

LECTURE

**ORTHOPAEDICS
AND
TRAUMATOLOGY**

Guillame Dupuytren 1832



**CONGENITAL
(DEVELOPMENTAL)
DYSPLASIA OF THE
HIP JOINT**



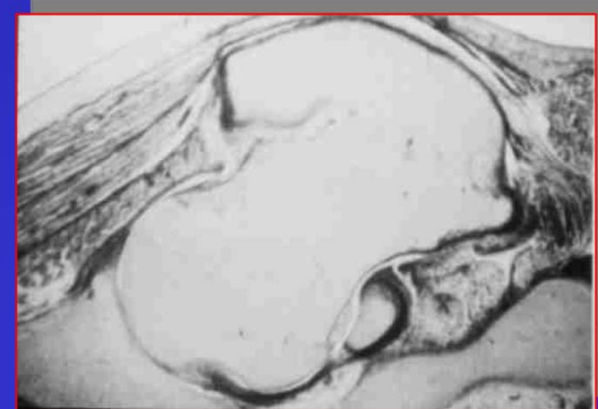
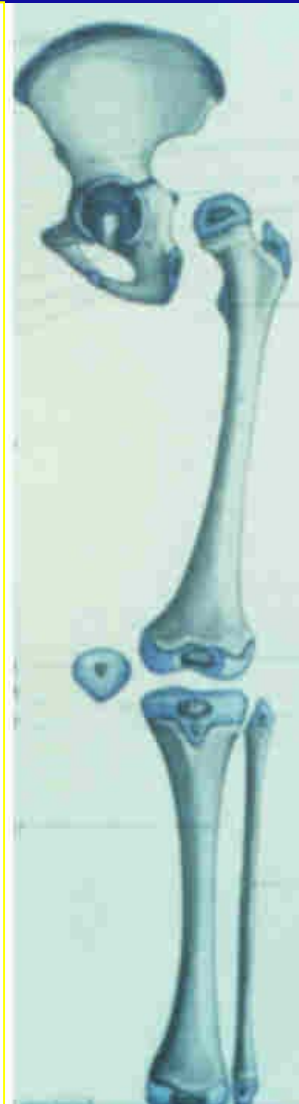
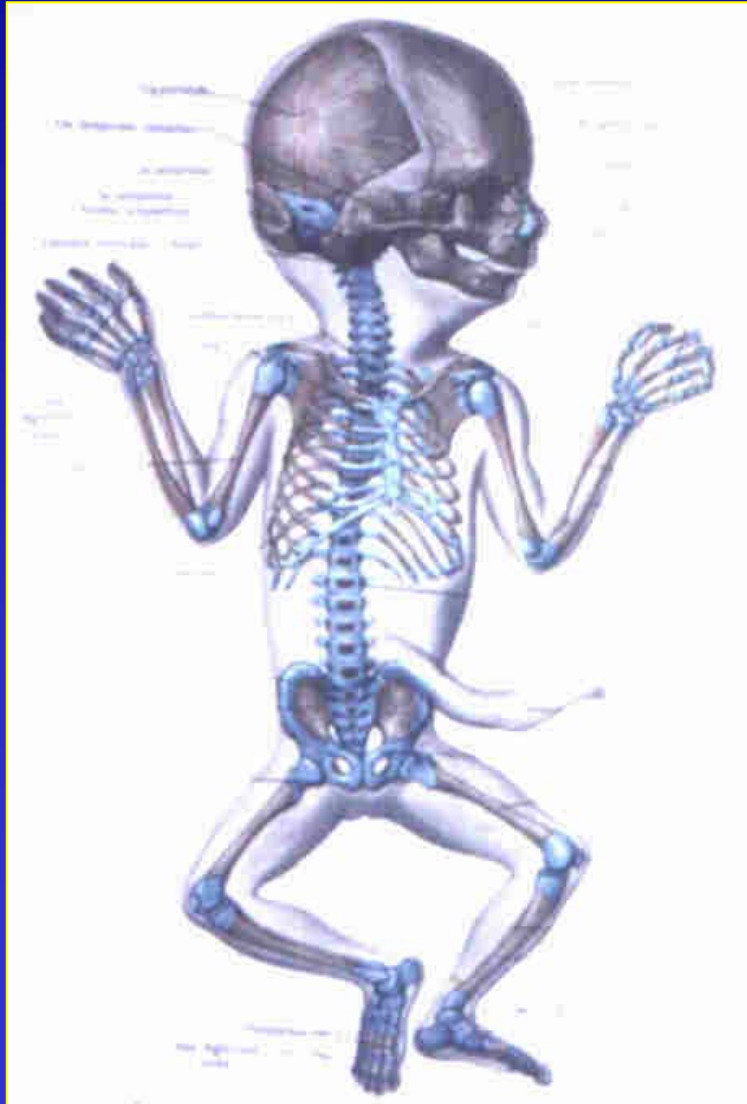
CDH

(congenital dysplasia of the hip)

• **DDH**

• (developmental dysplasia of the hip)

Development of the hip joint



Development of the hip joint

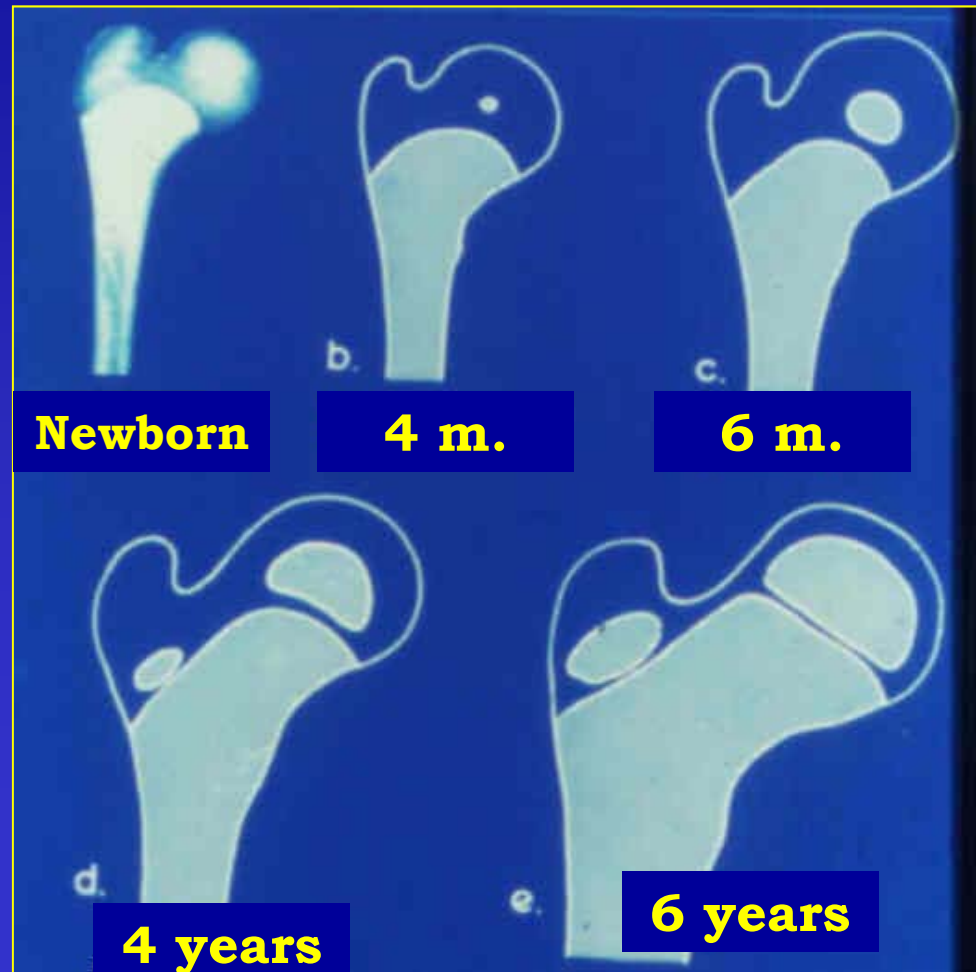


Development of the hip joint

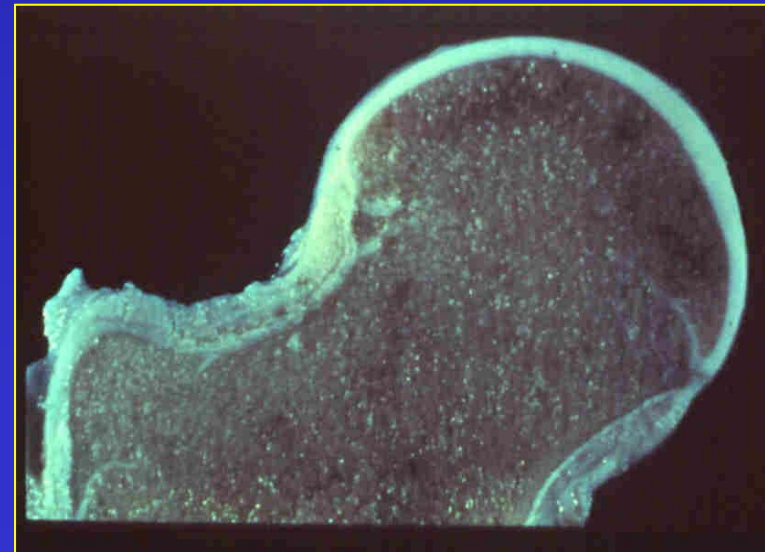
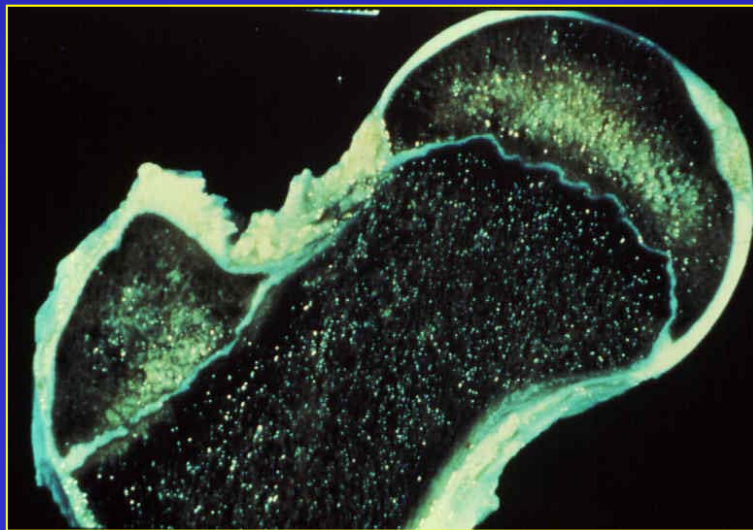
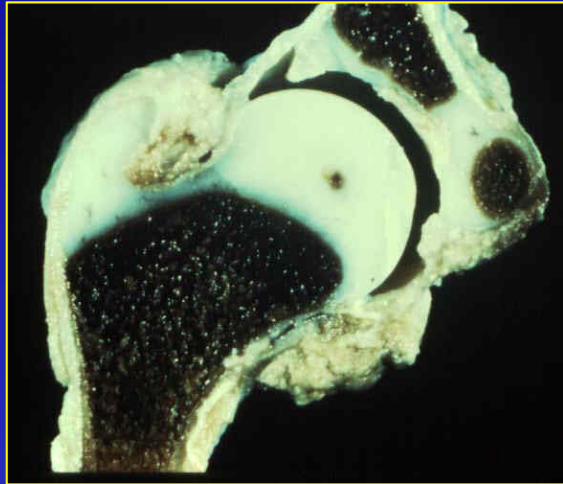




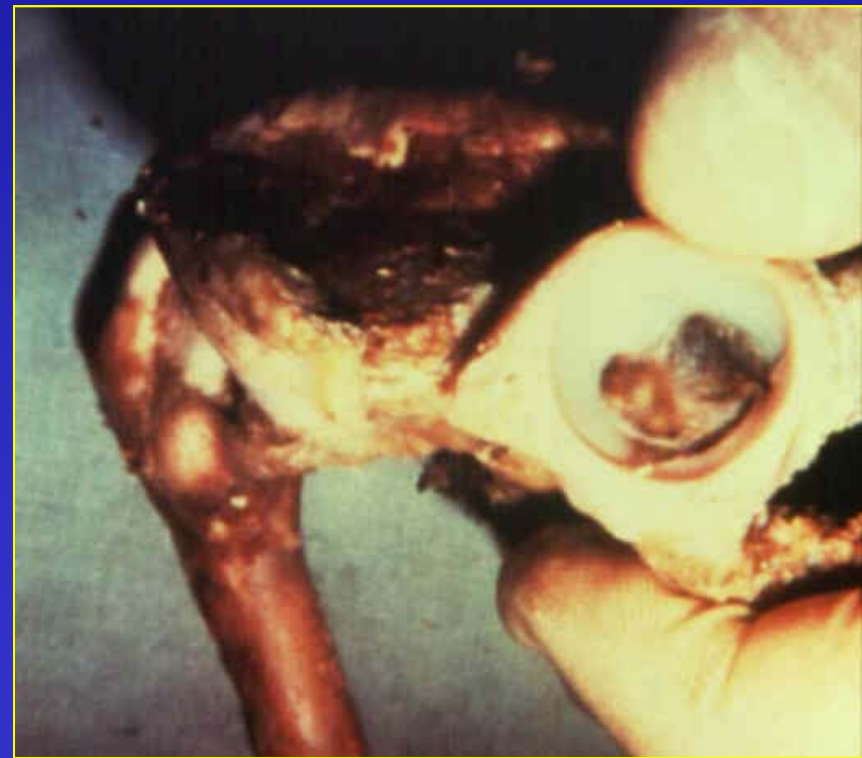
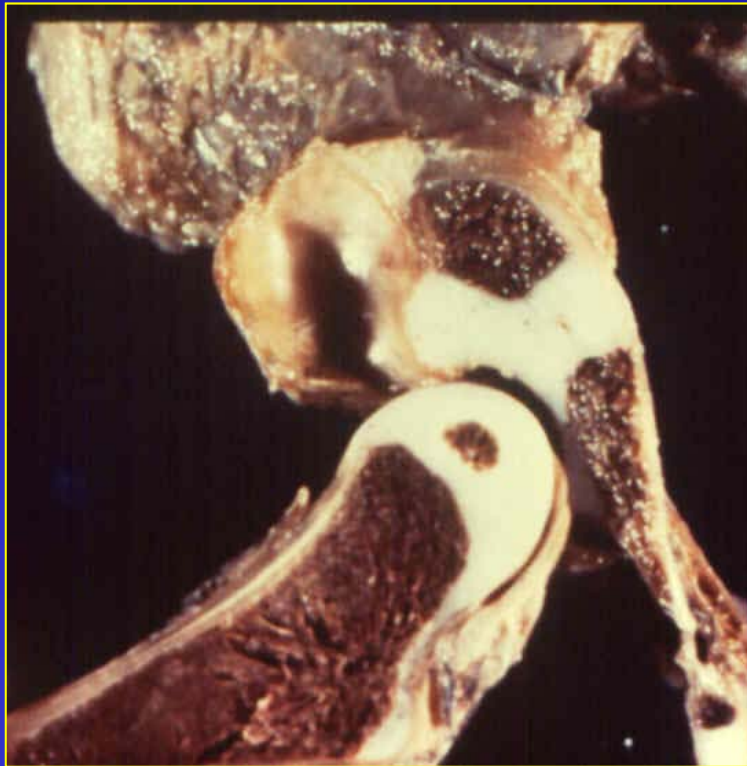
Development of the hip joint



Development of the hip joint



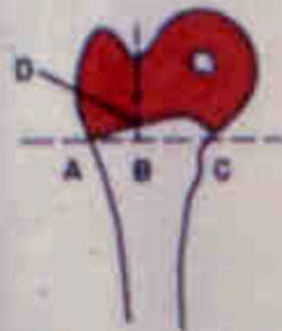
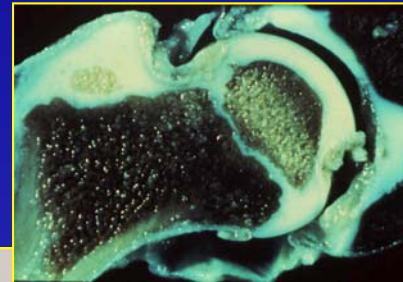
Development of the hip joint



