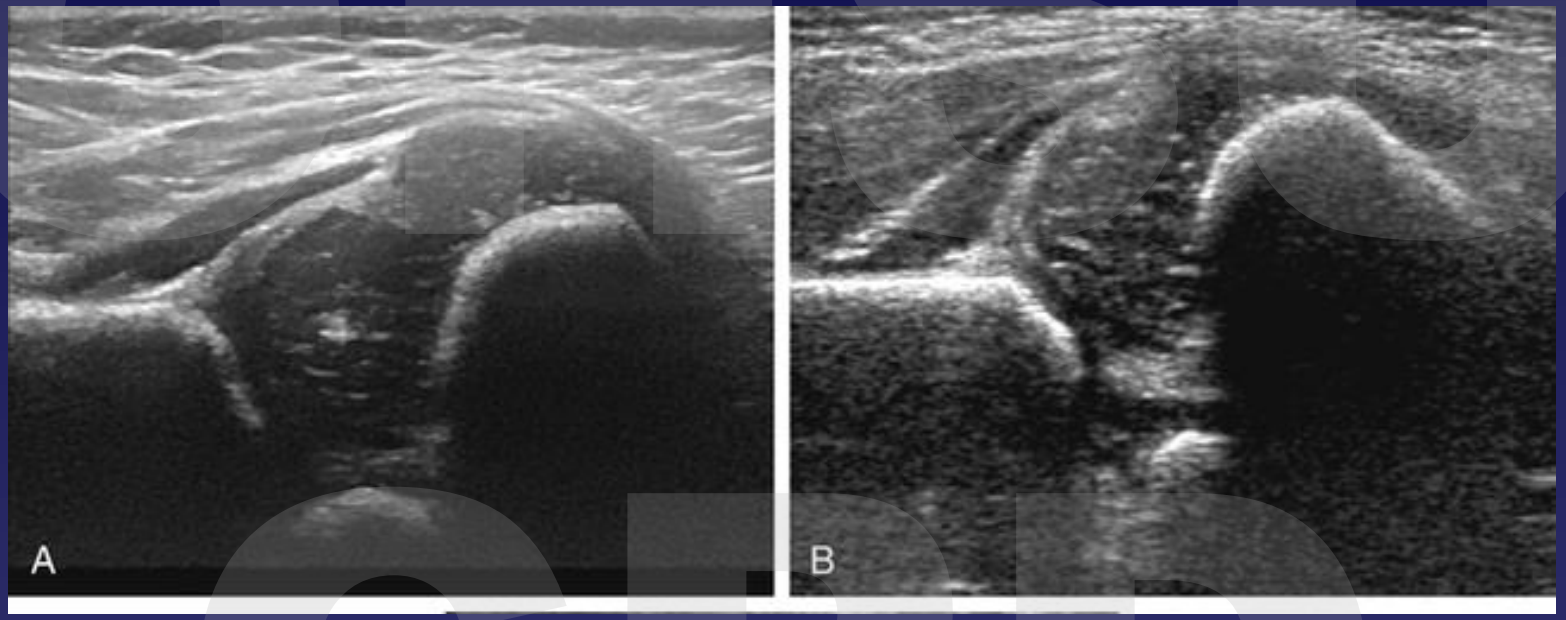
Stress View



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Graf Classification

Type	Maturity	Bony roof	Bony angle	Bony rim	Cartilage roof	β-angle	Age
Type I	mature	good	$\alpha \geq 60^{o}$	sharp	good coverage femoral head	Ia = $\beta < 55^{o}$ Ib = $\beta > 55^{o}$	All
Type II a+	immature but appropriate for age	adequate	50-59º	blunt	coverage femoral head		< 3 mo
Type II a-	immature and inappropriate for age	deficient	50-59º	rounded	coverage femoral head		< 3 mo
Type II b	delay in development	deficient	50-59º	rounded	coverage femoral head		> 3 mo
Type II c	stable or unstable	severely deficient	43-49º	rounded / flat	still coverage femoral head	$\beta < 77^{o}$	All
Type D	decentring hip	severely deficient	43-49º	rounded / flat	displaced	$\beta > 77^{o}$	All
Type III	eccentric hip	poor	< 43º	flat	labrum pressed upwards		All
Type IV	eccentric hip	poor	< 43º	flat	labrum pressed downwards		All

