Developmental Dysplasia of the Hip

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Developmental Dysplasia of the Hip

Comes in different flavors at different ages of kids

Common etiology: excessive laxity of the hip capsule with failure to maintain femoral head in the acetabulum

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DDH: "The Spectrum"

Fixed and Dislocated Hip

Reducible Hip
"Ortalani +"

Dislocatable Hip
"Barlow +"

Dysplastic Hip
"shallow"

Normal Hip

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What's new with hip dysplasia?

To begin with, the name:

- **Was**: CDH (Congenital Dislocation/Dysplasia of the Hip)

- **Is**: DDH (Developmental Dysplasia of the Hip)

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Why Change the Name to DDH?

1. As soon as we say "congenital" in a one-year old, we're backpedaling

2. Evidence for true "developmental" dislocations:
   - No matter what the screening program, late dislocations occur
   - Documented late presentations after normal exam, X-ray, and now, even ultrasound

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Missed or Developmental Dislocation of the Hip

FREDERIC W. ILFELD, M.D.,* G. WILBUR WESTIN, M.D.,** AND MYER MAKIN, M.D.†

In 15 documented cases, subluxation or dislocation of the hip was discovered months or years after previous multiple normal physical examinations. The examiners were unique in that six were professors specializing in children's orthopedics, four were board-certified orthopedists, and five were pediatricians. Delayed diagnosis of dislocation is not evidence that an inadequate physical examination was performed.

Clinical Orthopedics and Related Research 203:276, 1986

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EXAMINATION: BOTH HIPS (INA
(INFANT)

CLINICAL HISTORY: Possible hip dislocation.

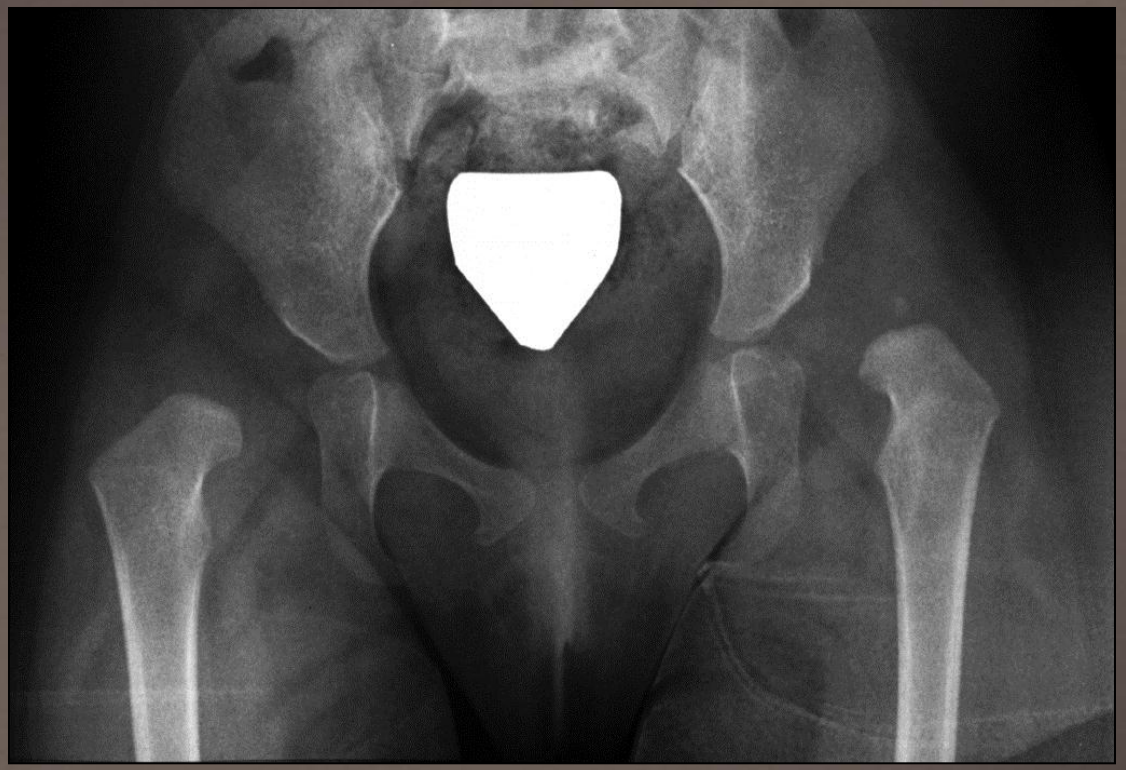
FINDINGS: AP and frog leg views of the pelvis are compared side-to-side. Capital-femoral epiphyses have not yet appeared. There is no bony deformity or significant subluxation identified at this stage. The angle of the pelvis and amount of cartilaginous deposition is symmetric.

IMPRESSION: Capital-femoral epiphyses not yet developed. There is no obvious subluxation or bony deformity. If symptoms persist, follow-up study is advised.

Classification of Developmental Dysplasia of the Hip (DDH)

Typical

Teratologic



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Teratologic Dislocations

Out in utero

Major changes in muscle, femoral head, acetabulum from birth

Associated with spina bifida, arthrogryposis, other conditions

Treatment is surgical (when indicated)

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Typical Dislocations

Near normal in utero

Minor changes at birth

Muscle contractures develop secondarily

Major bone changes only after neglected a year

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Incidence

Ethnic, cultural and geographic differences

- High: American Indians (188/1000 Manitoba), Caucasians
- Low: Chinese (Hong Kong 0.1/1000), African (Bantu 0%)

Dependent on definition

- Dislocation: 1/1,000
  - Female: 1/300 to 1/600
  - Males: 1/2,000 to 4,000
- Abnl newborn exam 1-2/100
- Abnormal ultrasound 8/100

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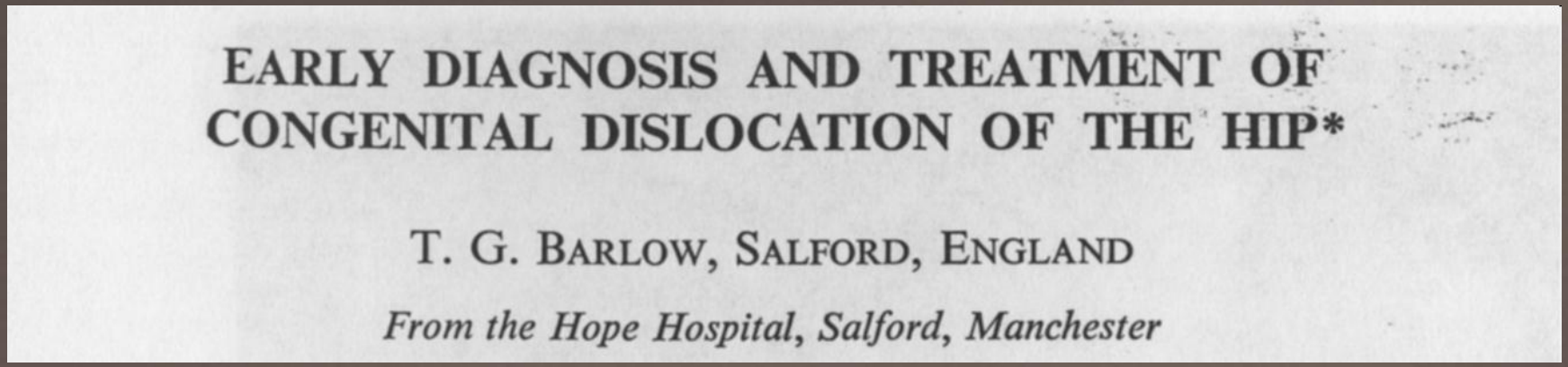
Natural History