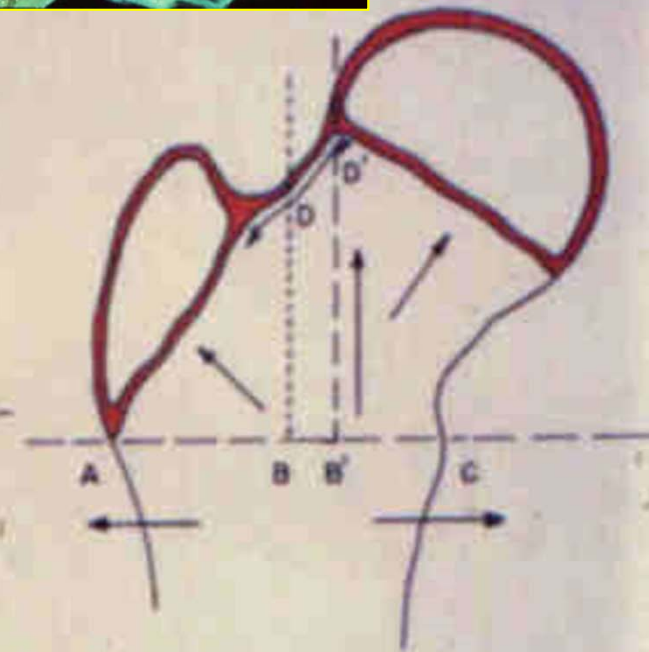
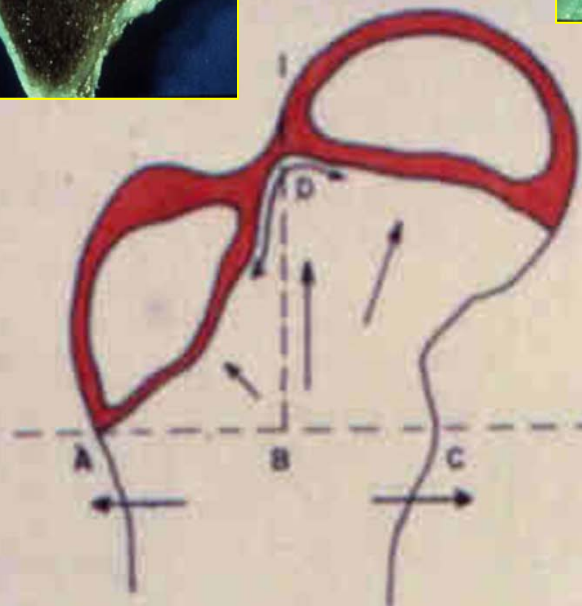
Stabilisation of the hip joint only by ilio-femoral ligament



Development of the hip joint

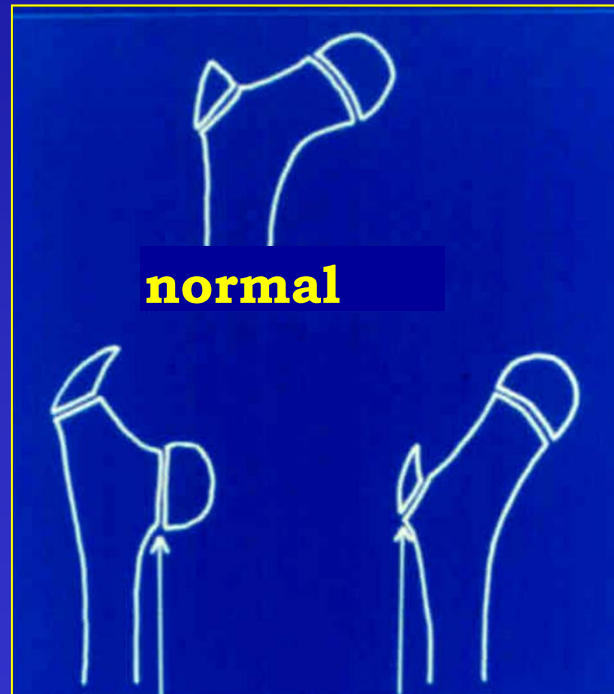
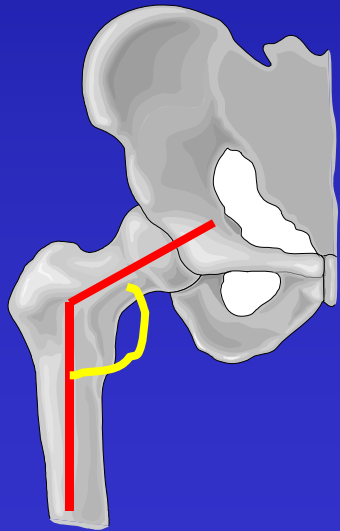


INTRAEPIPHYSEAL GROWTH



Development of the hip joint

CCD angle



varus

valgus



Antetorsion angle



DDH

DYSPLASIA – poor development of the hip joint
- acetabulum or proximal femur
or both elements of the hip joint.

DDH is the most common disease in orthopaedics

Incidence 1-60%, In Poland 4%

40% of orthopaedics beds = DDH

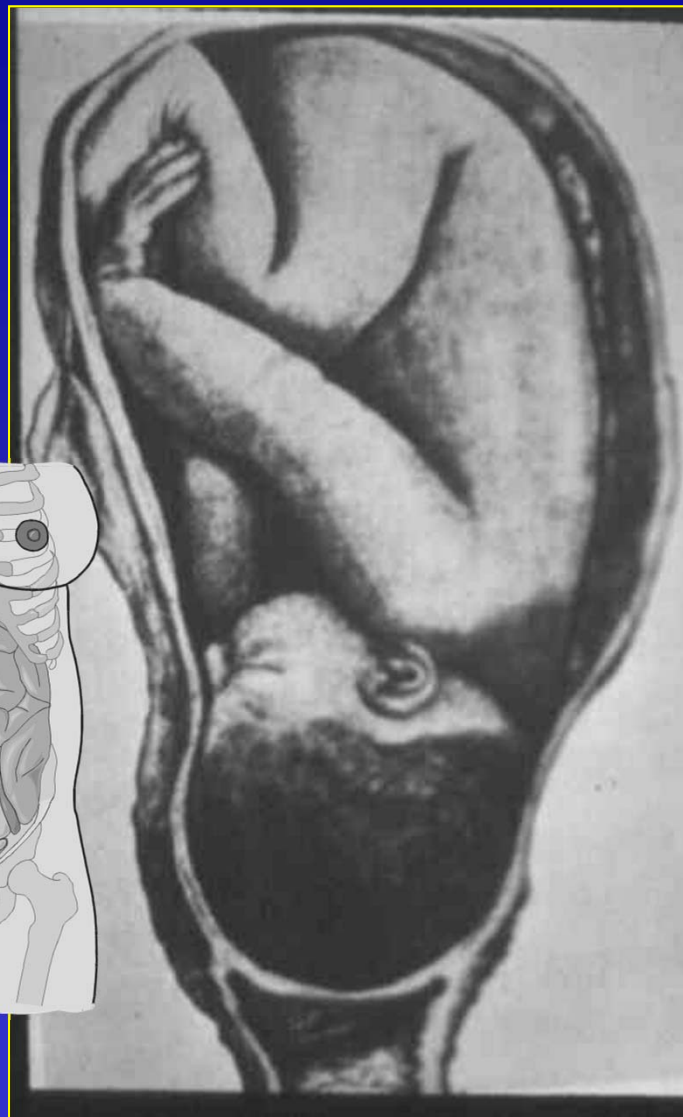
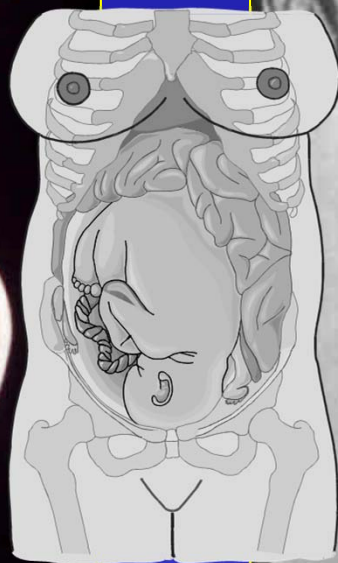
DDH

ETIOLOGY :

There is no single cause of DDH

- **Ligamentous laxity**
- **Prenatal positioning**
- **Breech position**
- **Postnatal position**
- **Hormones**
- **Diabetes Mellitus**

FETUS position



Breech position



DIAGNOSIS OF DDH

- **CLINICAL EXAMINATION**
- **ULTRASOUND EXAMINATION**
- **X-RAY**
- **CT - ?**
- **MRI - ?**

CLINICAL PRESENTATION

- * *Barlow TEST*
- * *Ortolani TEST*
- * **Limited hip abduction**
- * **Zwiększona rotacja do wewnątrz**
- * **Asymmetric skin folts**

DDH

Radiological symptoms of DDH :

Acetabulum :

- * Increased acetabular index
- * Shallow acetabulum
- * Widening of acetabulum

Proximal femur :

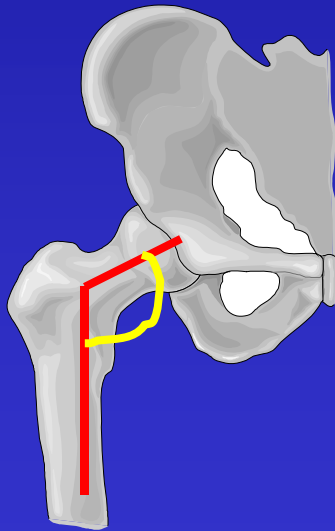
- * Increased CCD angle
- * Increased antetorsion angle
- * hypotrophy of osseus nucleus of the femoral head



DDH



Anteversion angle



CCD angle

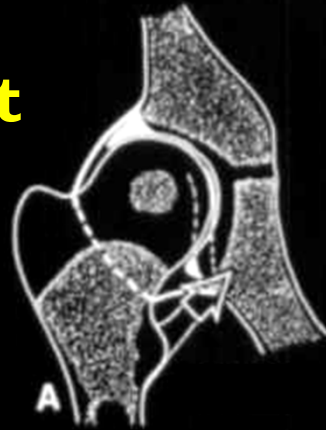


„Physiologic” hip dysplasia

- * Shallow acetabulum**
- * Increased AI**
- * Increased CCD angle**
- * Increased anteversion angle**
- * Most of the joint structure are cartilage**
- * Stabilisation only by ilio-femoral ligament**