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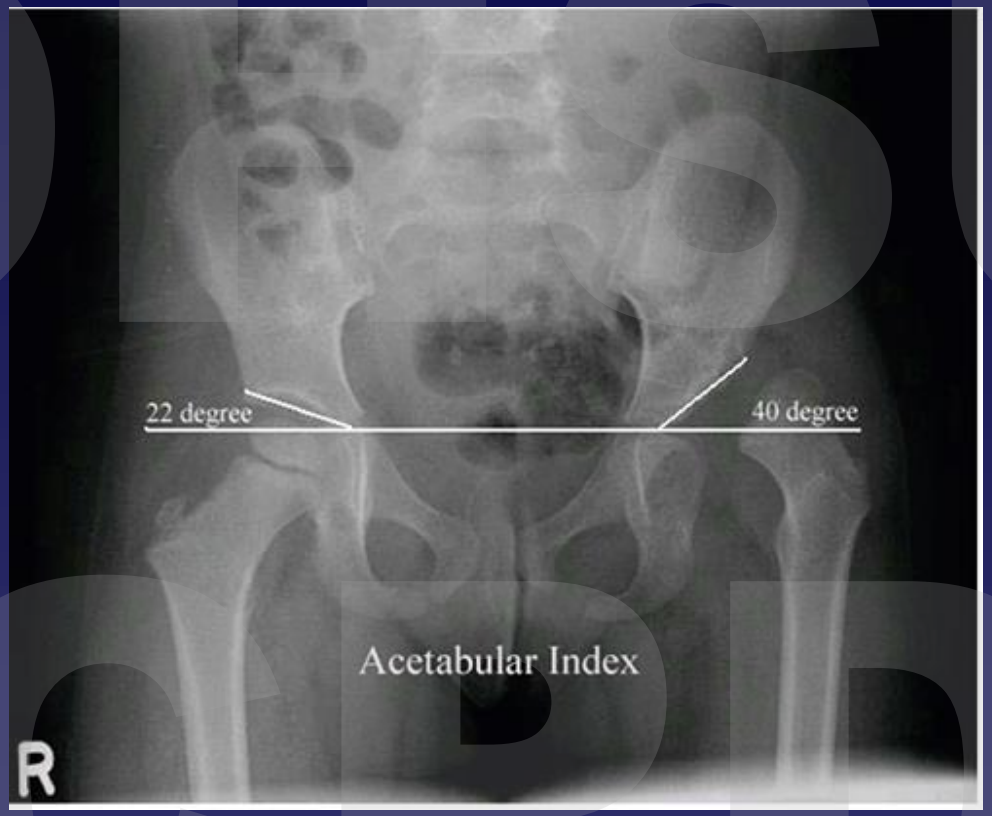
U/S Screening

- Newborn - All
  - Common in Europe
  - Poor specificity leads to overtreatment – not cost-effective
- Newborn – Breech
  - Recommended at 6 weeks, if normal exam
- Newborn – Abnormal exam (Barlow/Ortolani+)
  - Recommended early to establish baseline
- Serial exams are common
  - Undergoing treatment or equivocal exams/US results

Plain Radiography

- Single A/P pelvis starting at 4-6 months
- Signs of hip dysplasia
  - Increased acetabular index
  - Shenton line disruption
  - Teardrop absent
  - Femoral head ossification delayed
  - Femoral head coverage decreased