EARLY DIAGNOSIS AND TREATMENT OF CONGENITAL DISLOCATION OF THE HIP*

T. G. BARLOW, SALFORD, ENGLAND

From the Hope Hospital, Salford, Manchester

Barlow *JBJS 1962*

9,289 newborns

139 w/ abnormal hip (1.5%)

88 % normal in 2 mos

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Natural History – Newborn

Barlow

- Around 1 in 100 infants have instability (positive Barlow)
- 60% stabilize in 1st week
- 88% stabilize in 2 months without treatment
- 12 % become true dislocations and persist

Coleman (Navajo Children), *CORR 1968*

- 35 abnl hips <3 mn, 11/12 treated normalized
- 23 untreated, AI>40, lateralization of femoral beak
- 5 normalized, 9 dysplastic, 3 subluxed, and 6 dislocated at 3 years (78% abnl)

because not possible to predict outcome, all infants with instability should be treated

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Long term Natural History

Subluxation predictably leads to degenerative joint disease and clinical disability

- mean age symptom onset 36.6 in females and 54 in men

Cooperman, *JBJS*

- 32 hips with CE angle < 20 without subluxation
- 22 years all had xray evidence of DJD
- no correlation between angle and rate of development
- concluded that radiologically apparent dysplasia leads to DJD but process takes decades

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Etiology

Ligamentous laxity

Positioning

- Prenatal
- Postnatal

Genetics

Epidemiology

Risk Factors:

- First born
- Breech presentation
- Female
- Family History

Combined = 1:15

- Thus, heightened awareness is needed
- AAP now recommending routine imaging or referral
- However, it also means that 14/15 are normal

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Etiology – Ligamentous Laxity

Female predilection

- Maternal hormones (relaxin crosses placenta)

Umbilical cord collagen

- Increased ratio of type III to I in pts with DDH

Autosomal dominant ligamentous laxity

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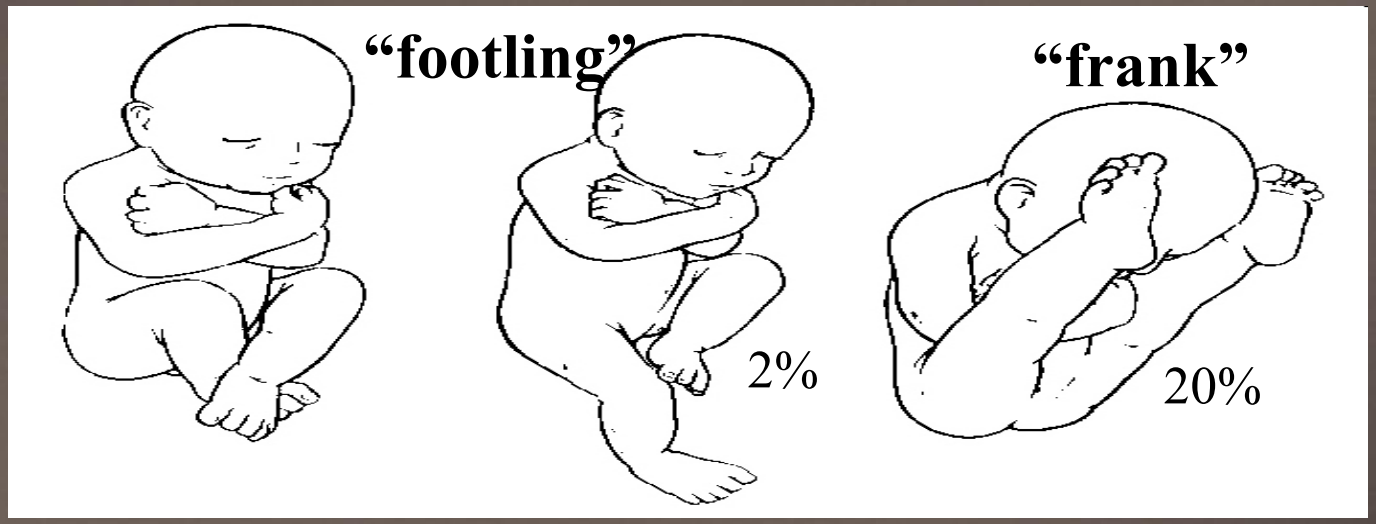
Etiology - Prenatal Positioning

Breech

- 2% of births
- 17 to 23 % of DDH



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Delivery Method and Breech Positioning

- Two studies have shown a lower incidence of DDH for babies delivered by C section vs vaginally in breech position

1. **Lowry – JBJS Br 2005**
   - 3.7% incidence with premature c-section
   - 6.6% incidence with term c-section
   - 8.1% incidence with vaginal delivery

   } P<0.02

2. **Fox – JBJS Br 2010**
   - US screening in patients – Graf 3+4 hips
   - 1.1% incidence with term c-section
   - 4.7% incidence with vaginal delivery

Etiology - Prenatal Positioning

DDH increased w/ oligiohydramnios

DDH assoc w/ other "packaging" problems

- Metatarsus adductus (1 to 10%)
- Torticollis (14 to 20%)

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Etiology - Prenatal Positioning

Intrauterine position

- Most common is L. occiput anterior
  - L hip adducted against sacrum
  - L. hip most commonly affected

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Etiology – Post Natal Positioning

-Extended hip positioning: Cradleboards
- Increased incidence of DDH

-Hips wrapped in flexed position or carried Astride the hip
- Decreased incidence of DDH

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Etiology – Genetics

Ethnic differences

- Low: African and Asian
- Higher: Caucasain and Native American

Identical twins 34%, Fraternal twins 3%

Increased risk w/ family history

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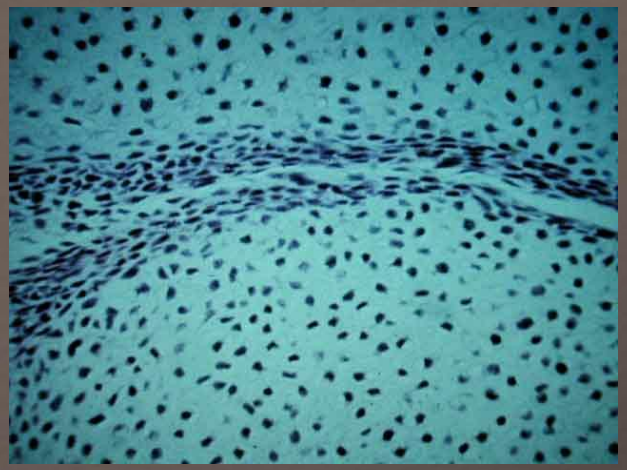
Hip Development – 8 weeks