DDH

Normal joint



Dysplastic joint



Dysplasia with subluxation



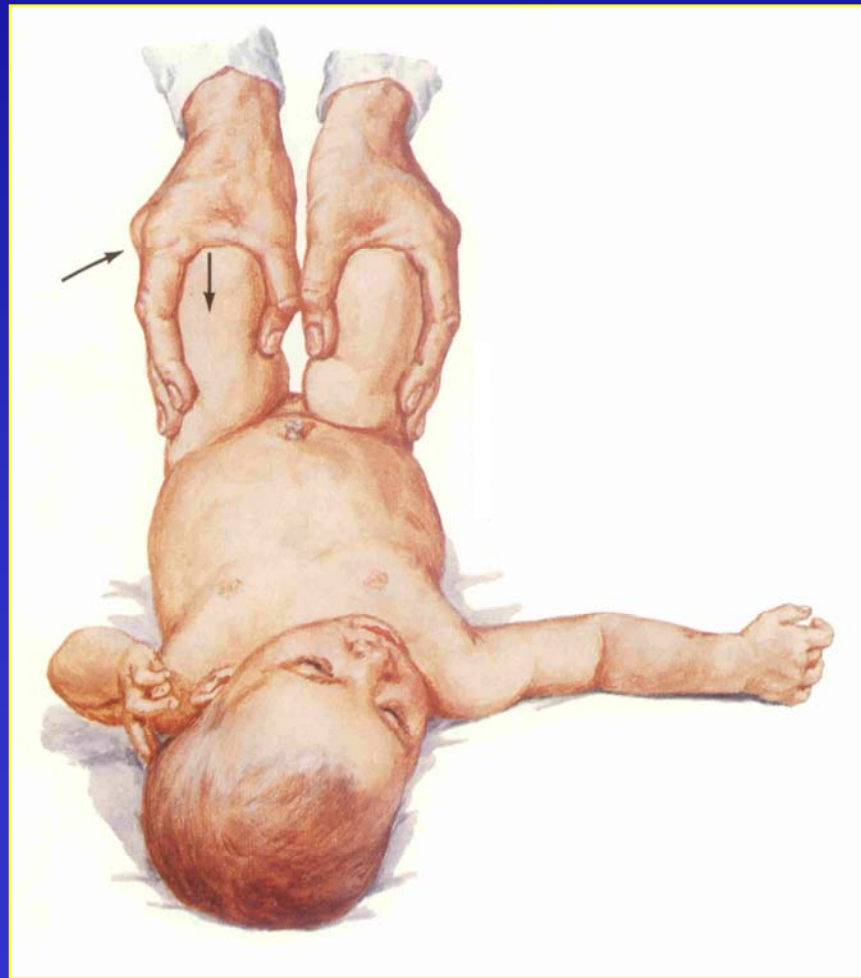
Dysplasia with dislocation

DDH

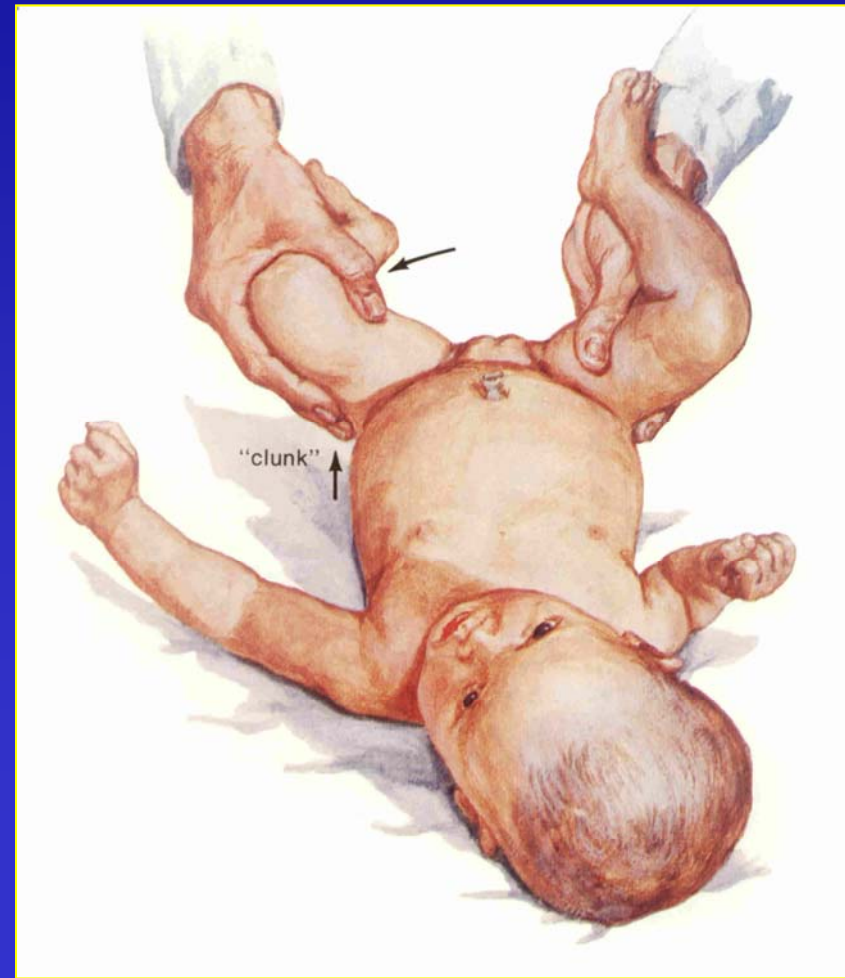


Clinical presentation

Barlow Test



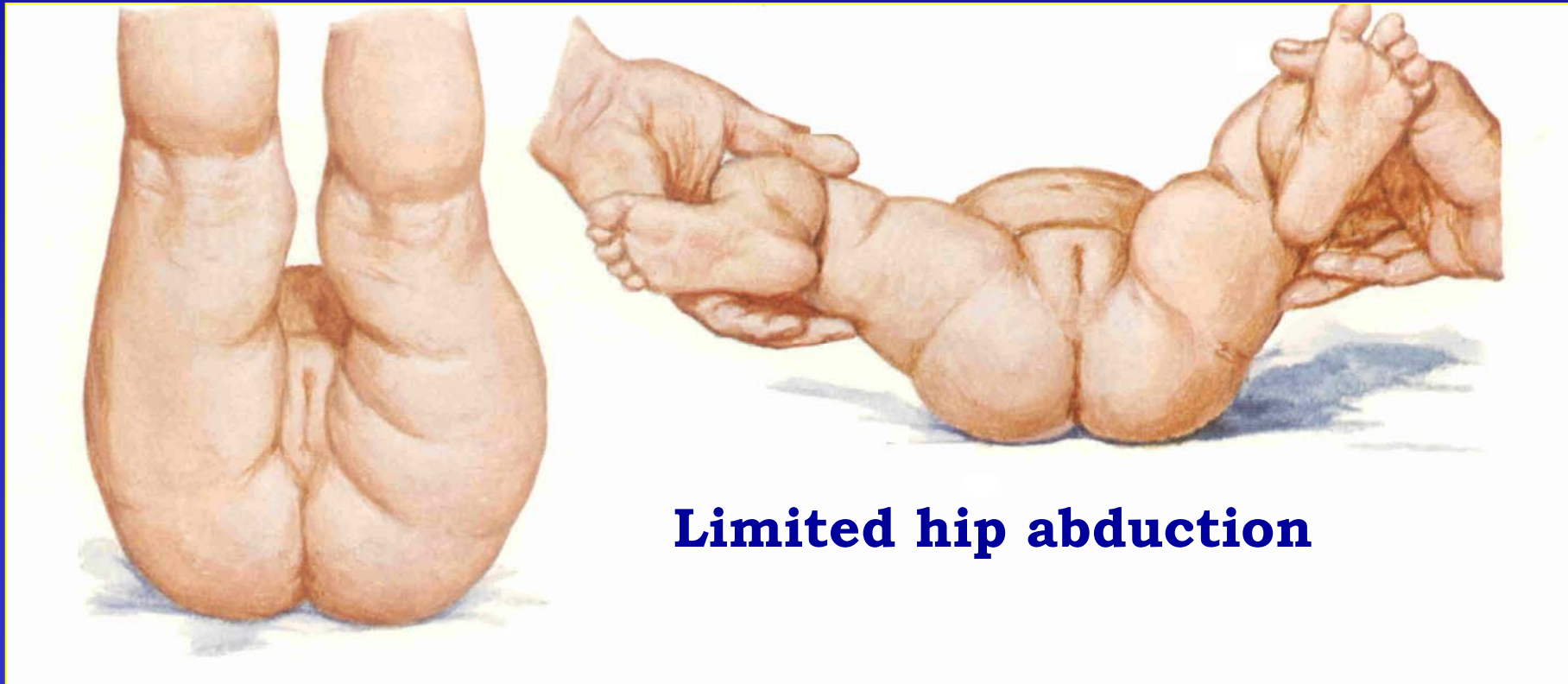
Ortolani Test



Clinical presentation



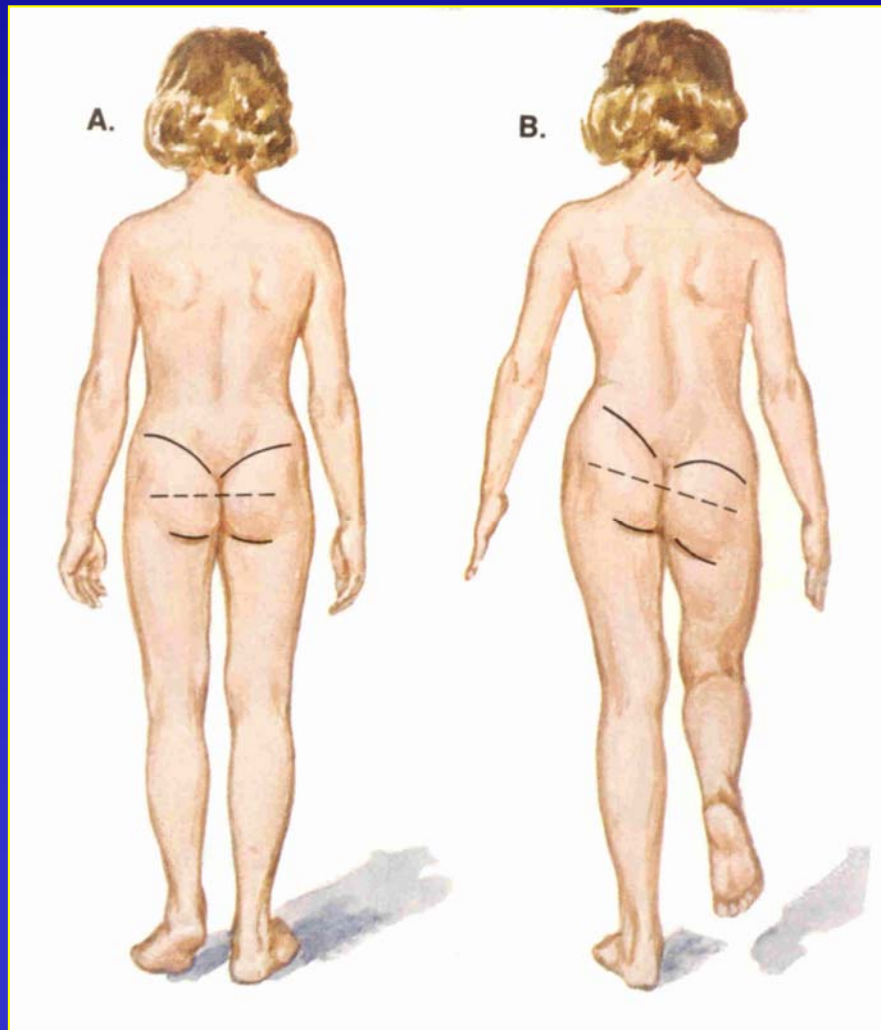
Clinical presentation



Limited hip abduction

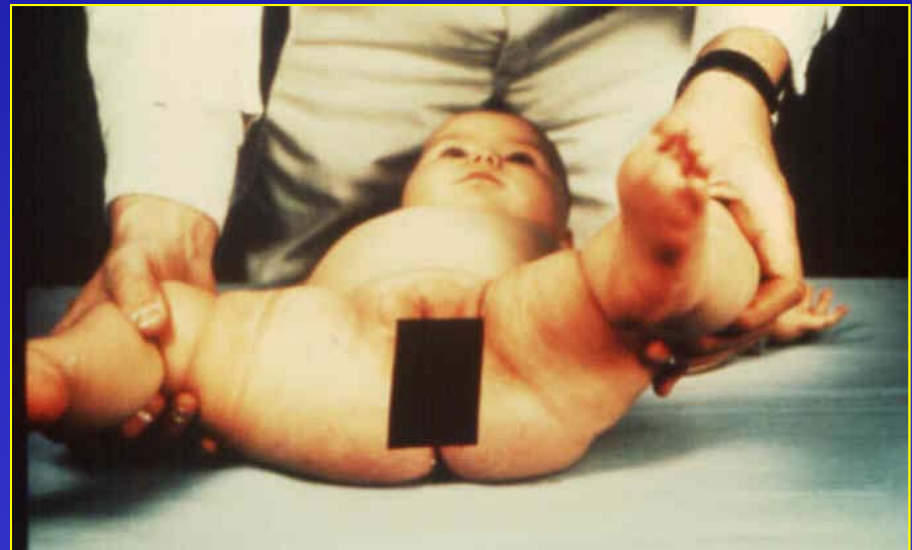
Asymmetric skin folds

Clinical presentation

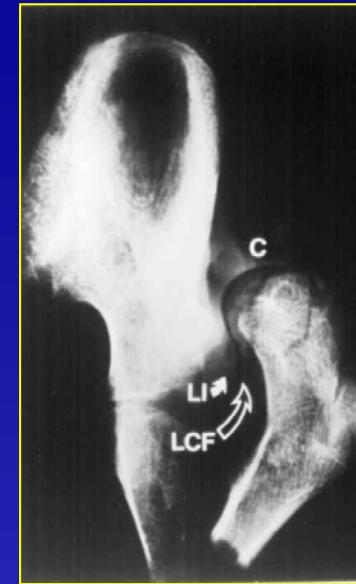


**Trendelenburg
sign**

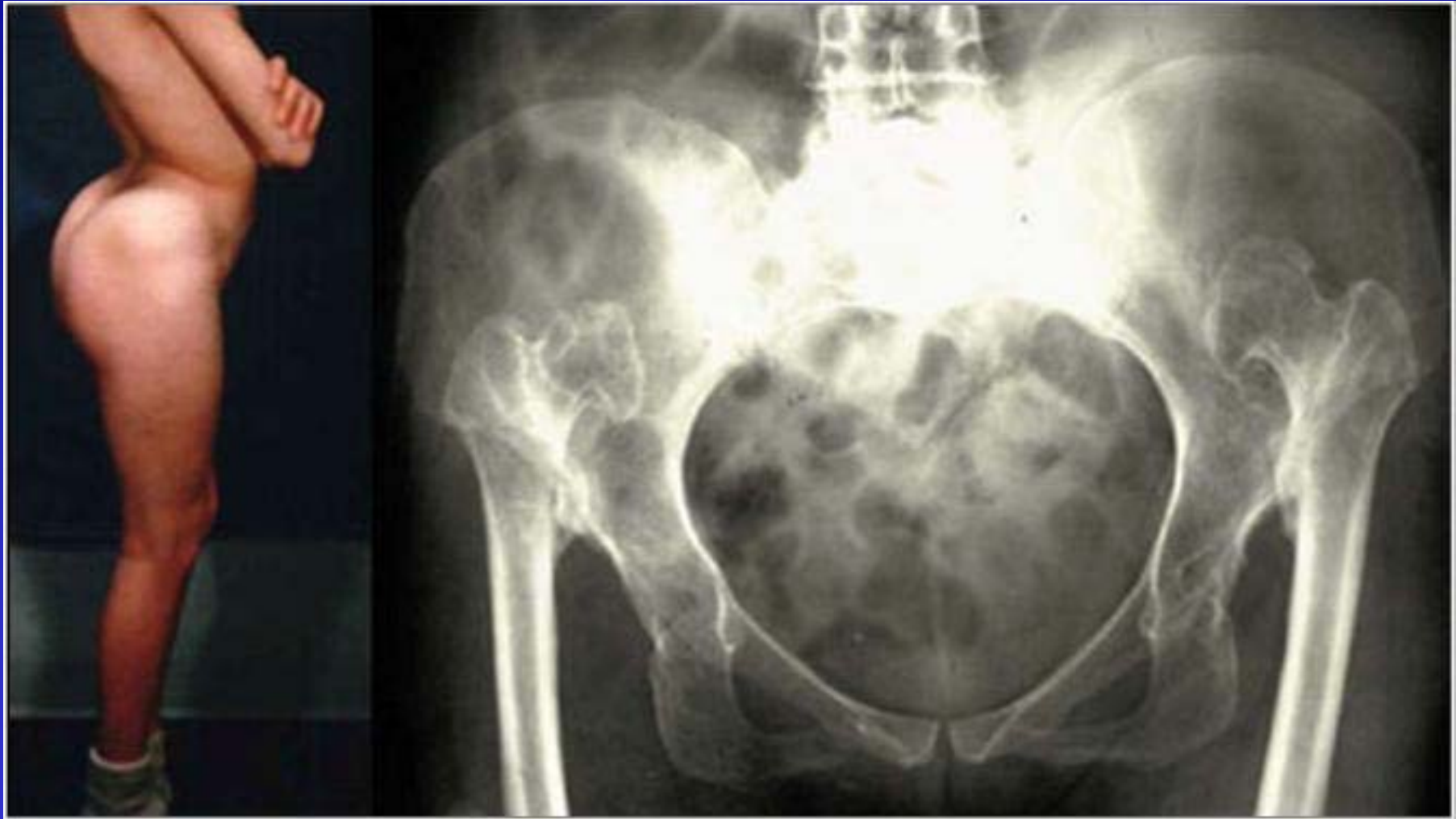
Clinical presentation



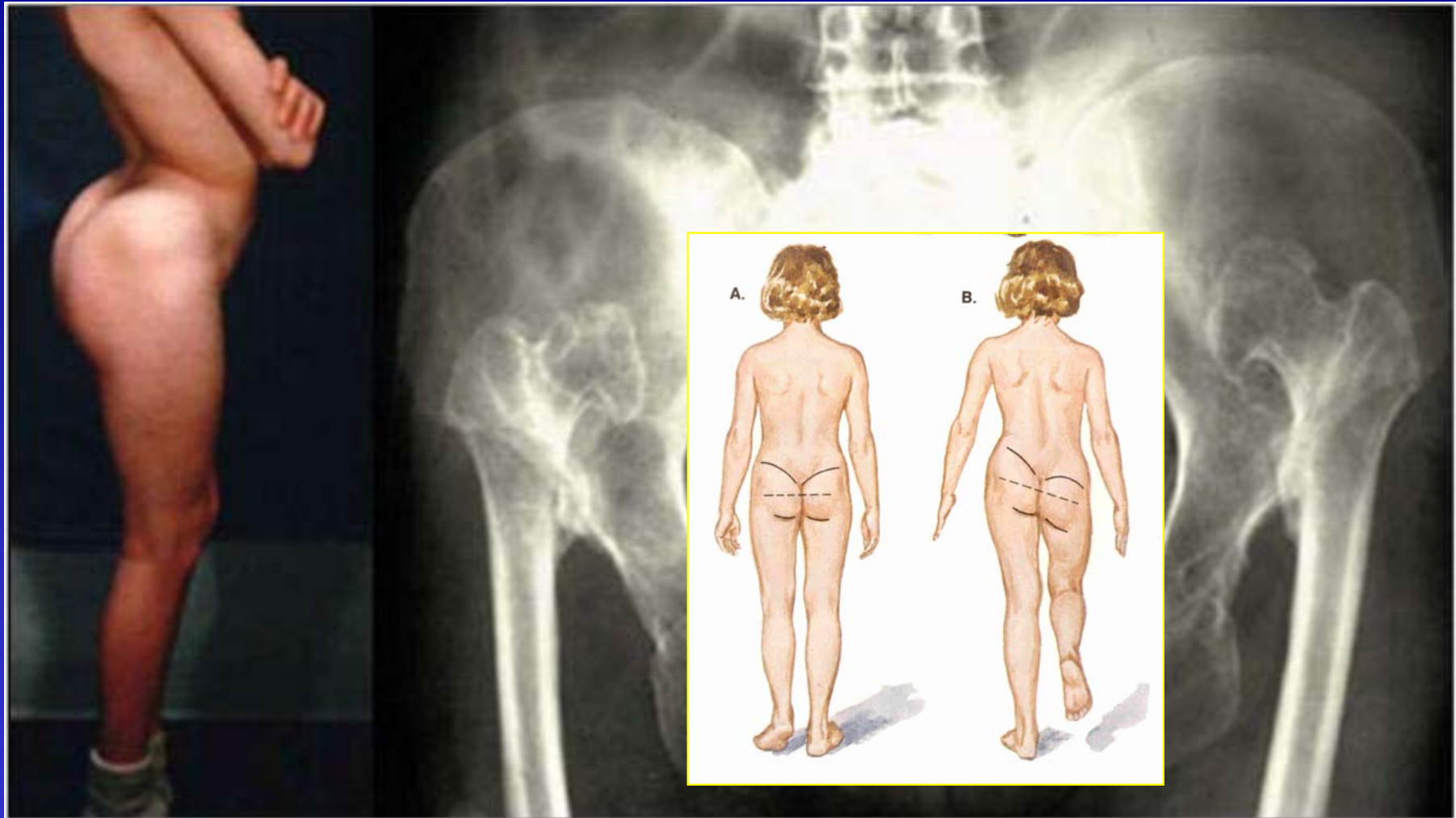
Clinical presentation of hip dislocation