Acetabular Index



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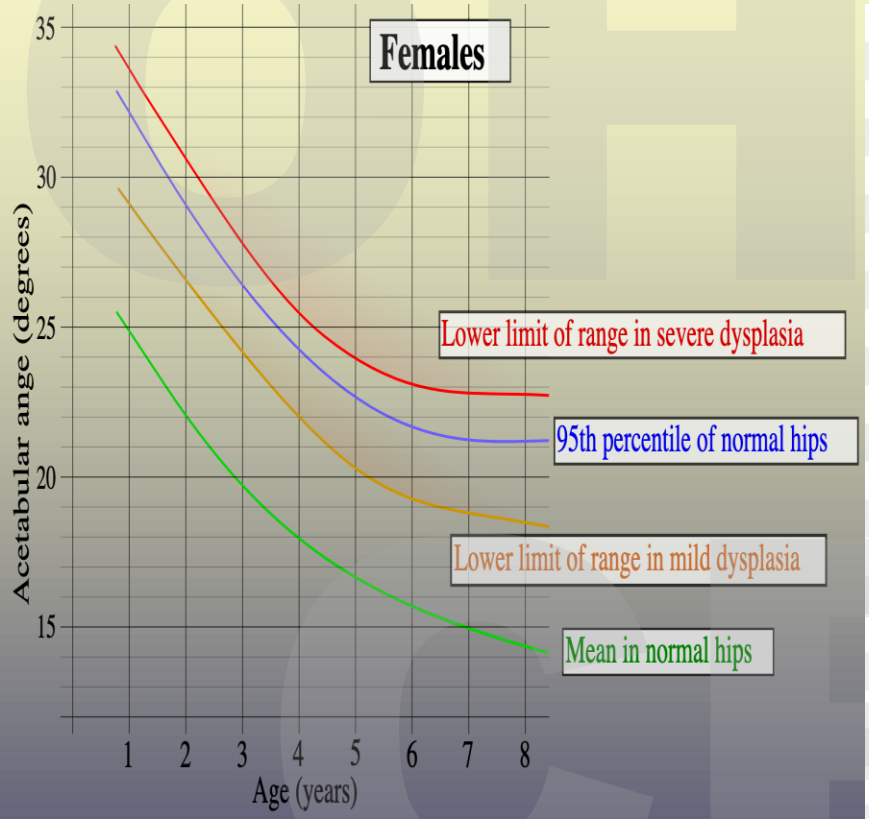