Cleft forms in mesenchymal hip analge

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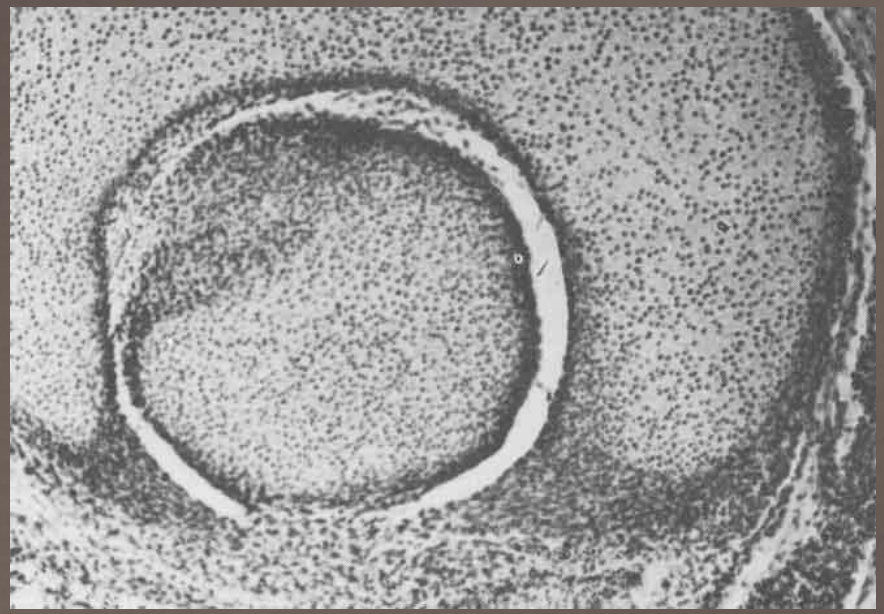
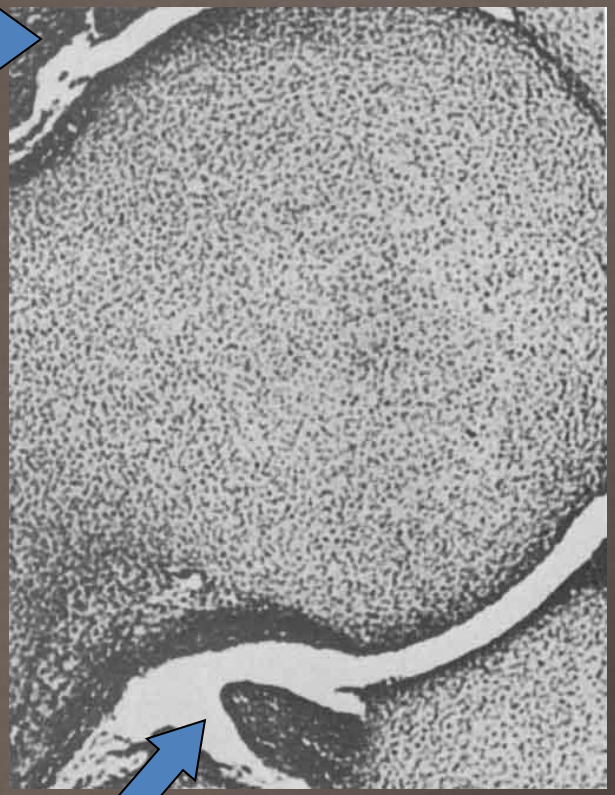
Hip Development – 16 weeks

Shape of the acetabulum follows the development of the round femoral head





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Hip Development – Post Natal

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History - Newborn

Birth order, position, weight

Family history

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History - Infant / Child

Toewalking

Painless persistent limp

Limb length inequality

Waddling

Swayback

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Examination - Newborn

Examiner must be *gentle*

Baby *must* be quiet

Neck, feet and spine

TABLE 1. Relative and Absolute Risks for Finding a Positive Examination Result at Newborn Screening by Using the Ortolani and Barlow Signs

Newborn Characteristics	Relative Risk of a Positive Examination Result	Absolute Risk of a Positive Examination Result per 1000 Newborns With Risk Factors
All newborns	. . .	11.5
Boys	1.0	4.1
Girls	4.6	19
Positive family history	1.7	
Boys	. . .	6.4
Girls	. . .	32
Breech presentation	7.0	
Boys	. . .	29
Girls	. . .	133

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Examination - Newborn

Normal

Instability w/o dislocation (“rubbery hip”)

Dislocatable (“Barlow positive”)

Reducible (“Ortolani positive”)

Fixed and dislocated

By 3 mos hip reduced or dislocated to exam

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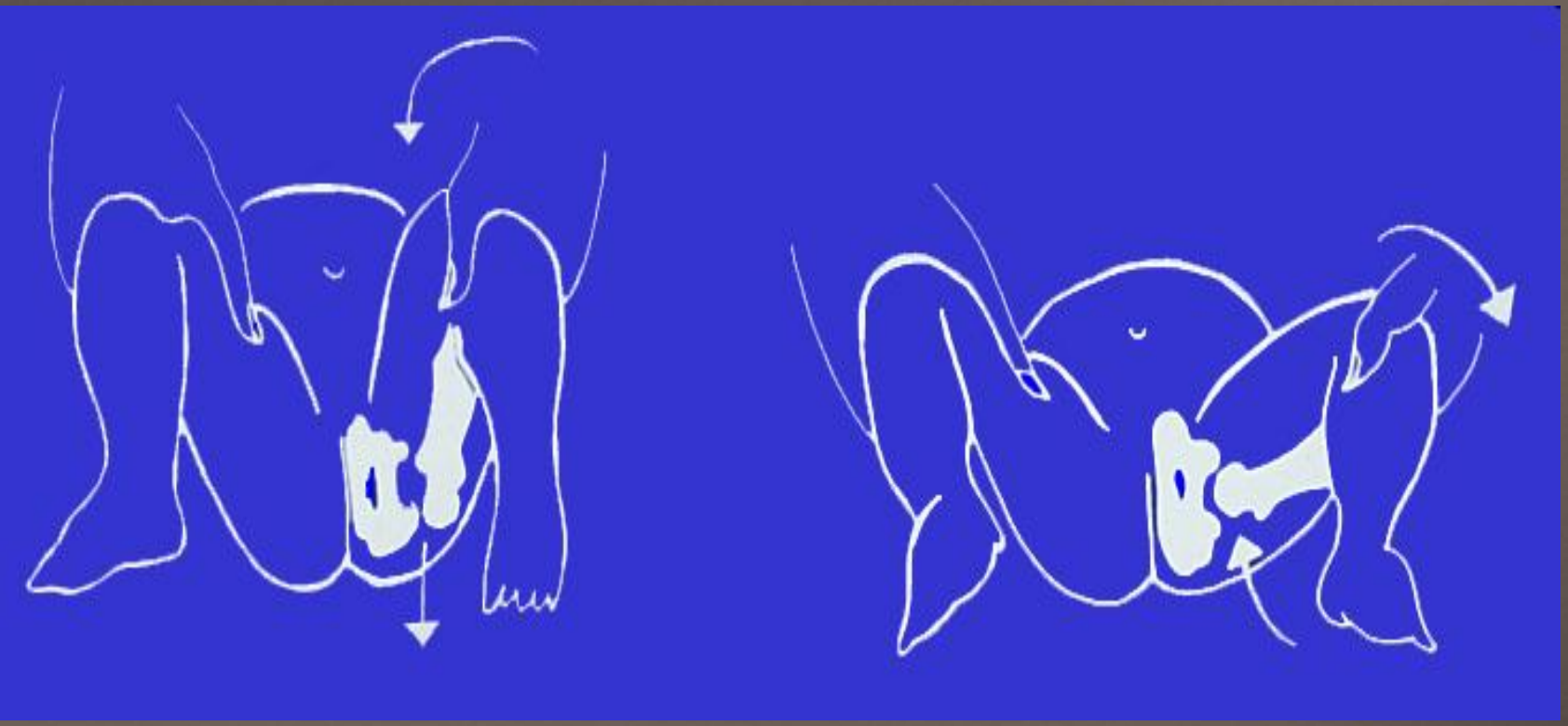
Examination – Newborn



Barlow = Dislocatable

Ortolani = Reducible

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Examination – Newborn

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Examination

Usually Not Significant:

- Asymetric thigh / gluteal folds (In infant)
- “Soft tissue clicks”

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Examination - Infant and Child

Limited abduction

- Especially in bilateral dislocations!