Clinical presentation of hip dislocation



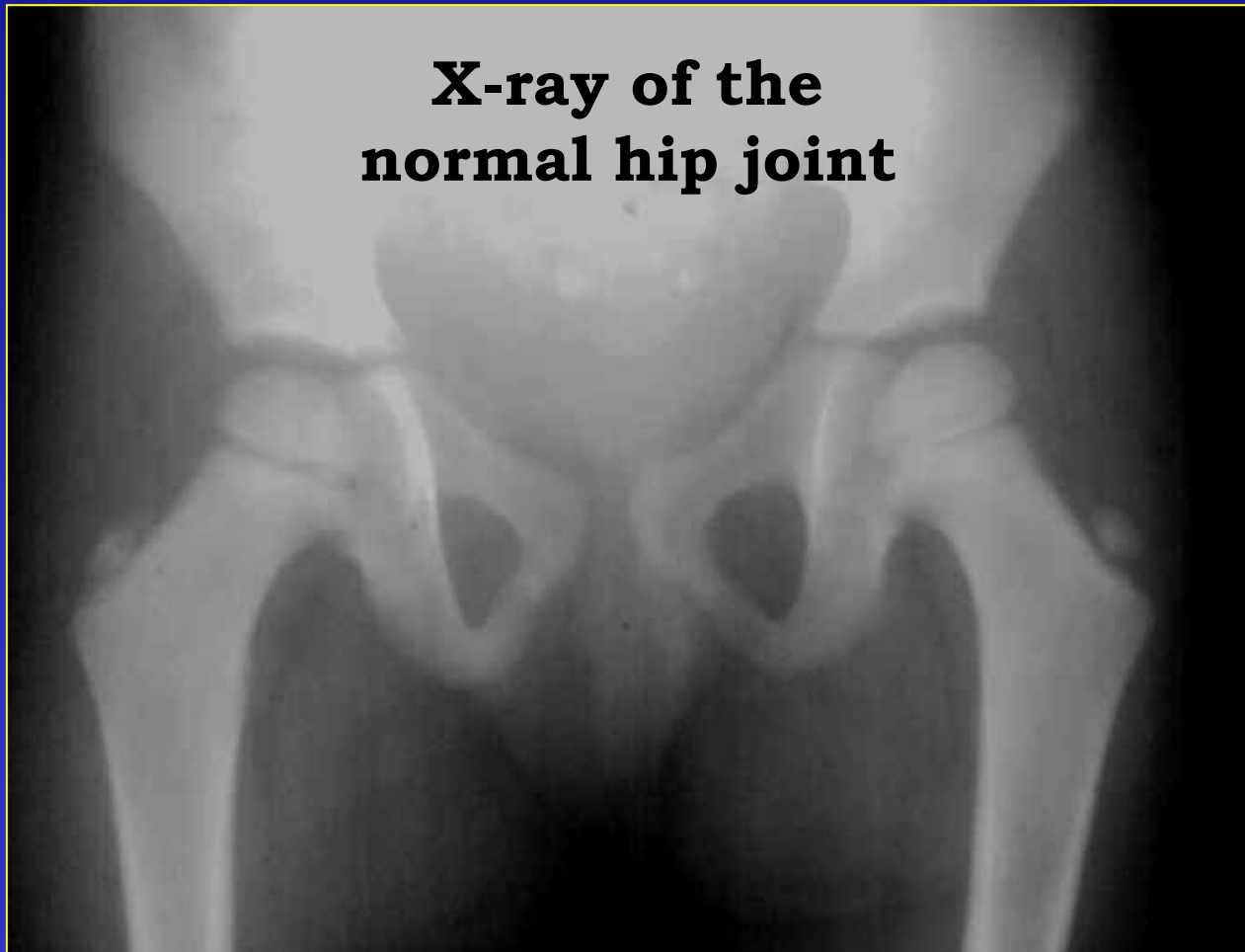
CLINICAL EXAMINATION



Hyperlordotic lumbar spine and waddling type of gait

DDH

**X-ray of the
normal hip joint**

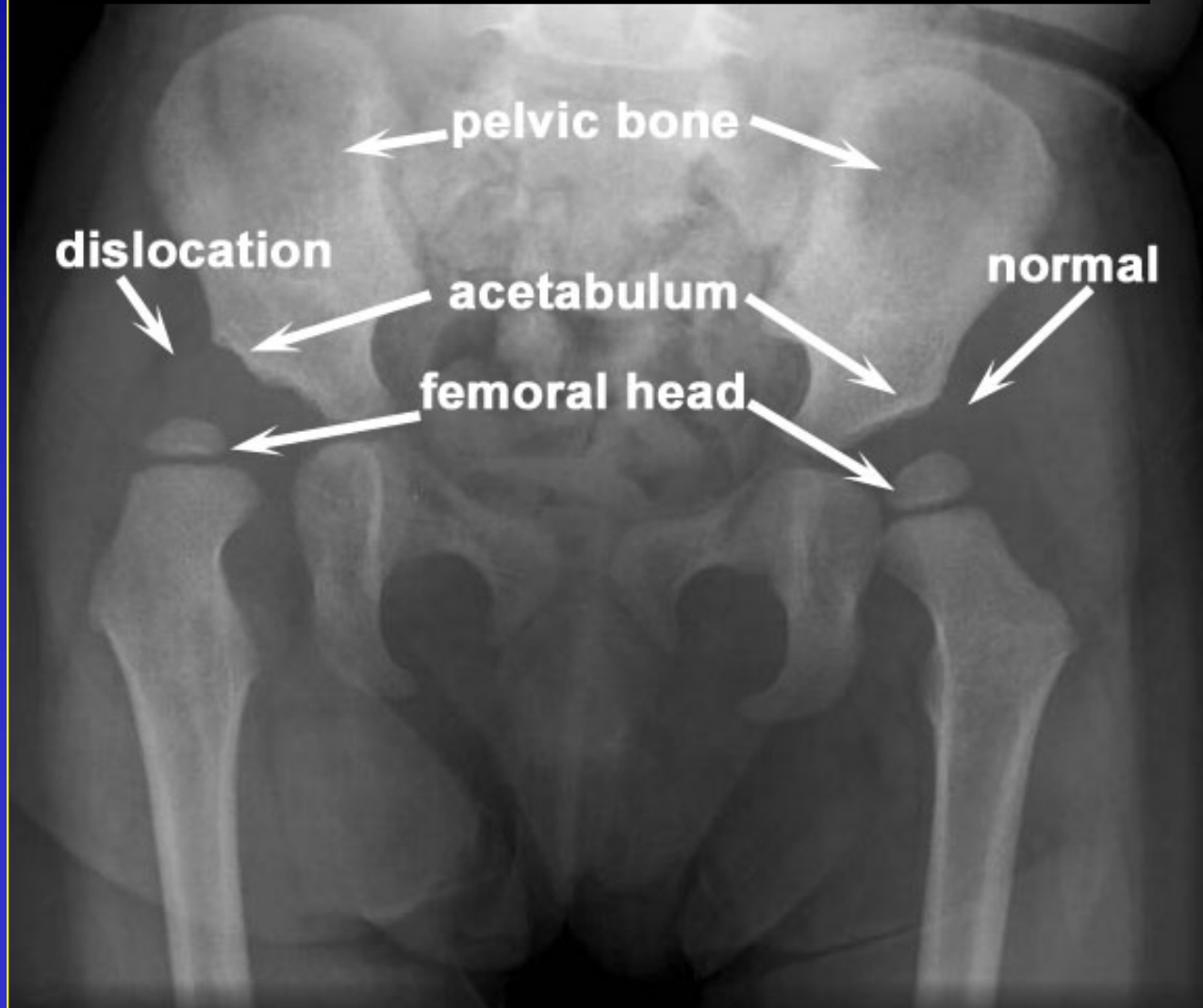


DDH

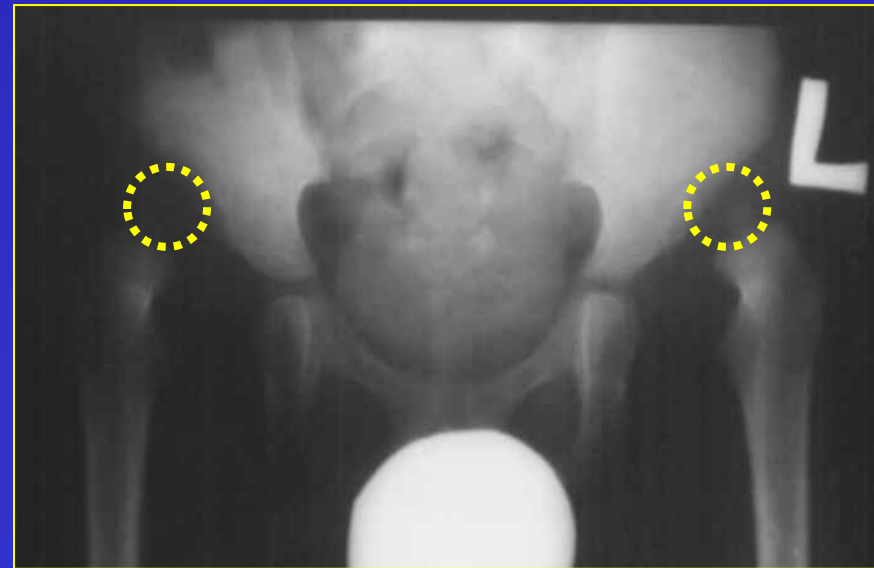
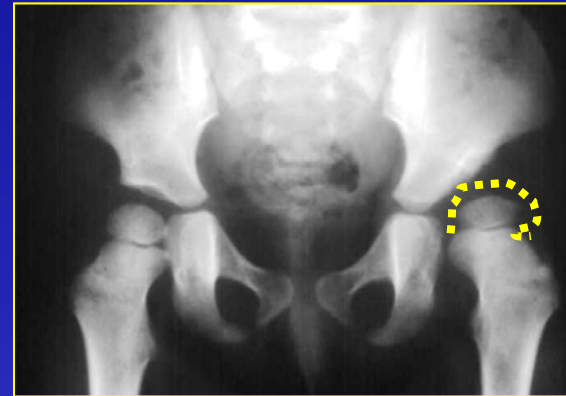


DDH

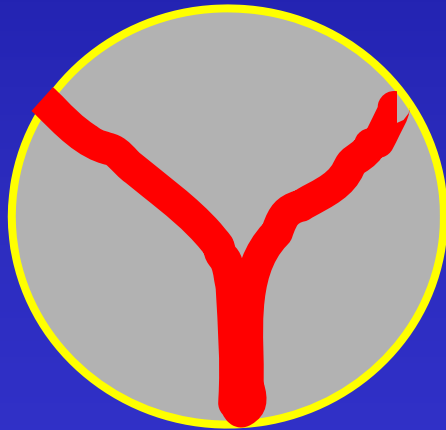
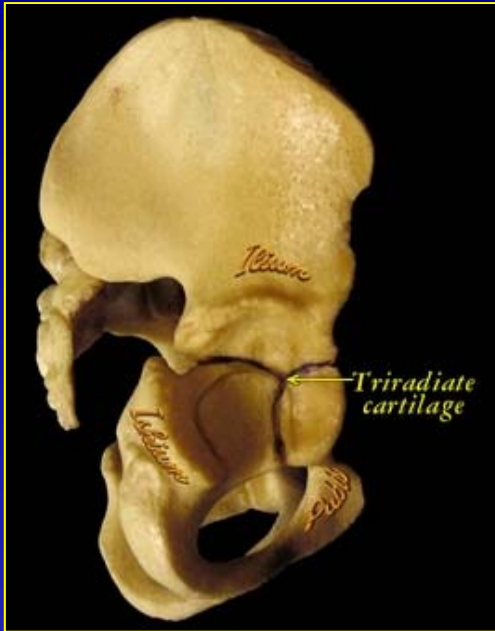
X-ray of the hip joint AP