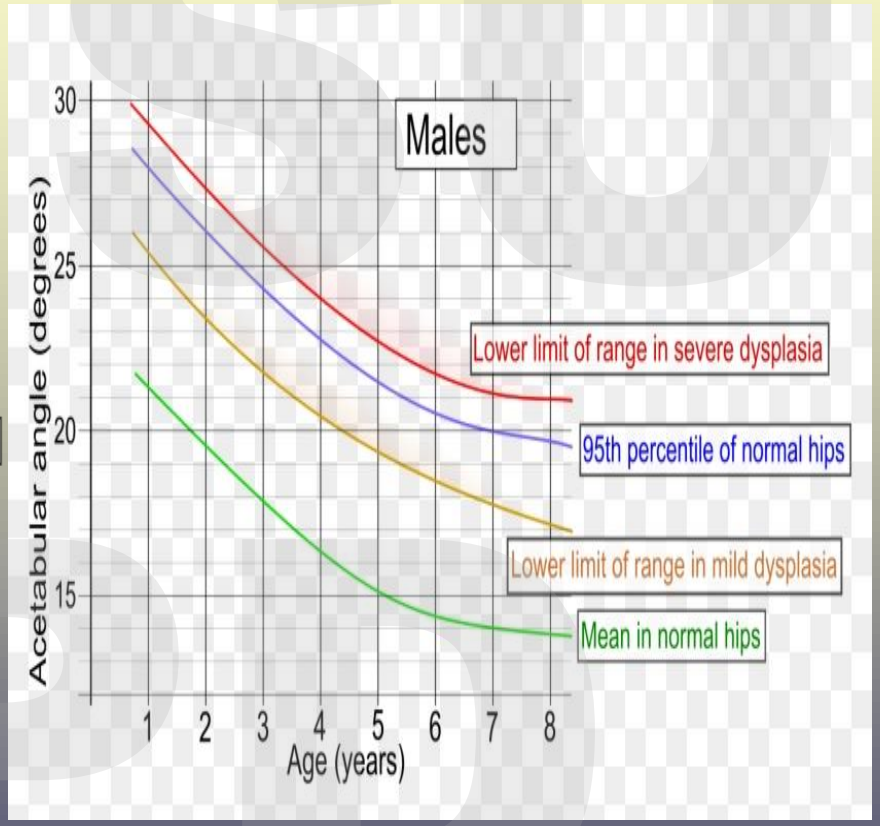
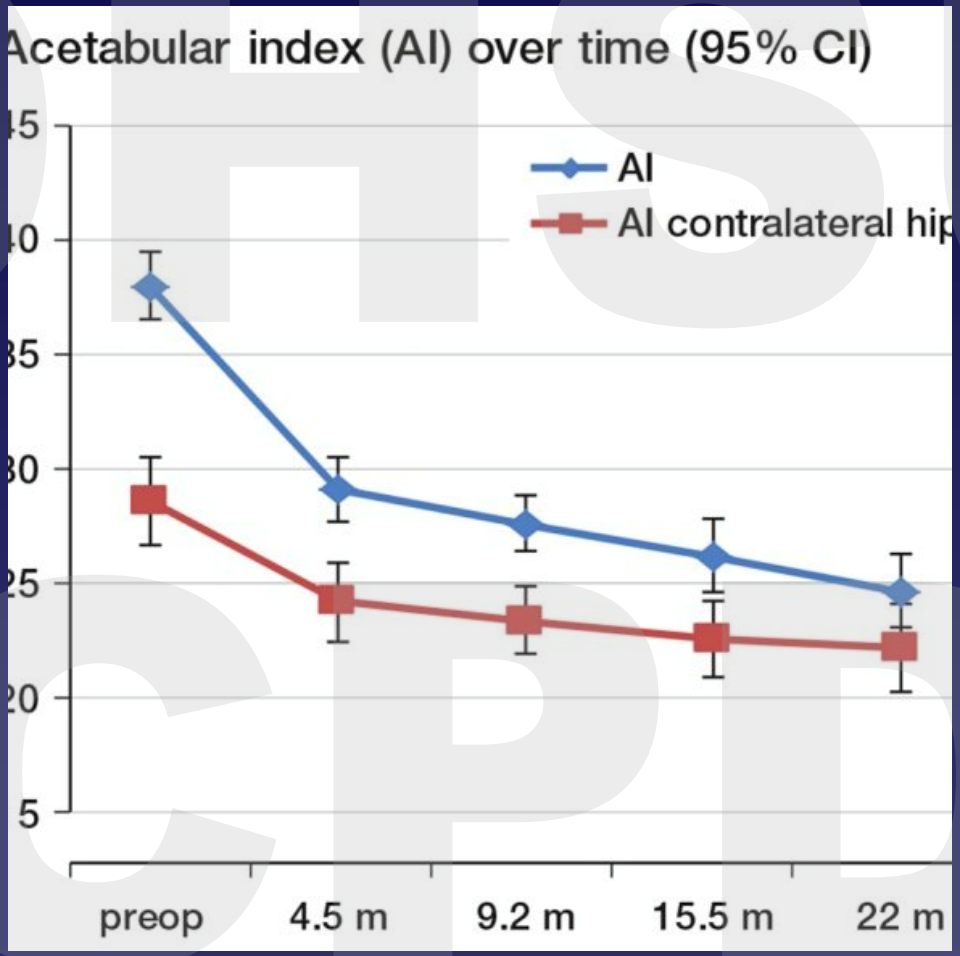
Acetabular Index Changes