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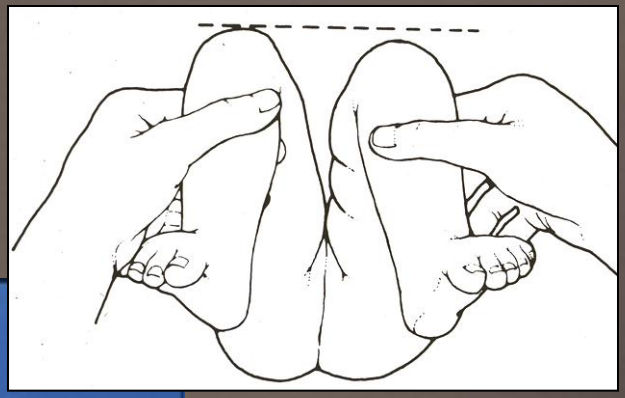
Examination - Infant and Child

Positive Galeazzi's sign

- (Apparent femoral shortening)



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Examination - Infant and Child

Klisic's Test

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Imaging

X-rays

- Most helpful after 4 mos
- Appearance of ossific nucleus

Ultrasound

- Allows visualization in newborn
- May be too sensitive

Arthrography

CT

MRI

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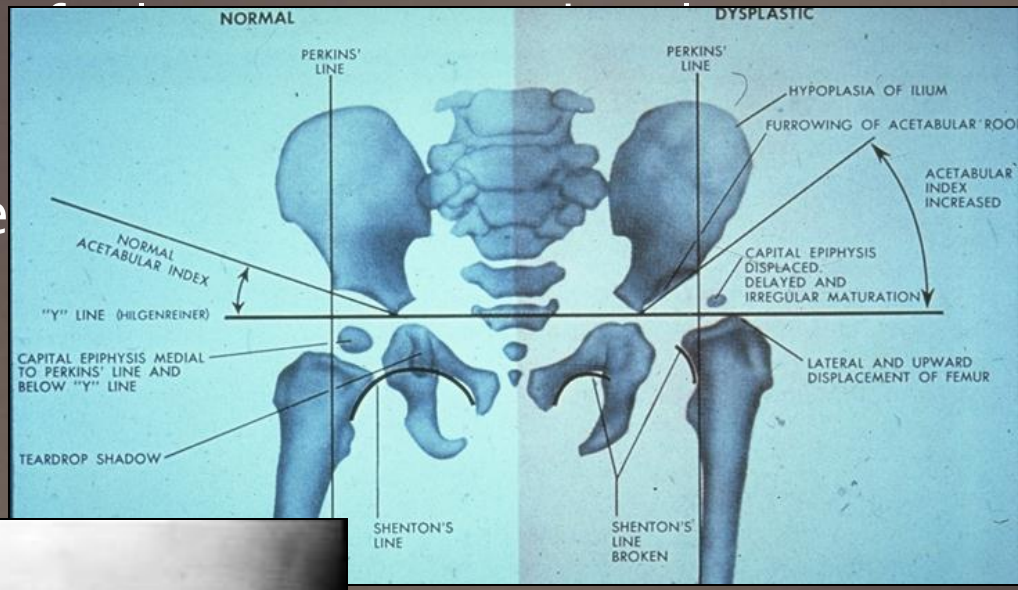
Radiographic Findings

Ossific nucleus high and wide

Increased Acetabular Index

Decreased Center-Edge angle

Break in Shenton's line



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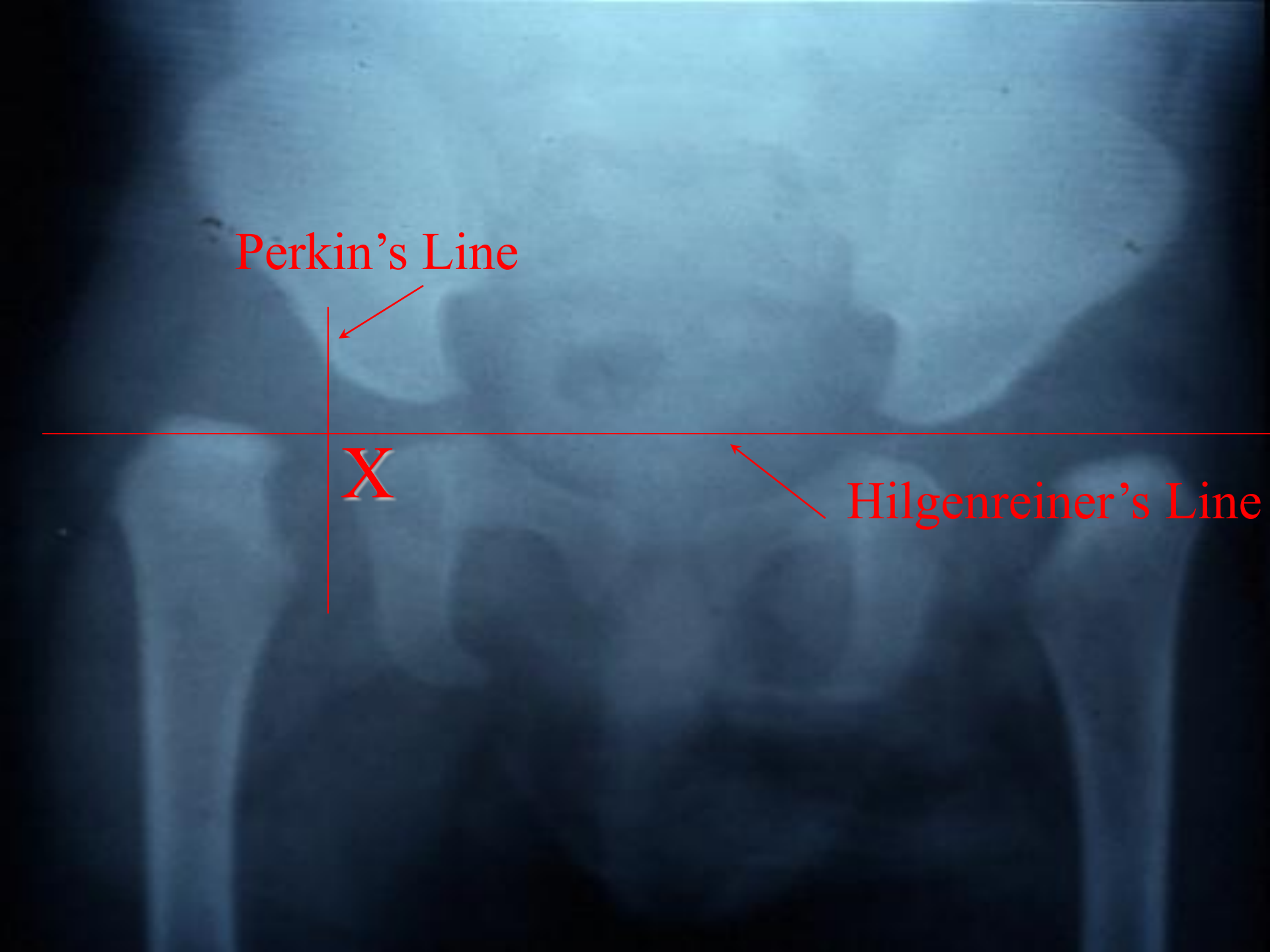
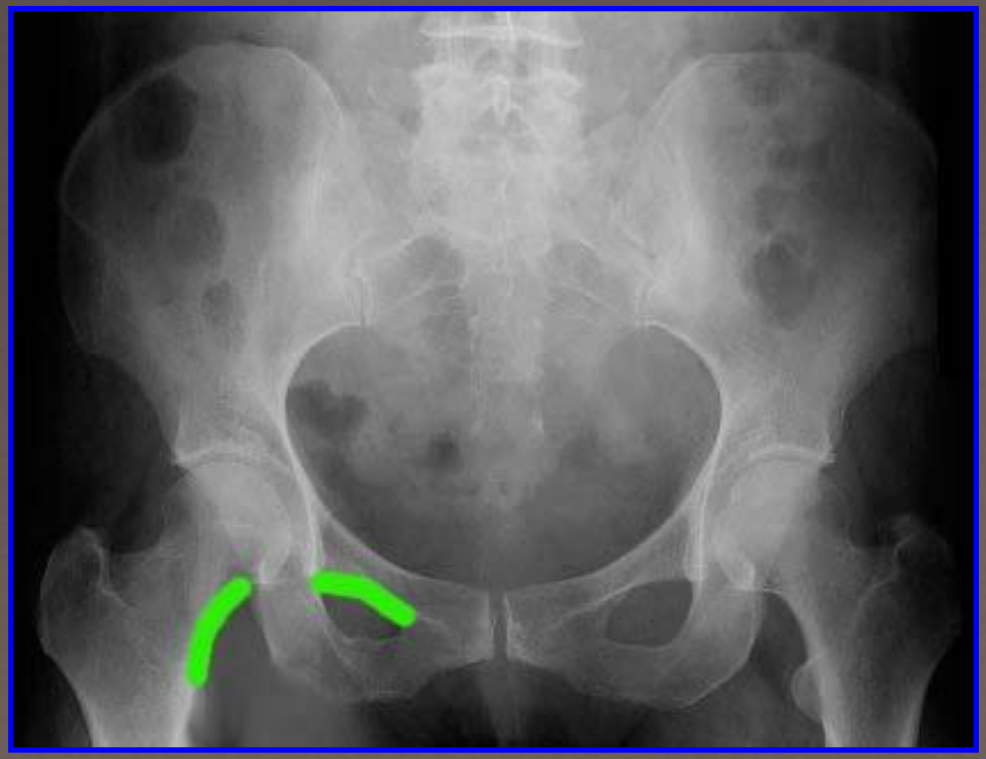