DDH

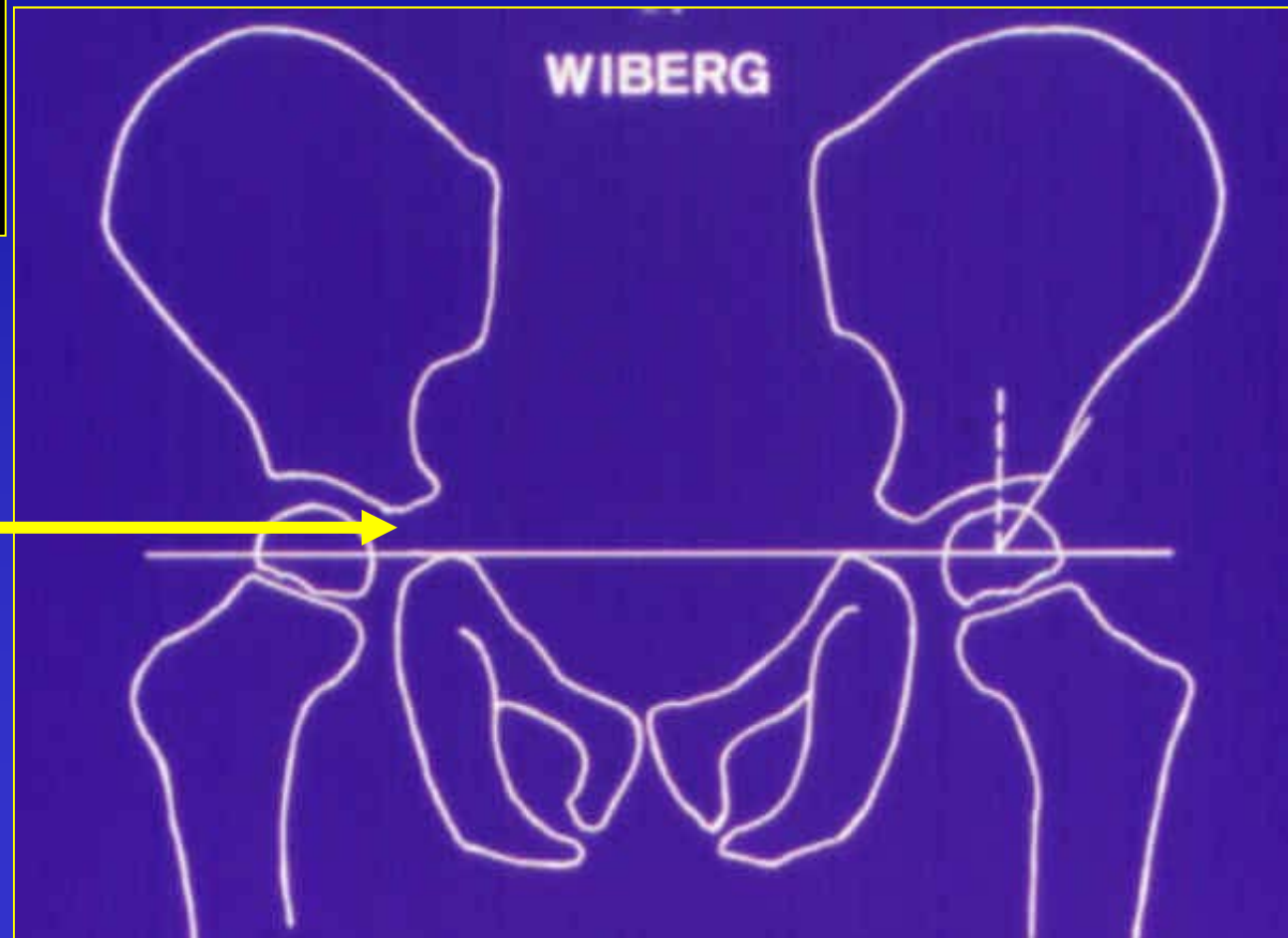


Diagnosis

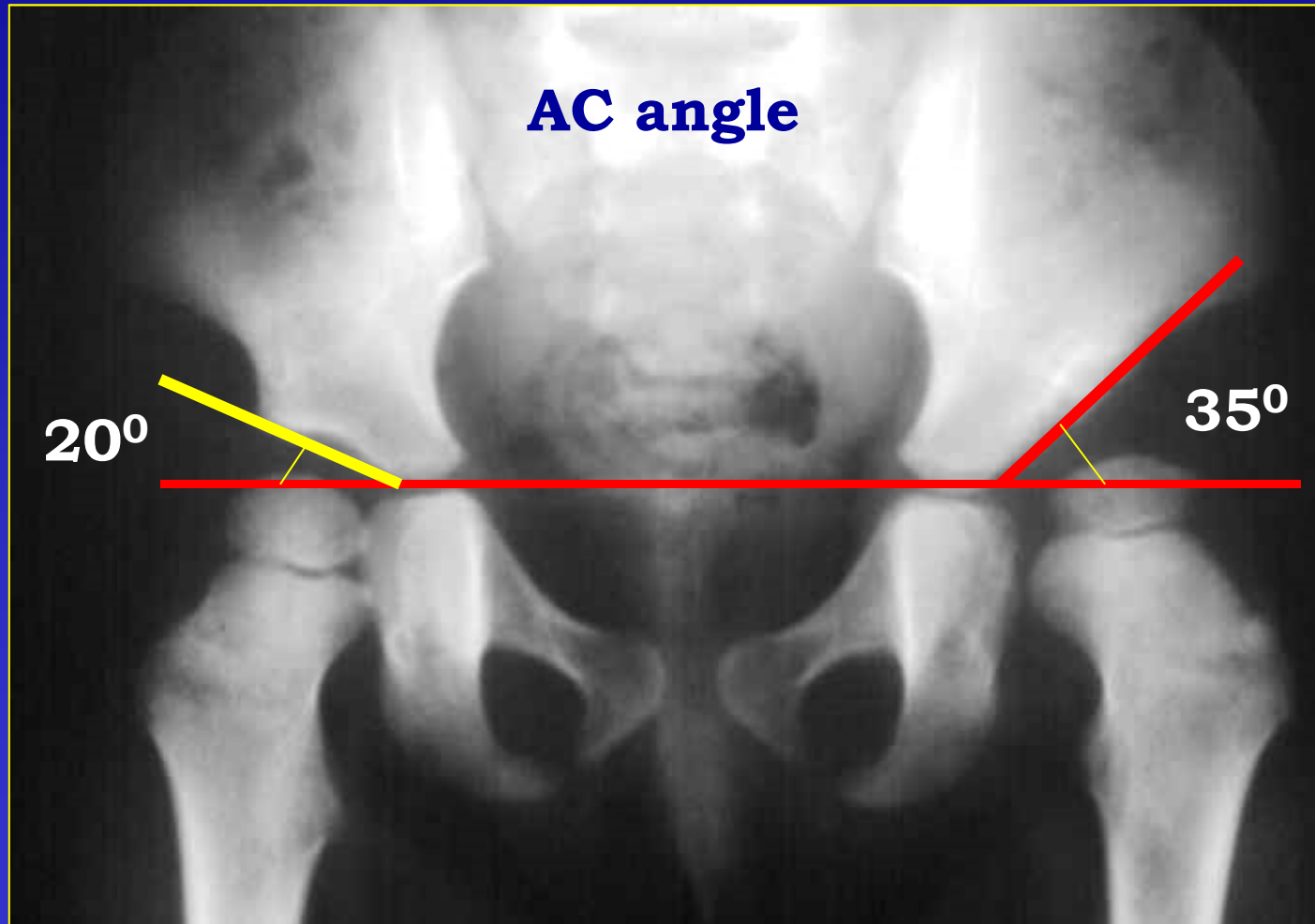


**Triradiate
cartilage**

Y



X-ray diagnosis



X-ray diagnosis



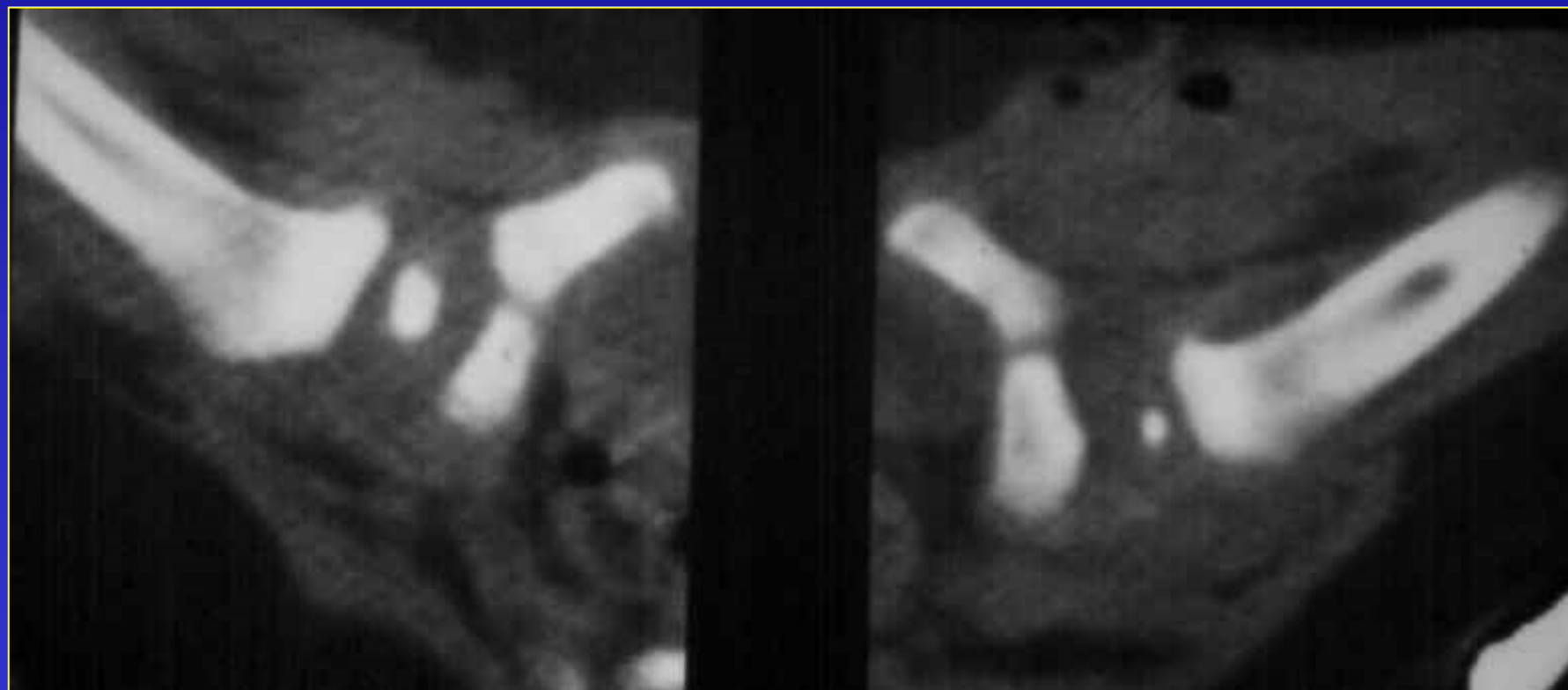
DIAGNOSIS

Arthrography



DIAGNOSIS

CT



DIAGNOSIS

**In most of the cases only
With the use of USG.**

USG :

From 5 day of life till 12 months of life

~~**RTG**~~

X-RAY

X-ray is performed only if :

- 1. Problematic interpretation of US**
- 2. In children over 12 months of life**
- 3. Before surgery**
- 4. After end of treatment**
- 5. In selected difficult cases**
- 6. Never below 5 month of life**