Post-op AI Changes



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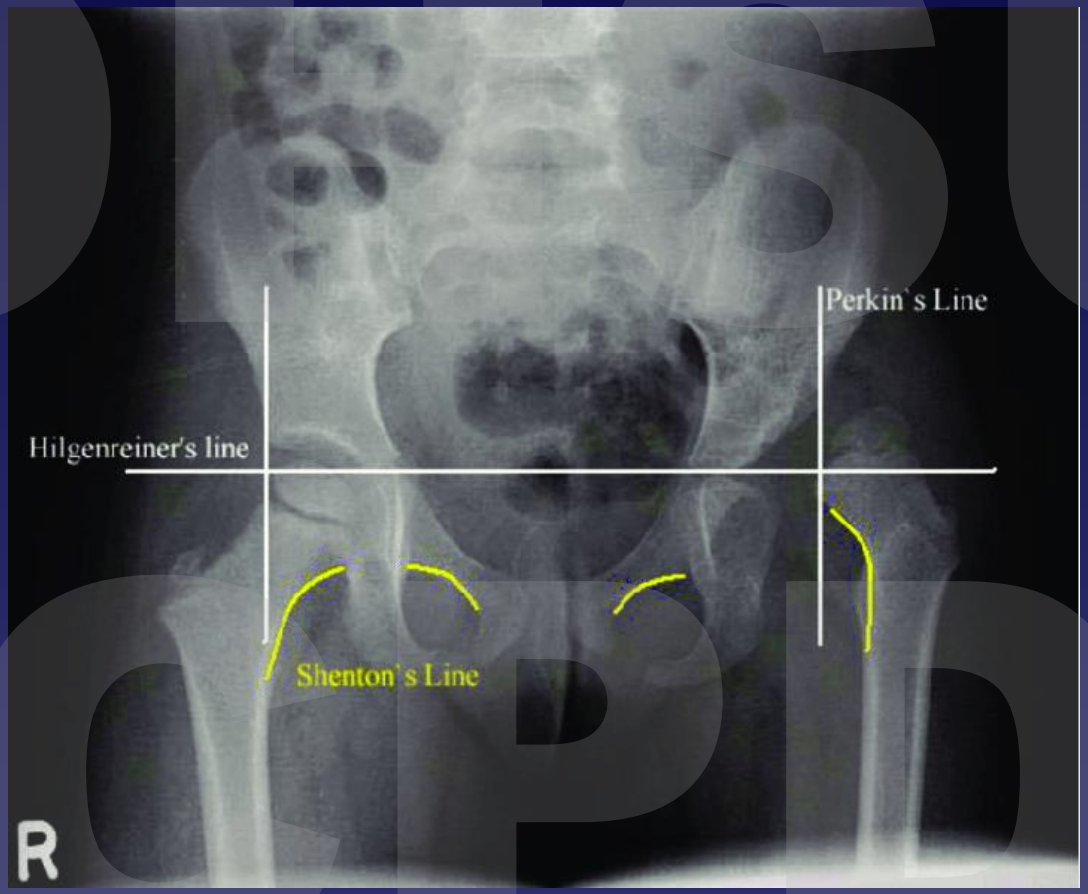
Shenton's Line



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Delayed Ossification

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Treatments

- Bracing
- Closed reduction
- Open reduction
- Femoral osteotomy
- Pelvic osteotomy

Pavlik Harness

- Age 0-6 months
- Hips at 90-100° flexion, adduction limited to -15°
- Fulltime with transition to nighttime use
- Serial U/S and exams to follow clinical course

Pavlik Harness

- Benefits
  - Usually helps with acetabular development and capsular tightening
  - If dislocated helps to keep femoral head located
  - Limits risk of needing closed/open reduction
- Risks
  - False acetabulum development
  - Femoral nerve palsy
  - Family resistance to use

Abduction Brace

- Indications
  - Failed Pavlik harness
  - Severe acetabular dysplasia
  - Hip dislocation in 6-12 month patient – not usual first choice in this case
  - Post-op bracing after spica casting

Closed reduction

- Indication
  - age 6-18 months
  - hip dislocated
  - failed Pavlik harness/abduction brace treatment

Closed Reduction

- Technique
  - Reduce hip under anesthesia
  - Test stability and assess safety zone
  - Consider percutaneous adductor tenotomy
  - Evaluate arthrogram
  - Place spica cast with hip in abduction, flexion and internal rotation
  - Check post-reduction MRI
  - Change spica cast at 6 weeks