Perkin's Line
X
Hilgenreiner's Line


Broken Shenton's Line
NO !

Shenton's Line



Intact Shenton's Line

Broken Shenton's Line

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Ultrasound

Useful in diagnosis & monitoring treatment

If hip is stable: get first u/s at 4-6 weeks : eliminates ~ 90% of false + hips

Ultrasound quality is extremely technician and radiologist dependant → send to a good radiologist!

Controversial as screening tool

- Never eliminate late presenters

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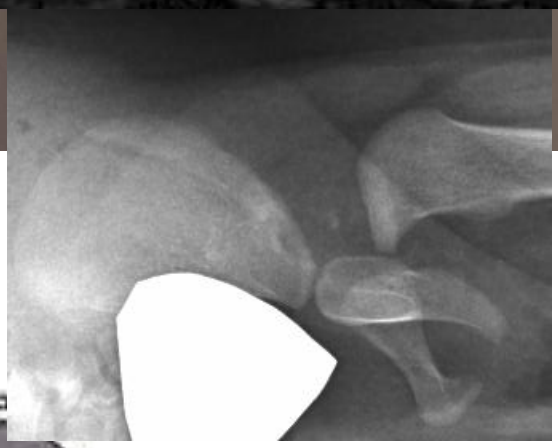

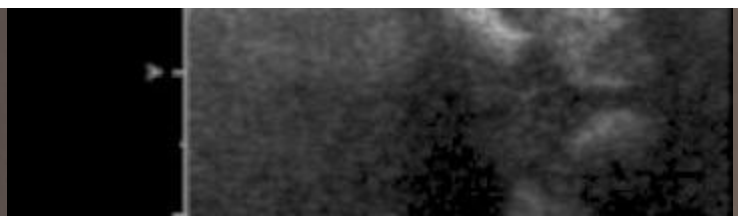

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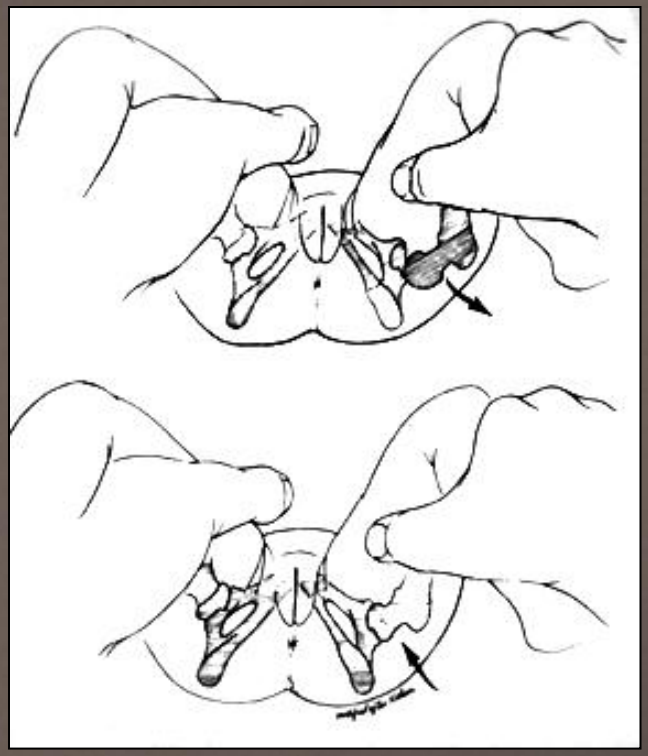
Dislocatable Hip

Reduced in the resting position

Dislocatable with the Barlow maneuver

May stabilize spontaneously or with treatment

May convert to dislocated without treatment



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Dislocated Hip

Dislocated in the resting position

May reduce with the Ortolani maneuver; this will be lost, usually by 8-12 weeks of age

Will not resolve without treatment

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Dislocated Hip

Dislocated and irreducible in the resting position:

- Asymmetric thigh fold
- Limited abduction
- Positive Galeazzi
- Pistoning
- Trendelenburg gait

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Treatment

Goal:

Obtain, maintain and confirm a gentle, atraumatic concentric reduction

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Treatment – 0 to 6 months

Pavlik Harness

- 95 to 99 % successful for “dislocatable” hips
- 50-80 % successful for fixed and dislocated

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Pavlik Harness

Indications:

- Dislocatable hips
- Dislocated hips and:
  - Patients under 6
  - Femoral head poi
    abduction

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Pavlik Harness

Technique:

- Keep hip flexed 100-120˚ flexed, slightly abducted
- Document hip reduction by 4 weeks; if not *reduced* by that time, abandon harness
- Hold until stabilized

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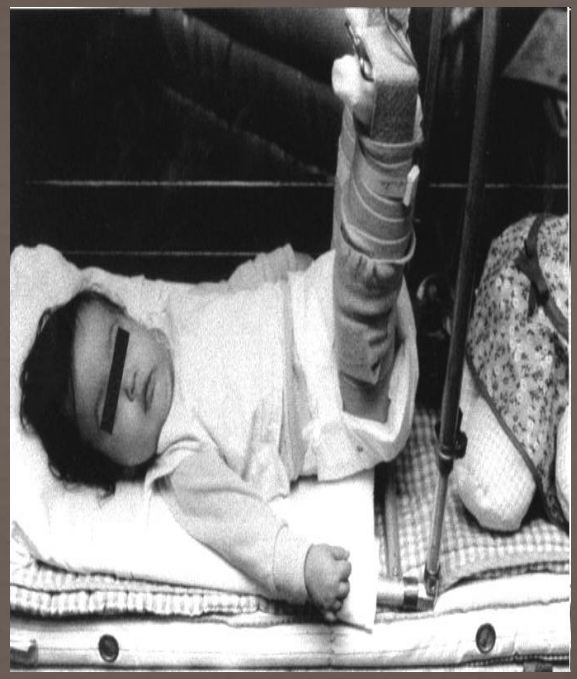
Treatment - 6 to 18 months

Closed vs Open Reduction

- Traction
  - Not universal
  - May increase success and decrease AVN



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Treatment

6-18 months (or after Pavlik harness failure):