TREATMENT

- **METHODS OF TREATMENT :**

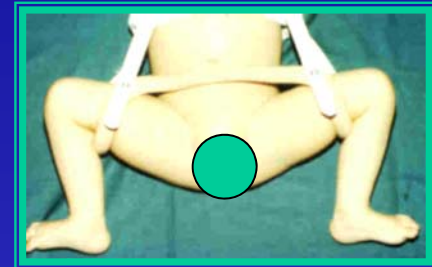
- **PILLOWS**

- **PAVLIK HARNESS**

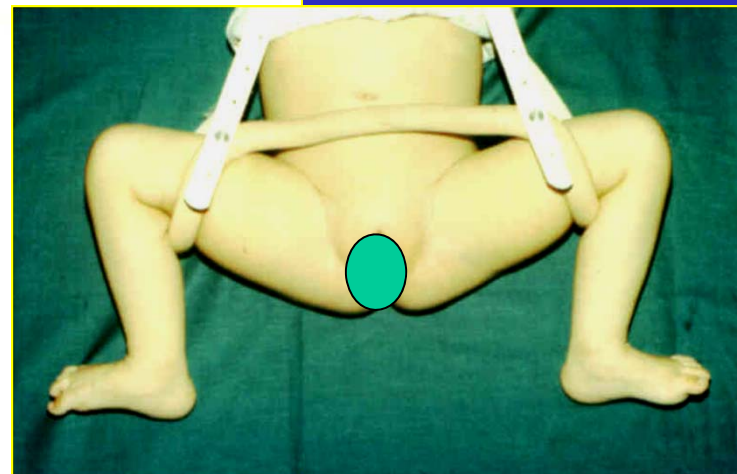
- **FLEXION-ABDUCTION DEVICES**

- **OVER-HEAD TRACTION**

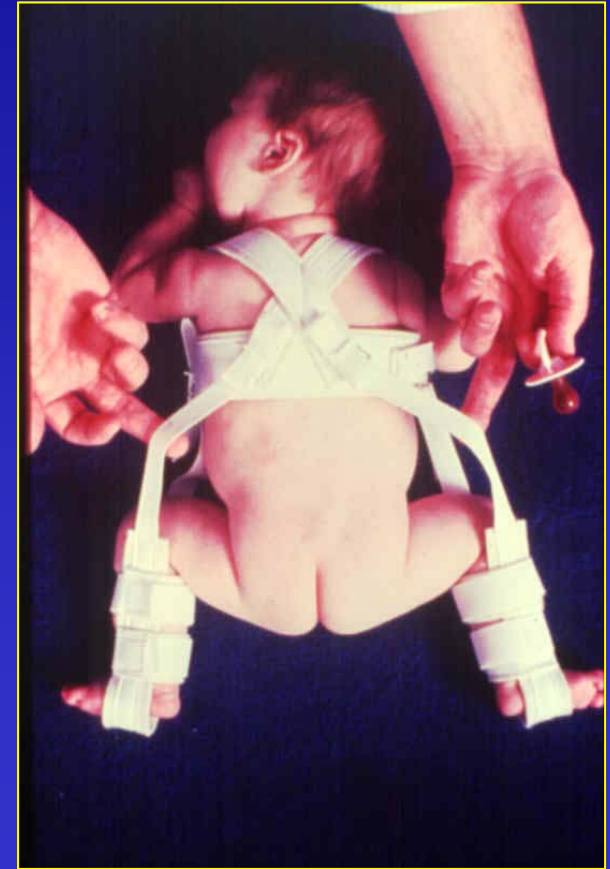
- **CLOSED REDUCTION**



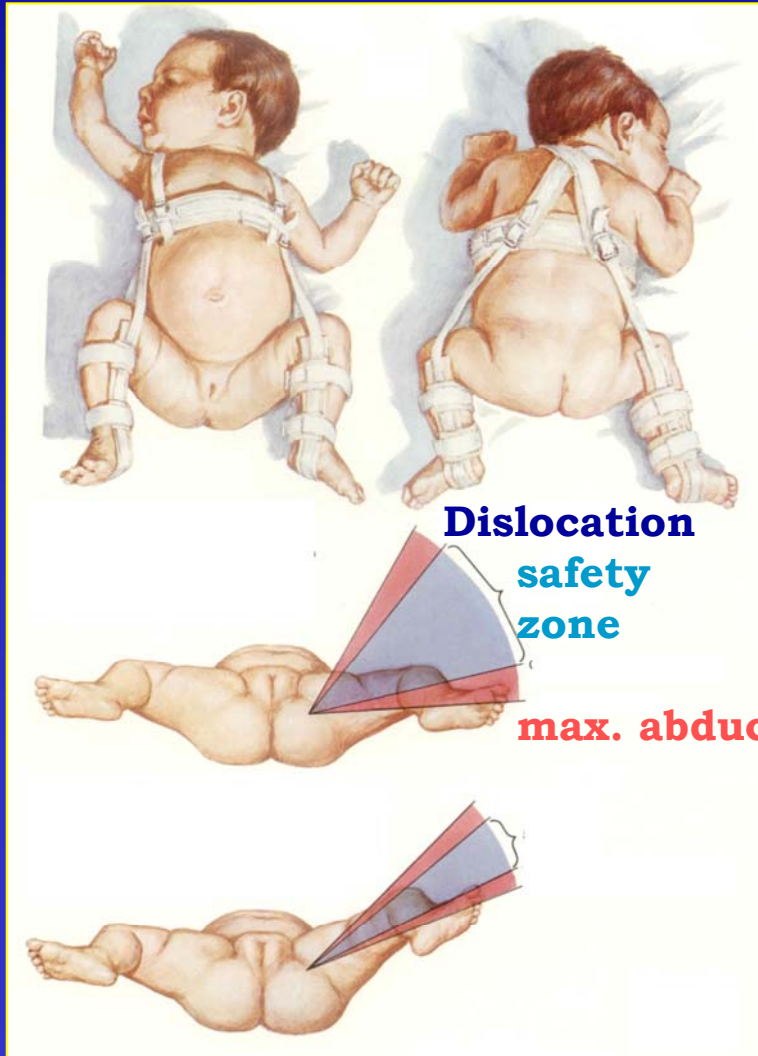
TREATMENT



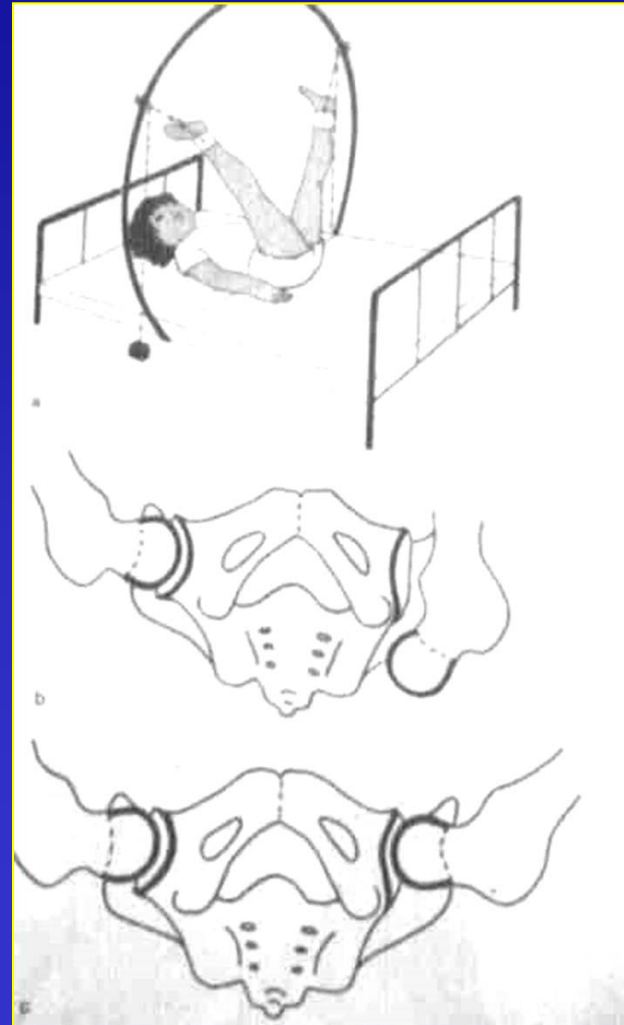
TREATMENT



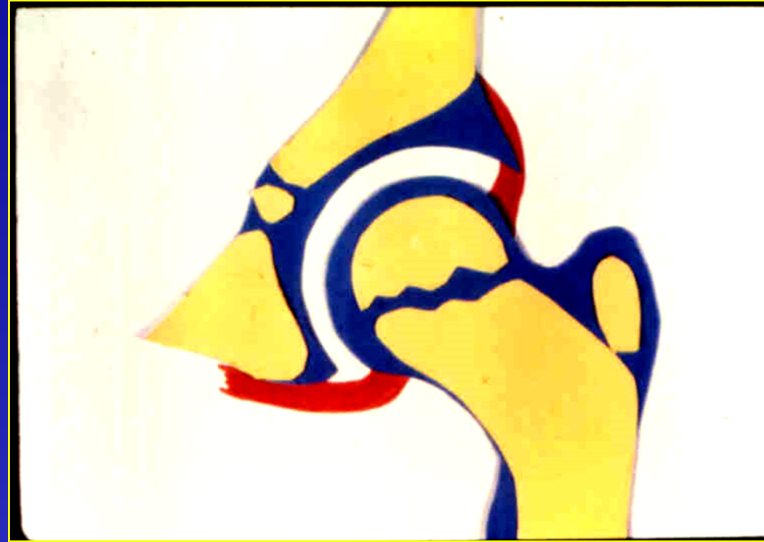
TREATMENT



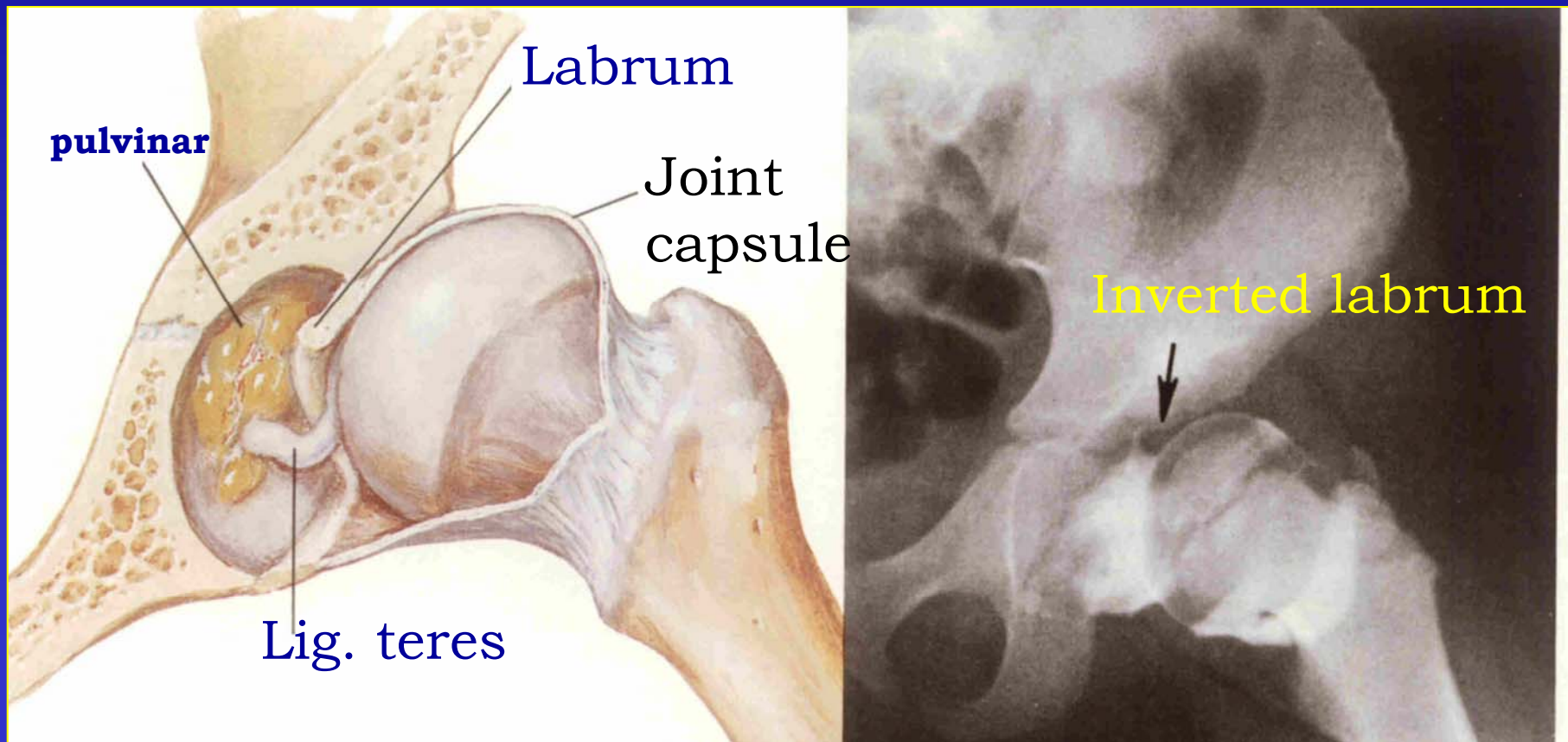
TREATMENT



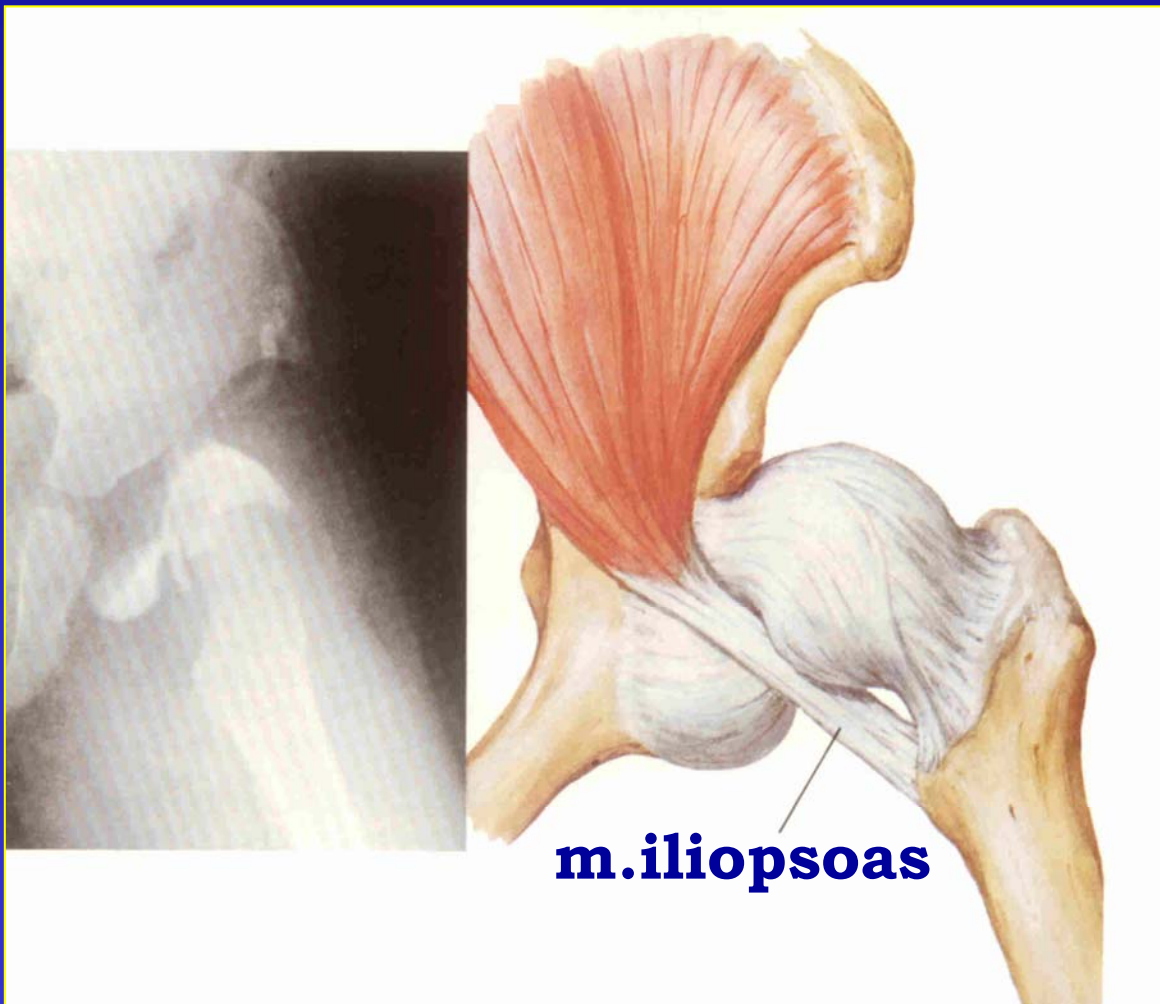
Problems in reposition



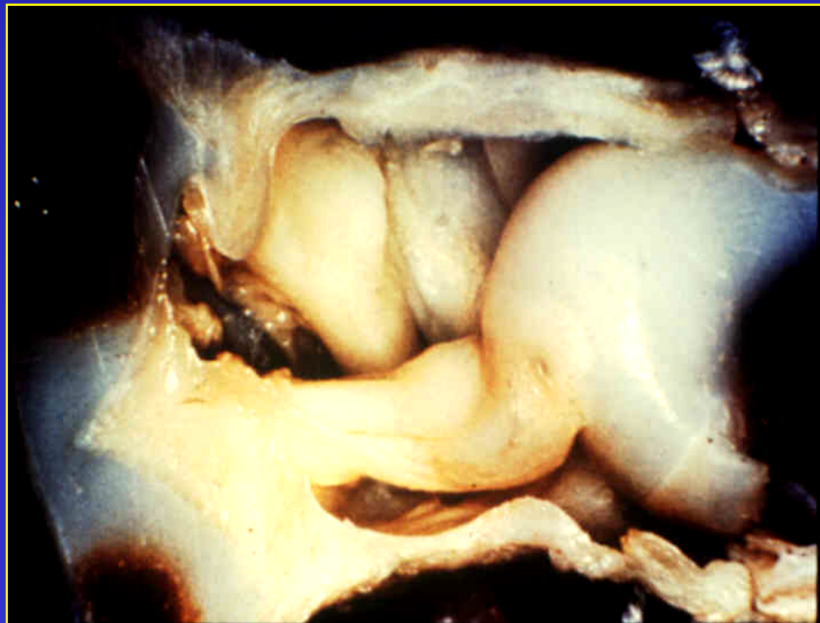
Problems in reposition



Problems in reposition



Problems in reposition



∠ CCD = 145°



∠ CCD = 115°



**OSTEOTOMIA
waryzująco - detorsyjna
kości udowej**

SURGICAL TREATMENT



DEGA



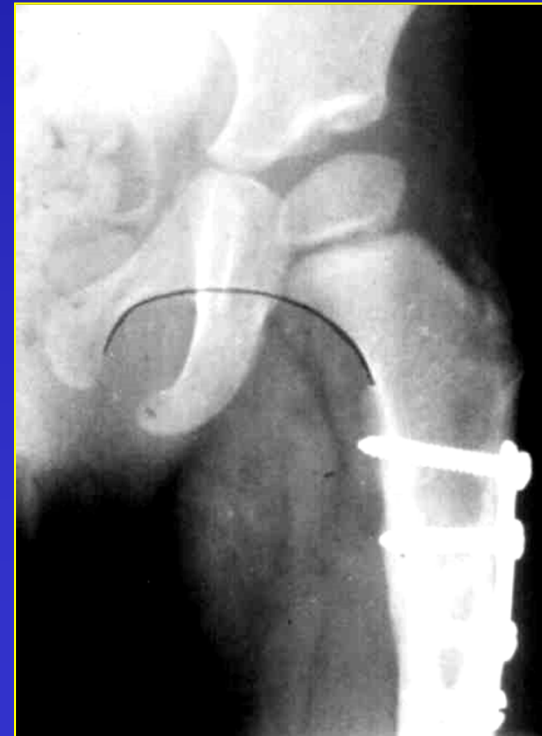
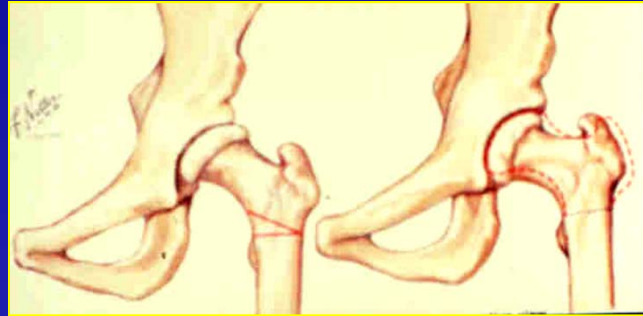
SALTER



CHIARI



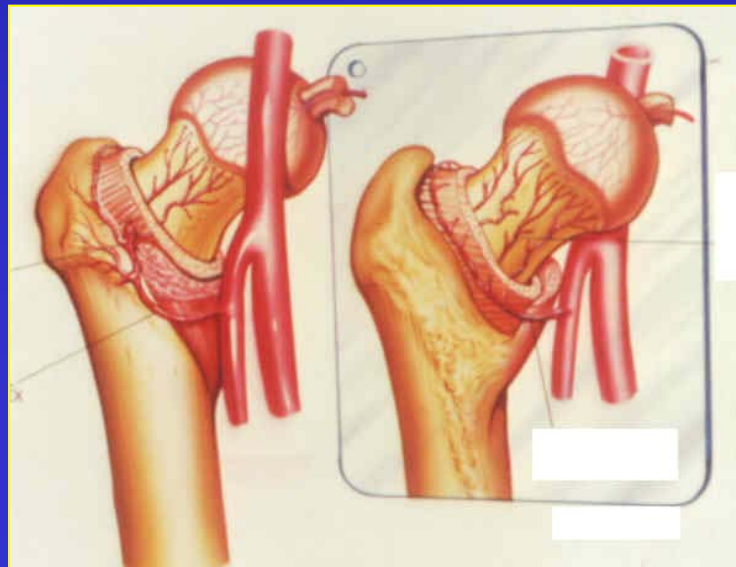
SURGICAL TREATMENT



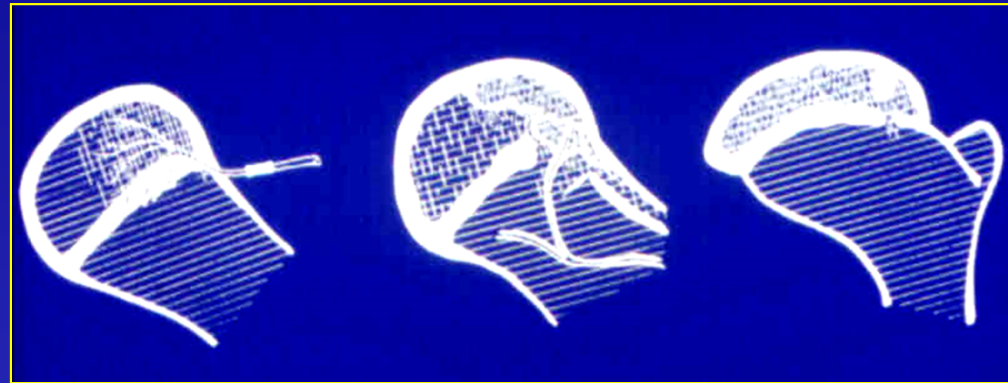
SURGICAL TREATMENT



VASCULARISATION OF THE FEMORAL HEAD

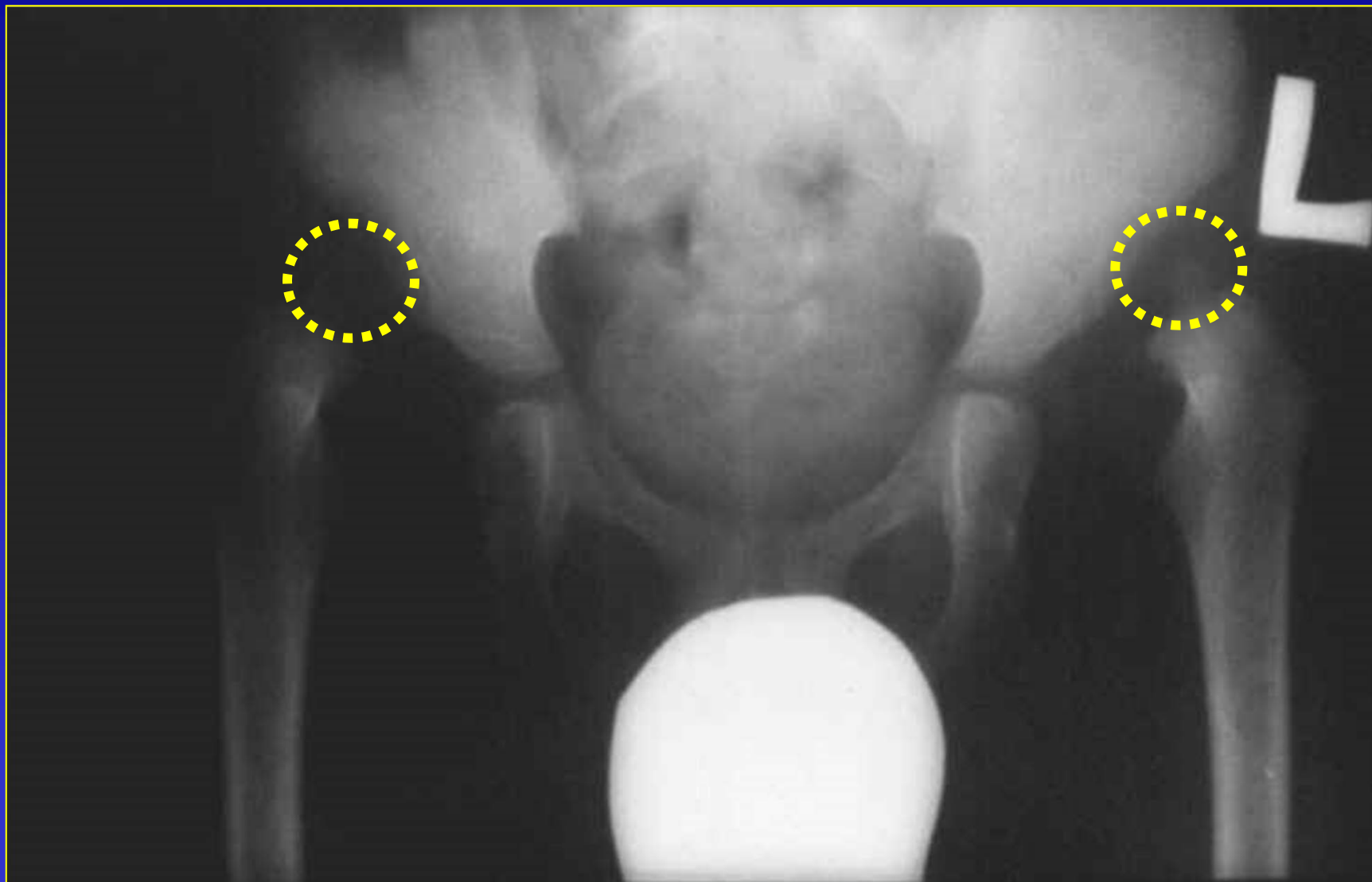


VASCULARISATION OF THE FEMORAL HEAD



**ULTRASOUND MONITORING OF
THE REBUILDING OF THE
DYSPLASTIC HIP JOINT**

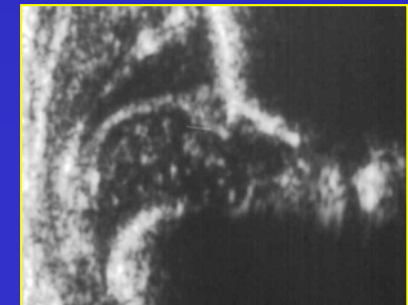
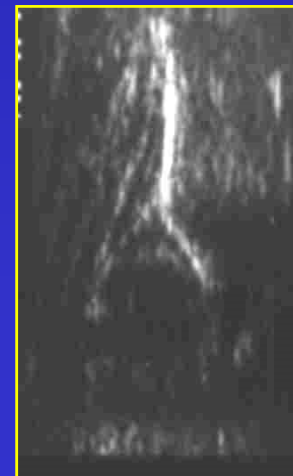
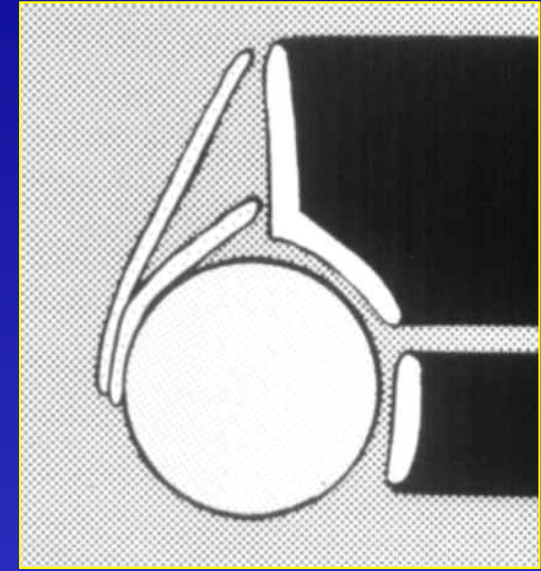
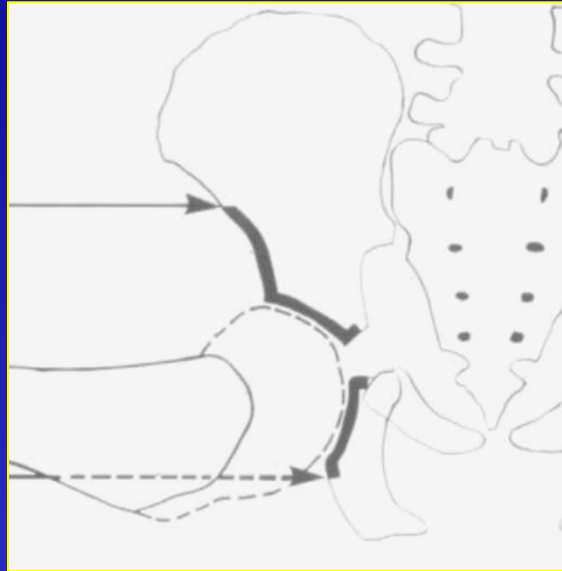
Early diagnosis !!!