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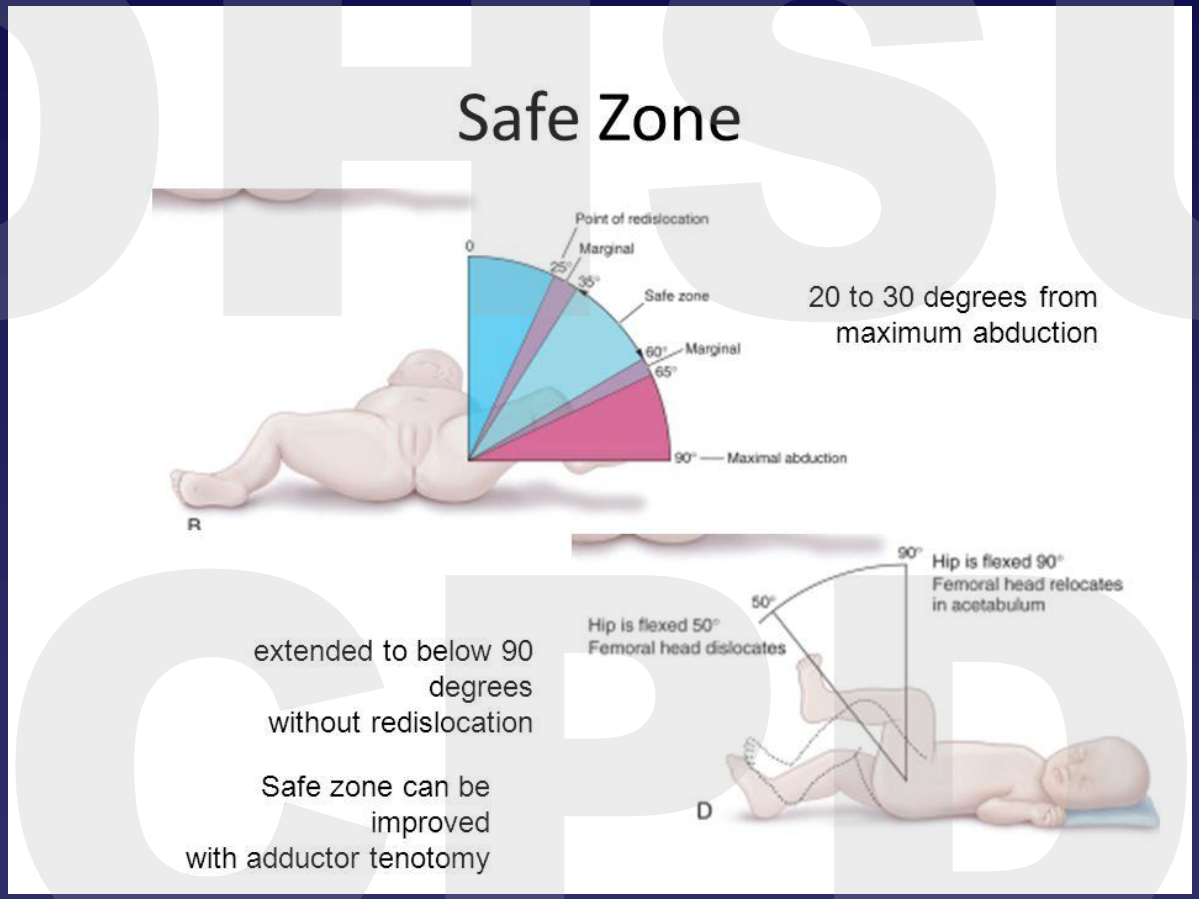
Safety Zone



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Arthrogram

- 50/50 mix dye and saline
- Spinal needle anterior or medial approach
- Fluoroscopic guidance

Arthrogram

Assessment of Reduction

- Stable and located without extreme abduction and/or flexion
- No medial dye pool or inverted labrum
- If needed, consider:
  - Adductor tenotomy
  - Psoas release
  - Medial capsular release