- Traction (Bryant's or other balanced skin traction)
- Closed reduction

  +/- adductor tenotomy,

  +/- arthrogram
- Double hip spica cast for 3 months

Open reduction if closed reduction fails

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Closed Reduction

Spica cast 3-6 months

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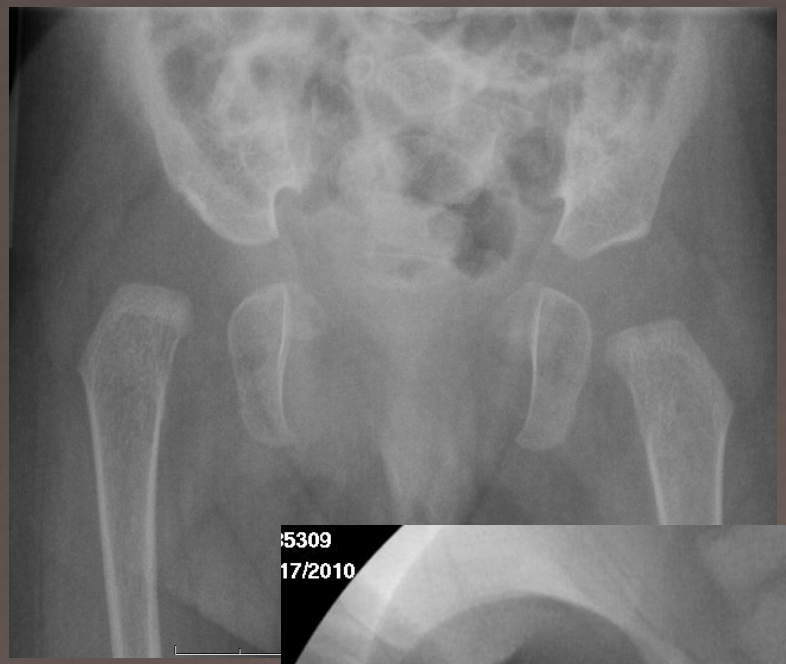

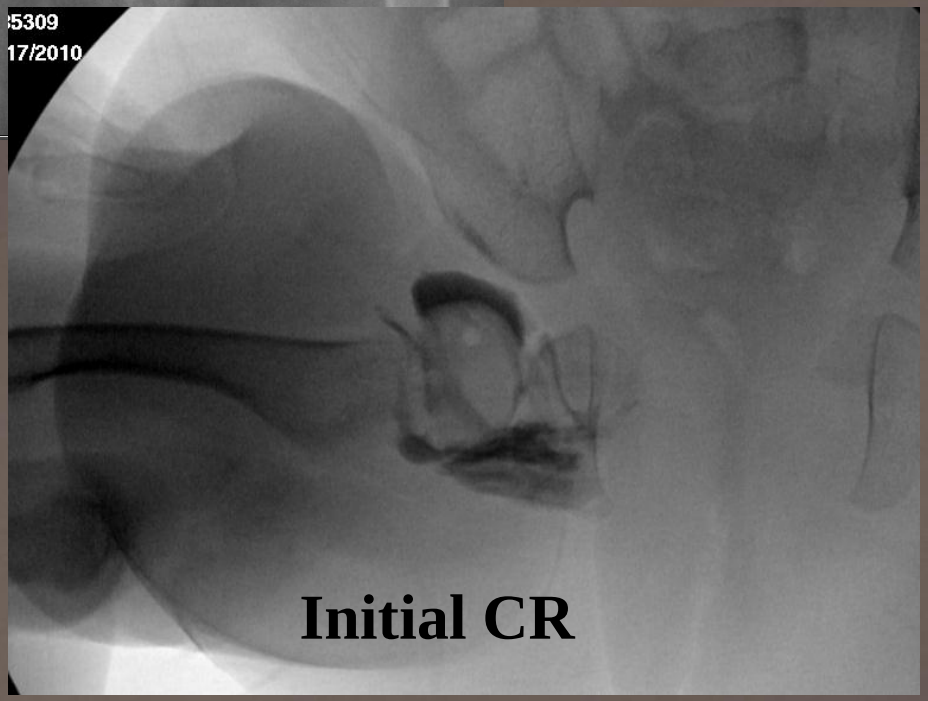

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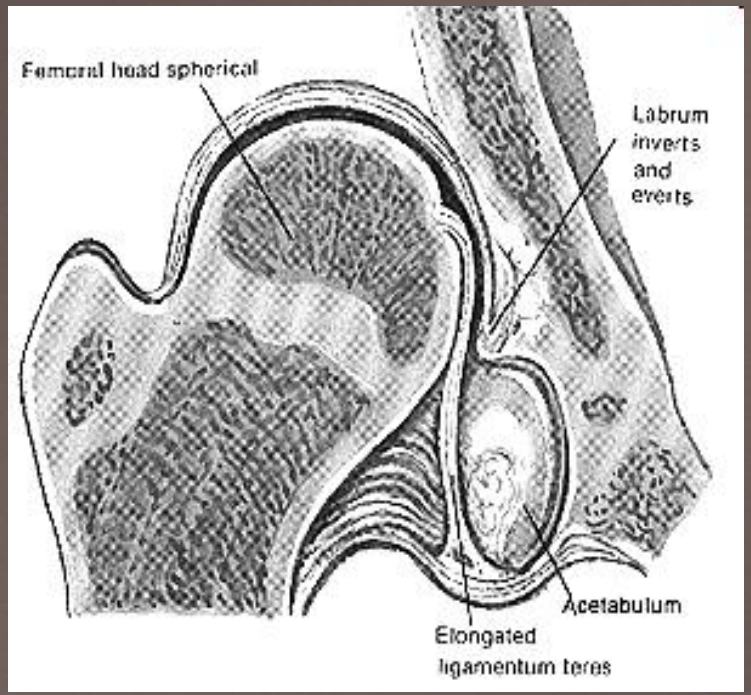
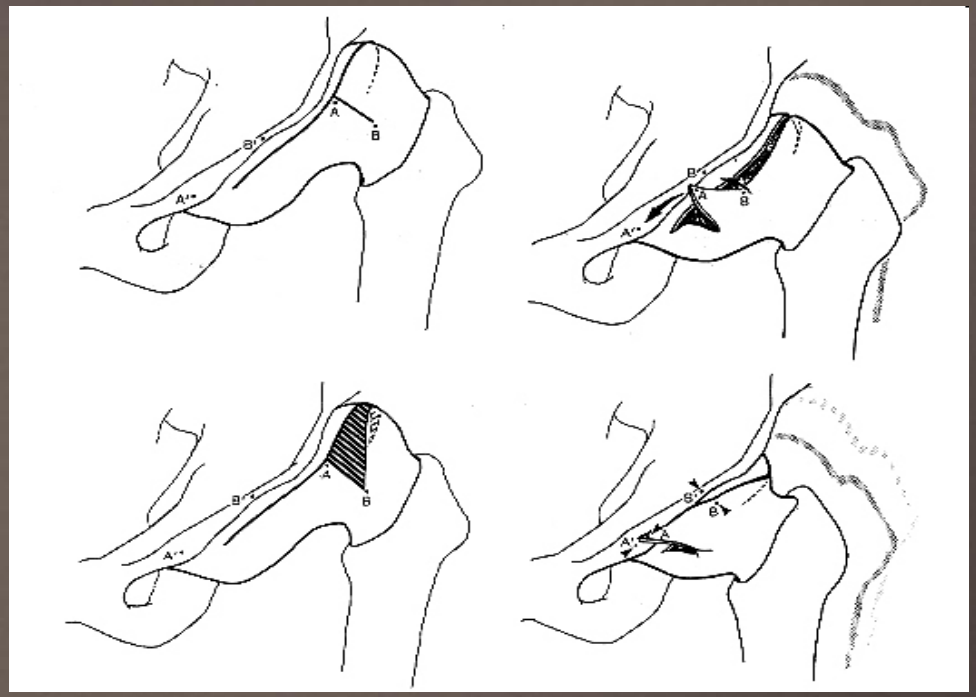
Open Reduction