US DIAGNOSIS

- **Today's standard**
- **Every child should have an US in the first 6 weeks of life**

USG



DDH

Late diagnosis ⇒  **chance for recovery**

According to Lehman :

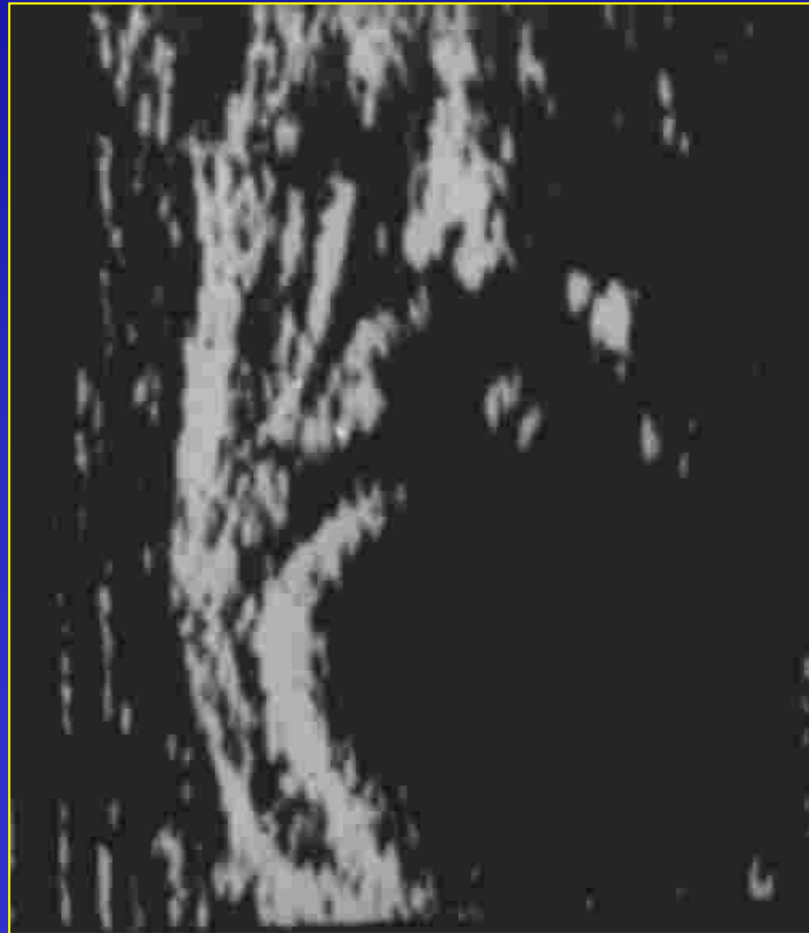
- ⇒ „golden period” = 0 – 3 weeks
- ⇒ „grey period” = till 3 month of life
- ⇒ „black period” > 3 month of life

GRAF'S METHOD

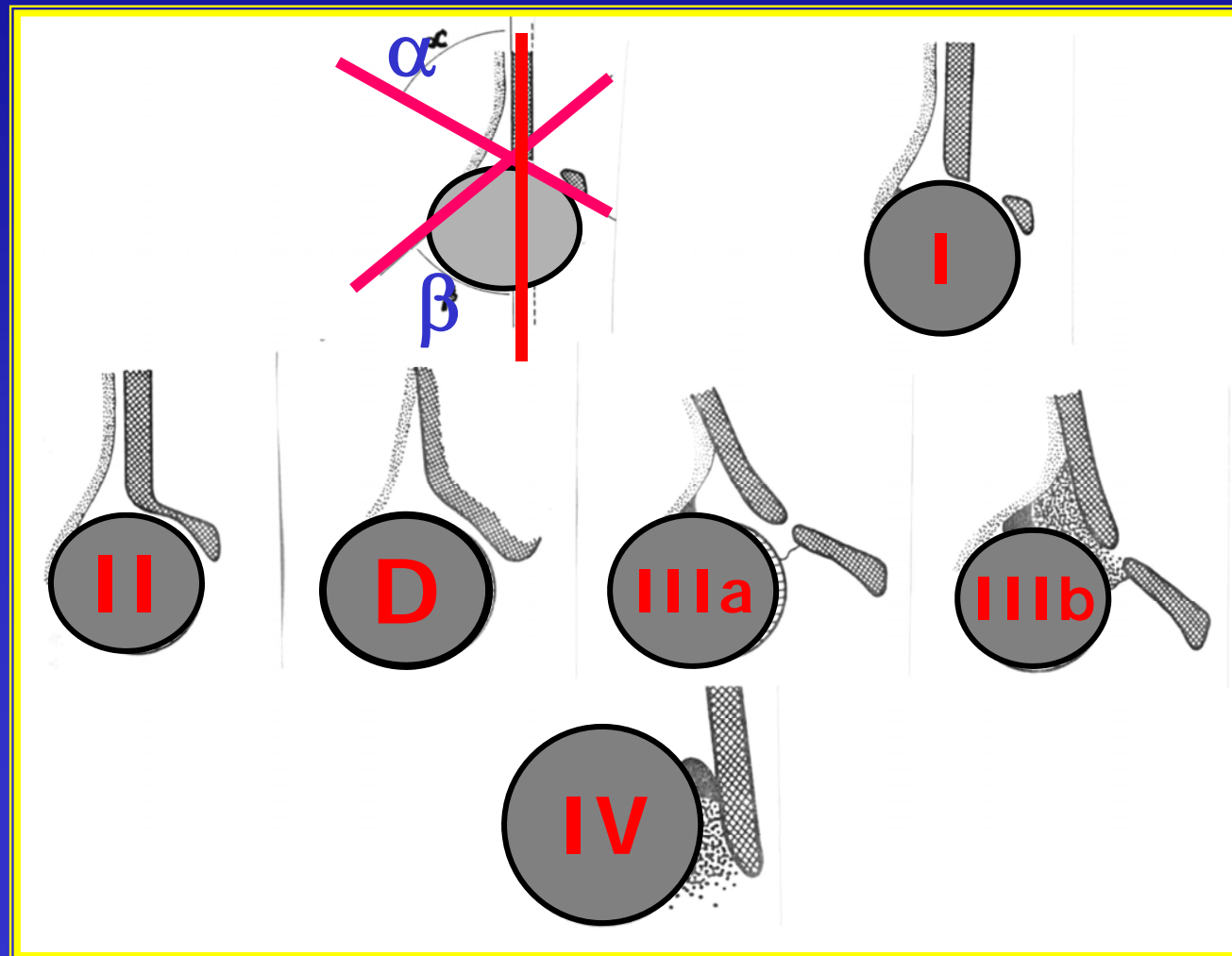
- **BASED ON α AND β ANGLES**
- **4 MAIN TYPES OF HIP DEVELOPMENT**
 - I a, I b
 - II a, II b
 - D
 - III a, III b
 - IV