Spica Cast

- Unfair test of parenting
- Needs a special car seat
- Double-diapering
- Two casts for 6 weeks each

Closed reduction

- Recent multi-center study results
  - 91% initial success at reduction
  - Of these, 91% remained located
  - 25% developed AVN
  - Mean acetabular index at final f/u was 25°

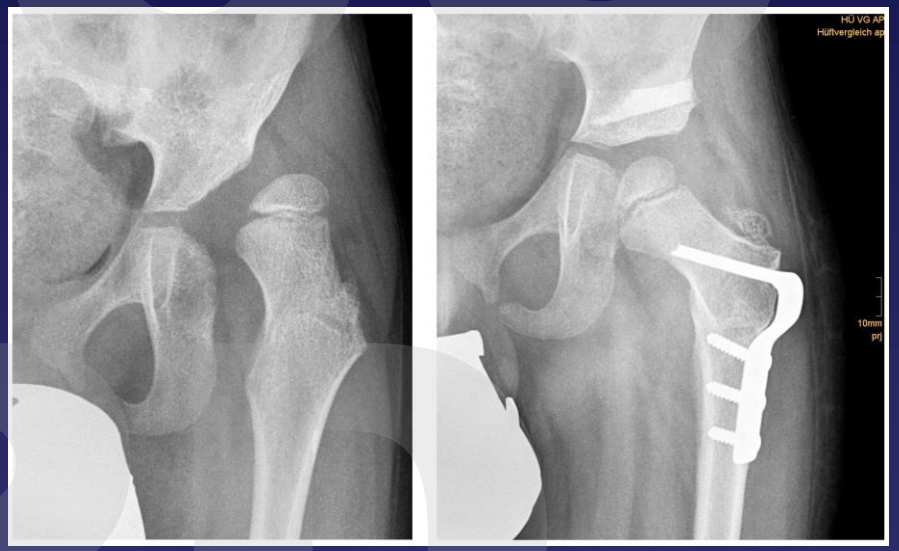
  - Sankar et al, JPO 39(3):111-118, 2017

Open Reduction

- Indications
  - 12-60 months old with hip dislocation
  - Usually includes adductor and psoas releases
  - May require femoral and/or acetabular osteotomies, especially if older
  - Approaches
    - Anterior, more typical
    - Medial, if younger (6-18 months)

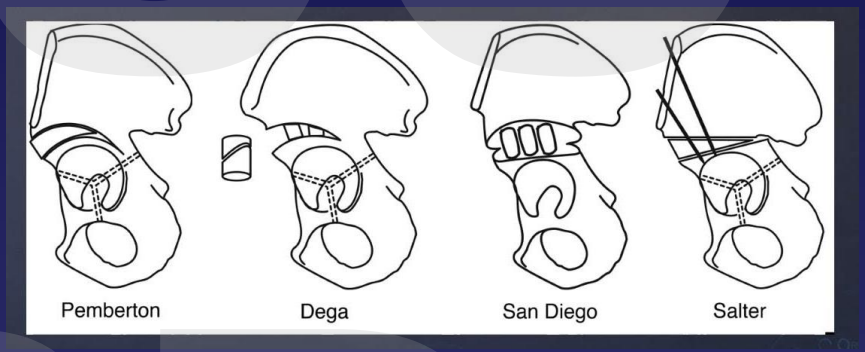
Osteotomies

- Femoral Osteotomy
  - High-dislocation
  - Older age
  - Syndromic dysplasia
  - Decreases pressure on head
  - Types:
    - Shortening
    - Varus derotational osteotomy



Osteotomies

- Acetabular
  - Severe acetabular dysplasia
  - Older age – less time for remodeling
  - Syndromic dysplasia
  - Types for younger children:
    - Salter – redirection only
    - Pemberton – redirect and decrease capacity
    - Dega – redirect and decrease capacity



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Referral

- Physician consult line
  - 503-346-0644
- Okay to discuss benefits of referral versus continued close monitoring, especially with equivocal U/S results

Thanks!