Remove all impediments to reduction

Medial or Anterior





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Treatment > 2 Years of Age

Open reduction

Capsulorraphy

Femoral shortening

Pelvic Osteotomy

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Upper age limit

Unilateral: 8 yea

Bilateral: 6 years

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Quality Improvement, Subcommittee on Developmental Dysplasia of the Hip

Clinical Practice Guideline: Early Detection of Developmental Dysplasia of the Hip

PEDIATRICS Vol. 105 No. 4 April 2000

- Routine u/s screening of all babies not recommended

- Recommendation from AAP to screen female breech babies and + FH with u/s

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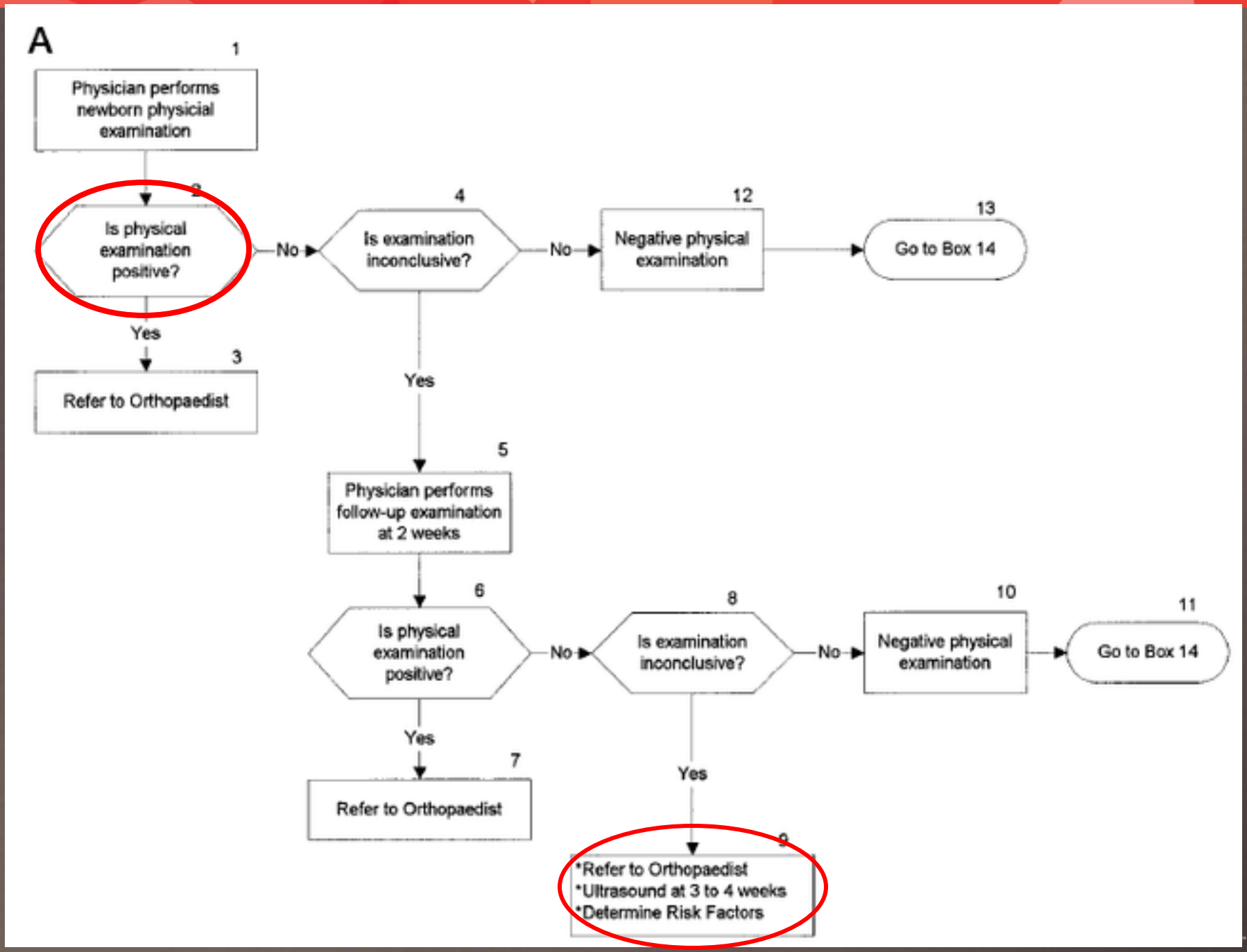
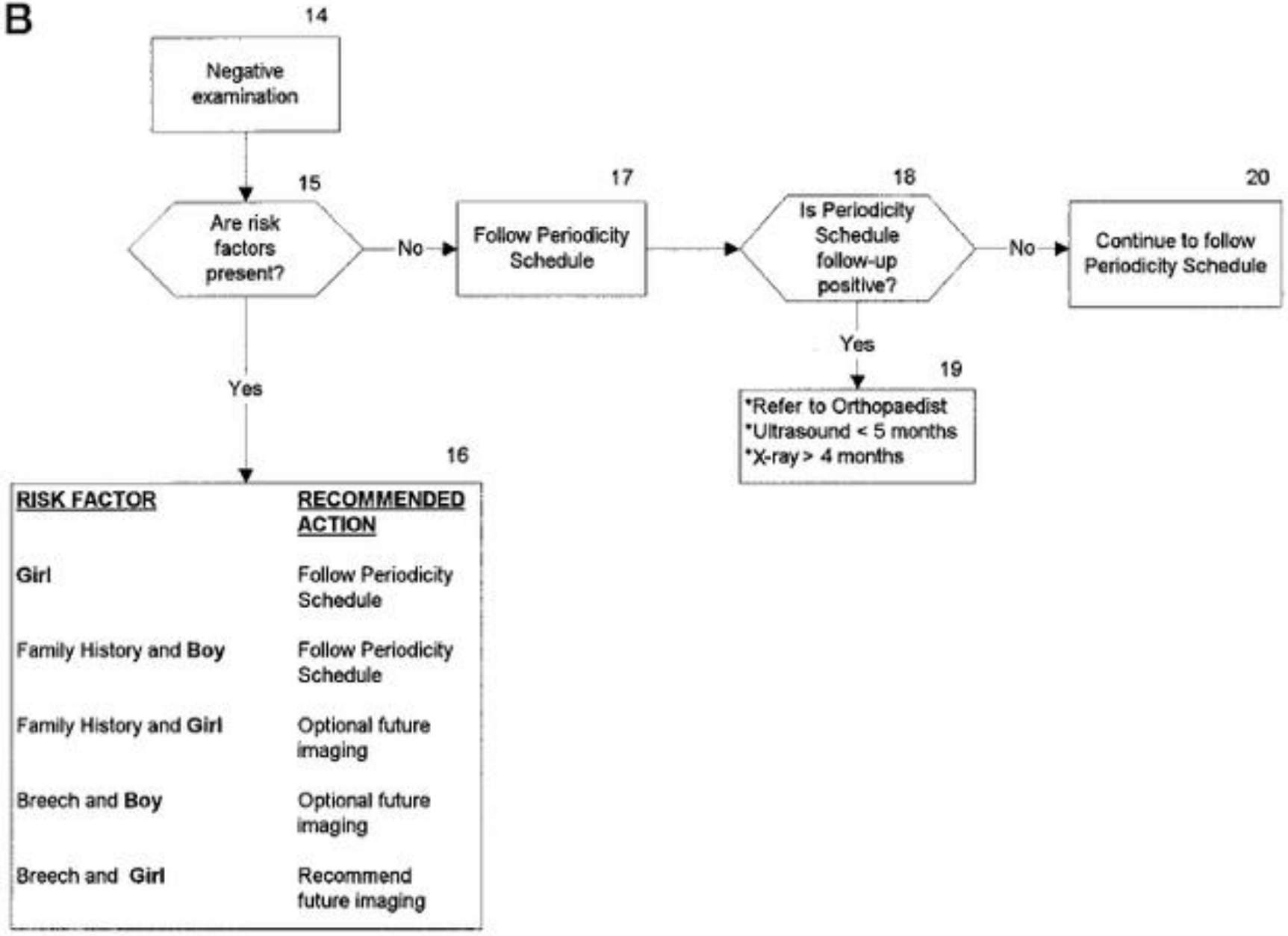

A
1
Physician performs newborn physicial examination
2
Is physical examination positive?
No
4
Is examination inconclusive?
No
12
Negative physical examination
13
Go to Box 14
Yes
3
Refer to Orthopaedist
Yes
5
Physician performs follow-up examination at 2 weeks
6
Is physical examination positive?
No
8
Is examination inconclusive?
No
10
Negative physical examination
11
Go to Box 14
Yes
7
Refer to Orthopaedist
Yes
9
*Refer to Orthopaedist
*Ultrasound at 3 to 4 weeks
*Determine Risk Factors

B



RISK FACTOR	RECOMMENDED ACTION
Girl	Follow Periodicity Schedule
Family History and **Boy**	Follow Periodicity Schedule
Family History and **Girl**	Optional future imaging
Breech and **Boy**	Optional future imaging
Breech and **Girl**	Recommend future imaging

Remember this!

Hip dysplasia is hear to make all good pediatricians and pediatric orthopaedists look like fools!

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Stable hip, abnormal US

What is the problem?

- The exam missed the instability
  - Poor technique, baby crying
  - Hip initially unstable but only for a few days (or hours)
- The hip has some “dysplasia factor”
- Or the ultrasound is too sensitive

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Stable hip, abnormal US: the exam

Who did the exam?

On what day of life was the exam done?

Was the baby crying or relaxed?

Does the baby have

- loose ligaments?

STABLE EXAM, ABNORMAL US

Most presume that the exam missed the instability

Hip was loose on the first few days of life, then stabilized

HOWEVER……

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BABY "JONES"

Outside exam-> click

Age 2 weeks

Exam by resident-normal

Exam by me-normal

Return at 6 wks age for ultrasound

Ultrasound positive

Immediately repeated exam by me-nor

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Ultrasound post 3 wks in Pavlik

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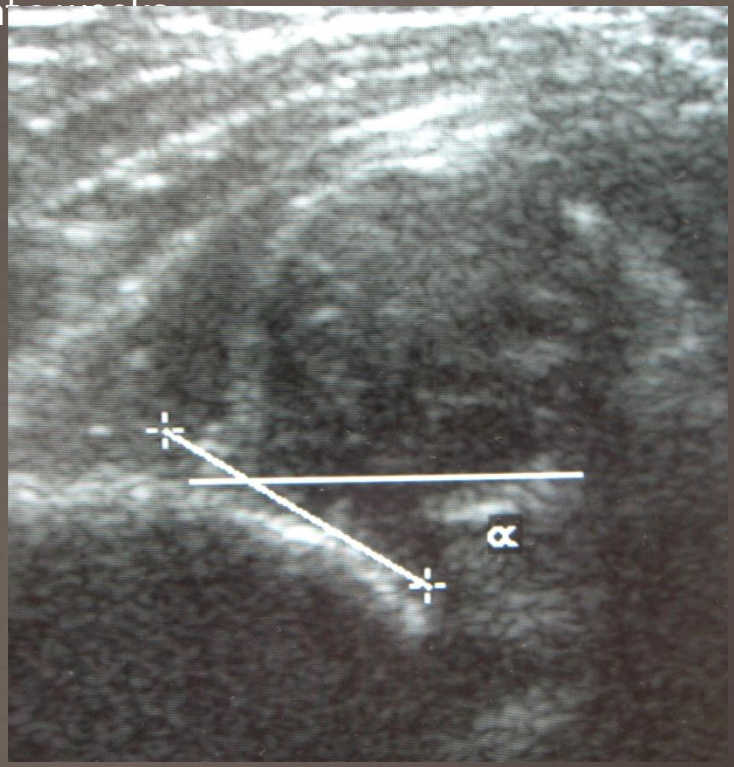
BABY SMITH

Initial exam at birth unknown

My exam, my PA's exam, my resident's exam all negative at [illegible]

Ultrasound at 6 weeks

Exam repeated-still normal



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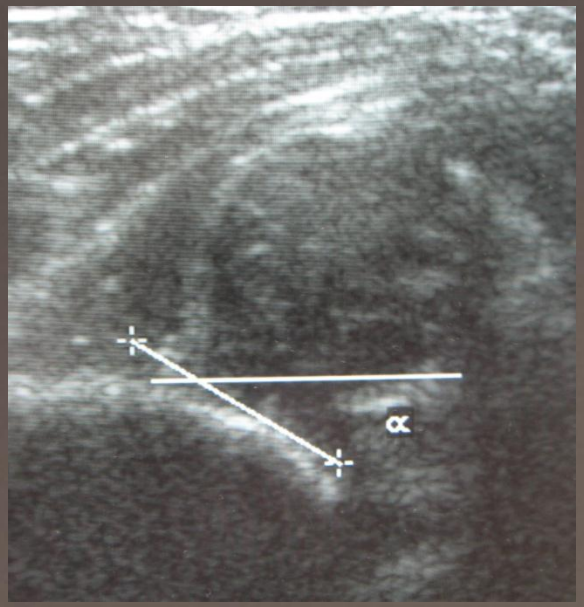
Normal exam, US dysplasia

Treatment-Pavlik harness, ultrasound done after 3 weeks in harness.



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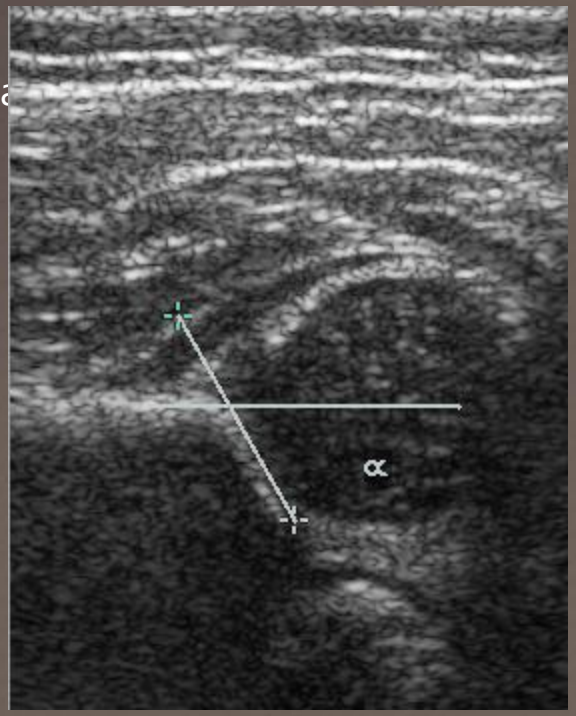
Response to Pavlik is rapid



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CONCLUSIONS

- These hips probably have “subtle instability”
- They should be treated
- We need to overtreat some hips to include the ones which will subluxate or dislocate
- We should study this objectively (hard to do)

SUMMARY

Hip instability is best treated if detected early

Know the risk factors: breech, +FH, 1st born female

If hip is unstable → refer to pediatric ortho

If hip is stable on exam → u/s at 4-6 weeks if needed

>12 months old with chronic, nonpainful limp→ THINK HIP DISLOCATION!

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