GRAF'S METHOD

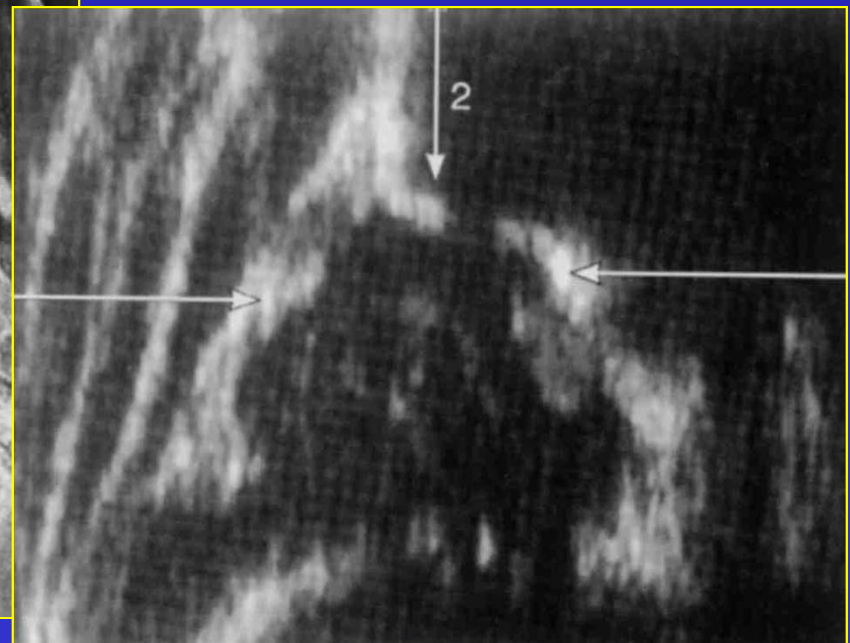


GRAF'S METHOD





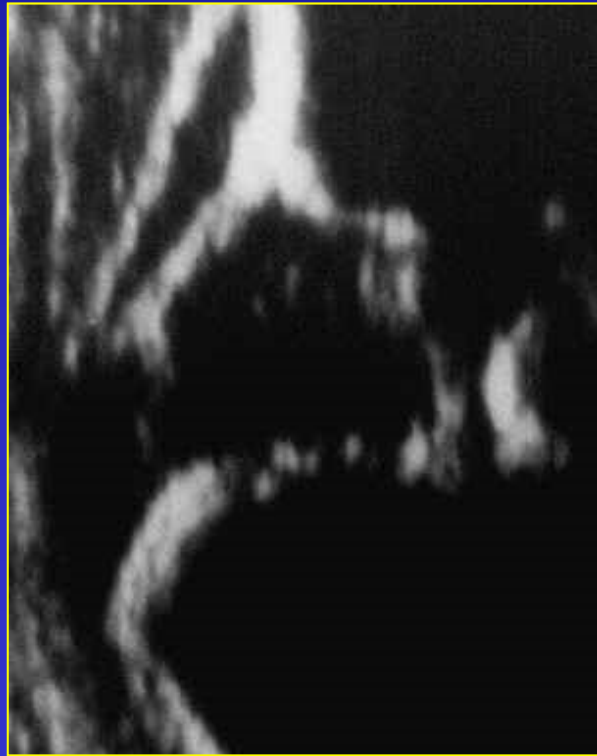
KEY POINTS





HIP REBUILDING

Type IIa



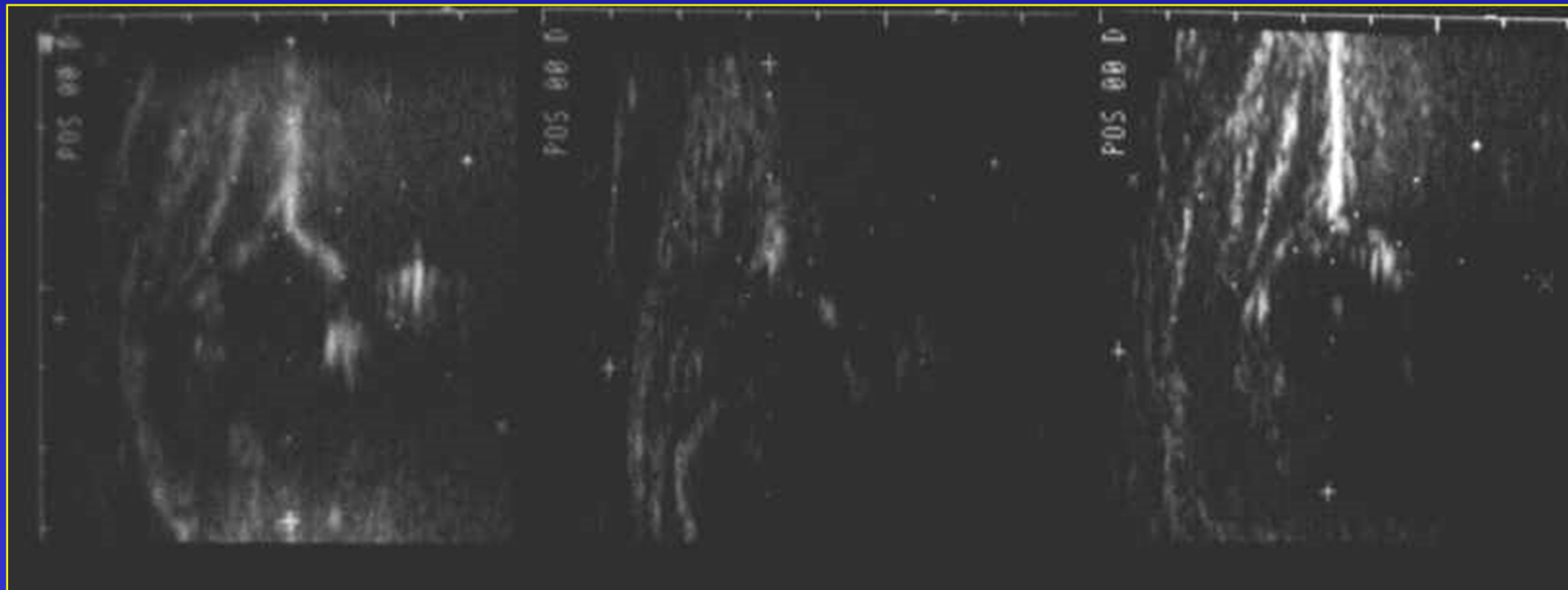
3 weeks



7 weeks

HIP REBUILDING

Type IIb



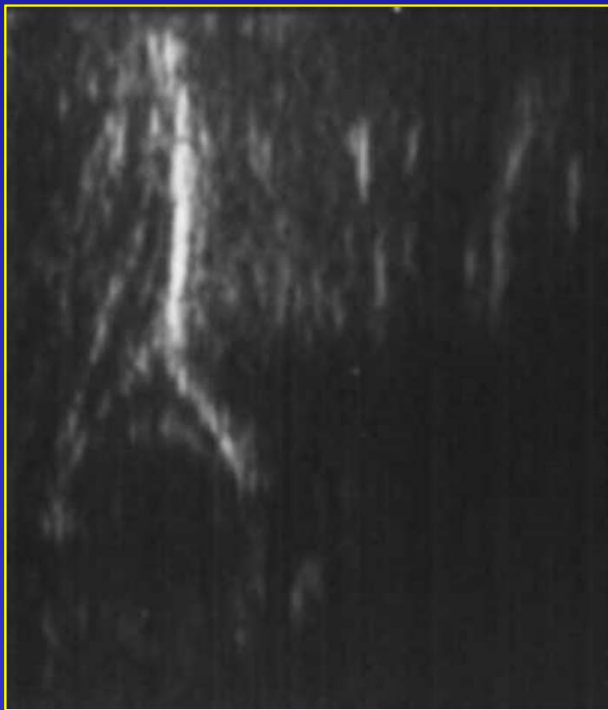
3 months

4 months

6 months

HIP REBUILDING

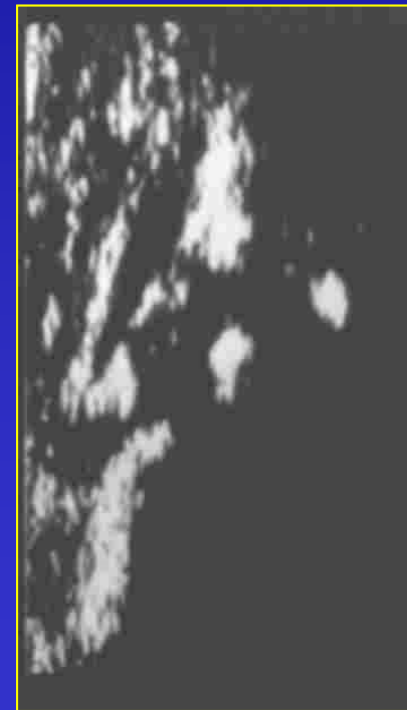
Type D



2 months



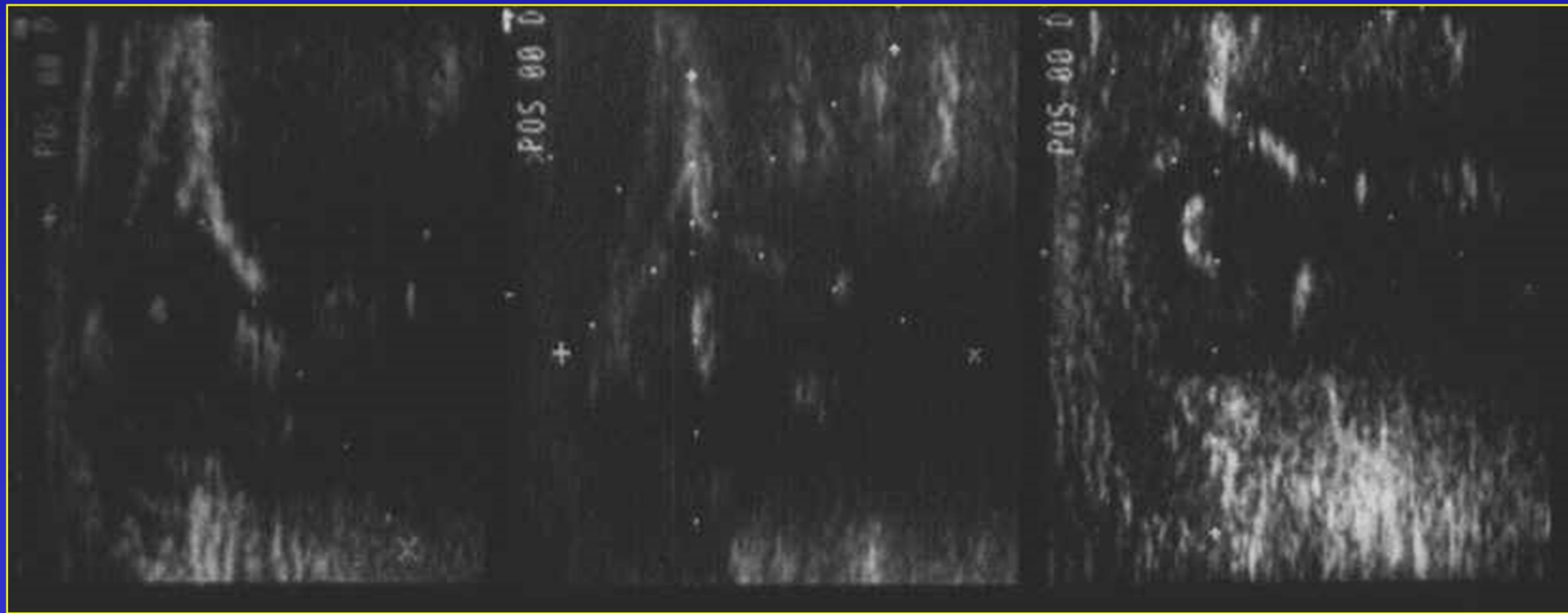
4 months



7 months

HIP REBUILDING

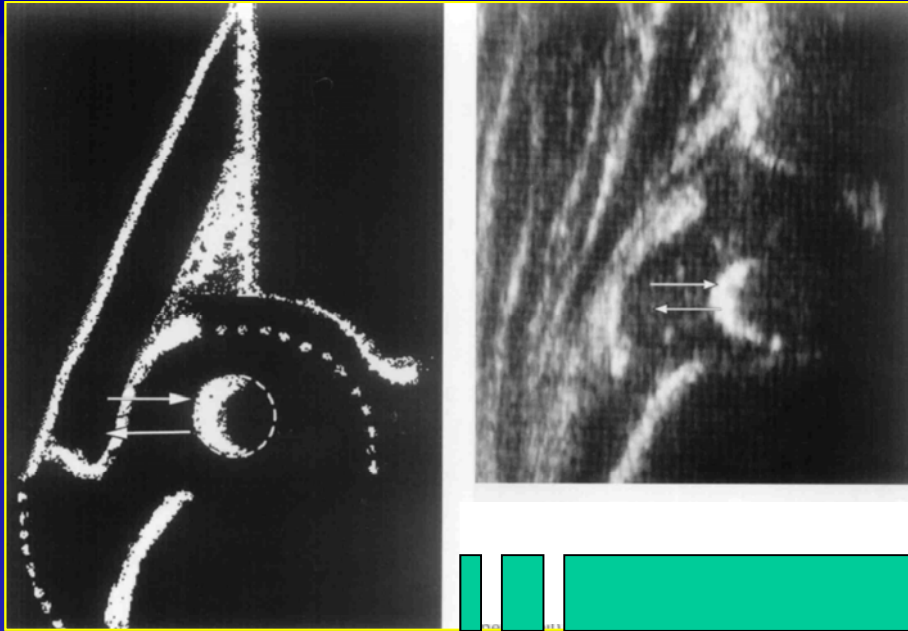
Type IIIa



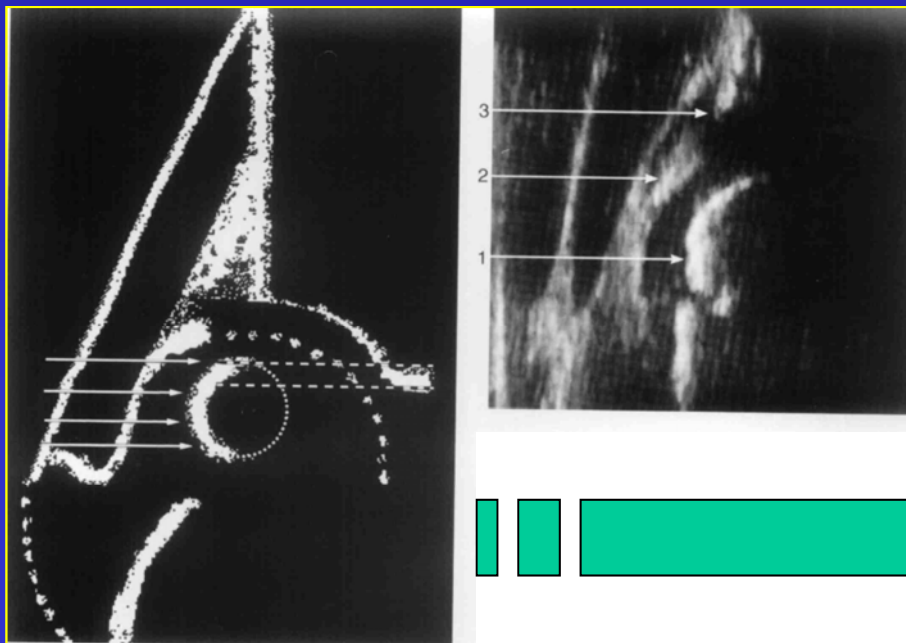
4 months

6 months

9 months



Half-moon Phenomenon



*Appears when
the femoral head
is partly ossified.*

EXAMINATION TECHNIQUE



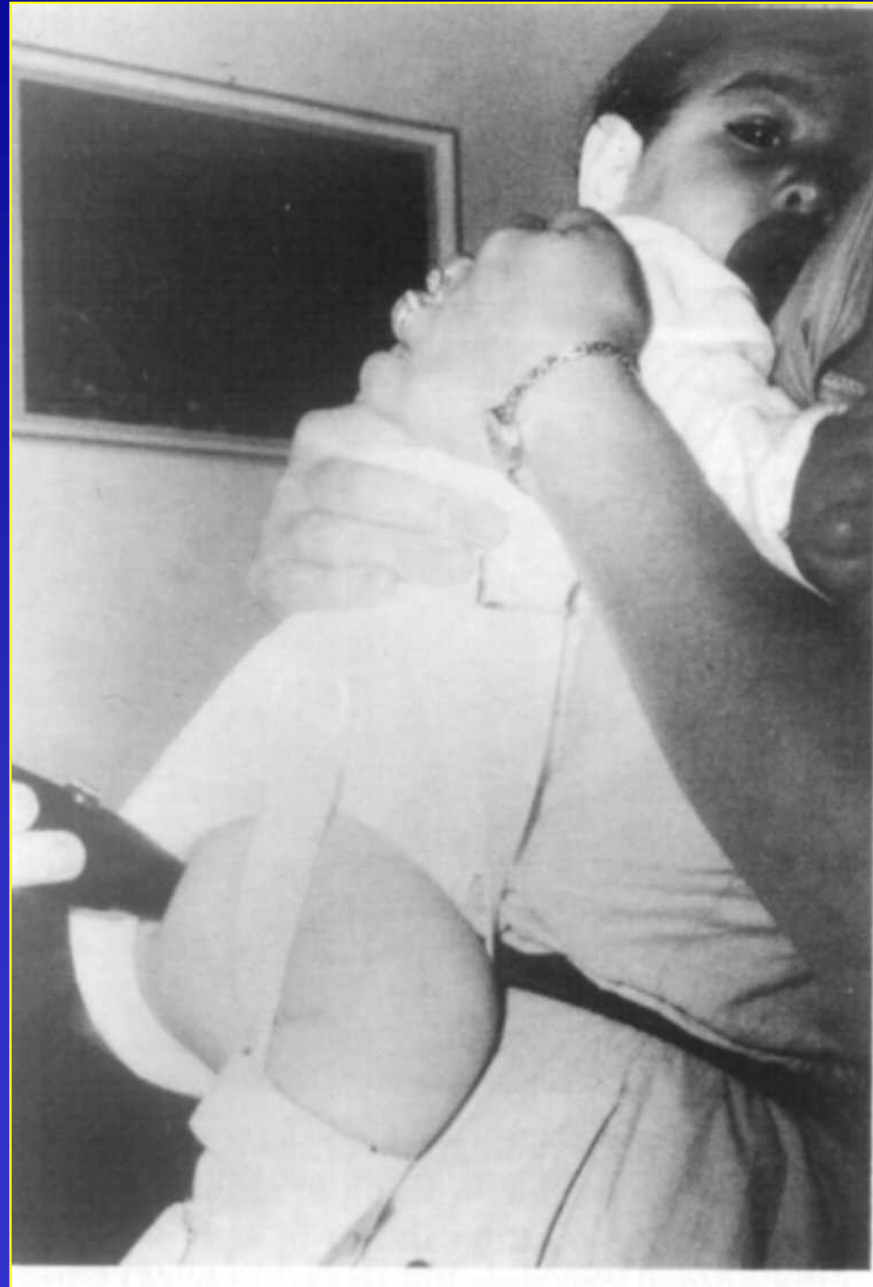
NAME: CHARLES, BRADLEY
I. # 61030
STUDY: HIPS 3MHz
RT. LAT
POST
FLEX 90
INF

APR 16 84
TIME 14: 3:29
SECTOR
DEPTH 7.7 CM
FRAME



59%

0.06



HARCKE'S METHOD

DYNAMIC



**TRANSVERSE
NEUTRAL**



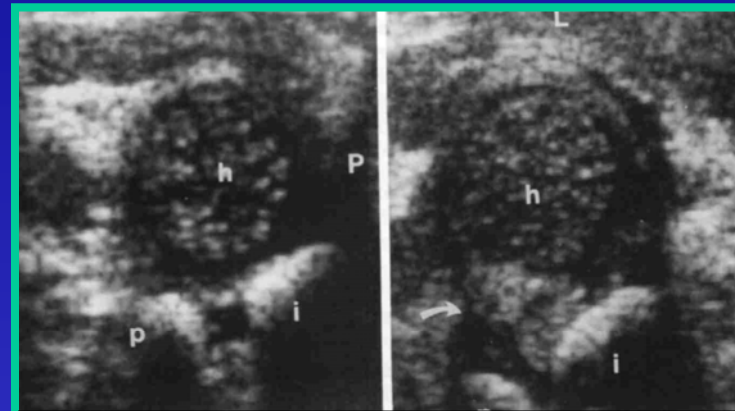
**TRANSVERSE
FLEXION**



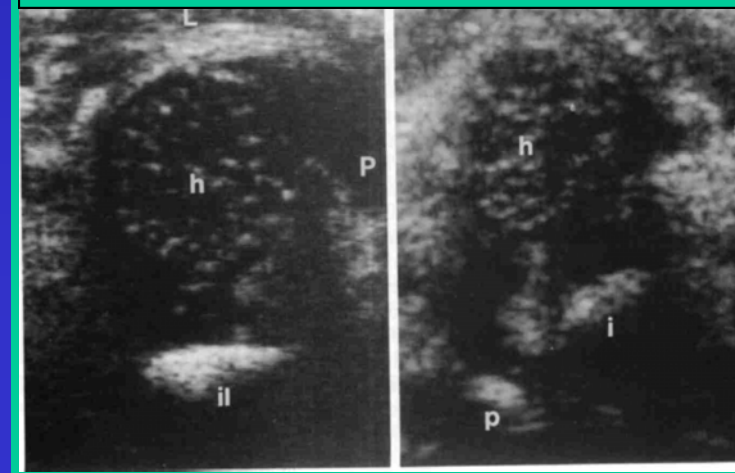
**CORONAL
FLEXION**

HARCKE'S METHOD

DYNAMIC

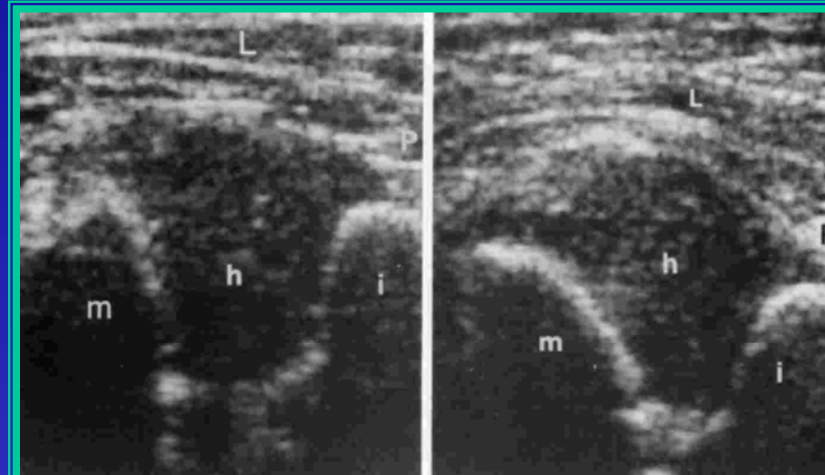
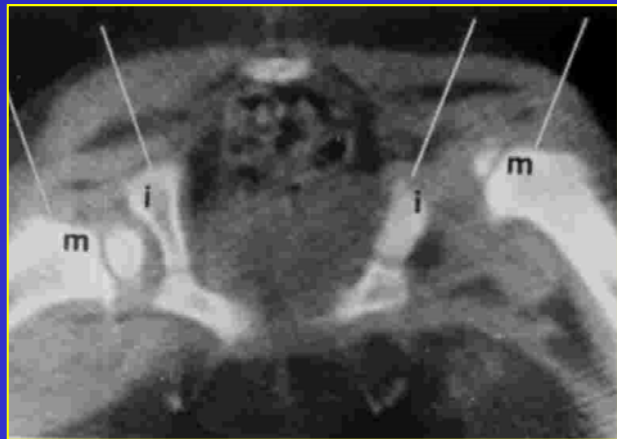


TRANSVERSE NEUTRAL

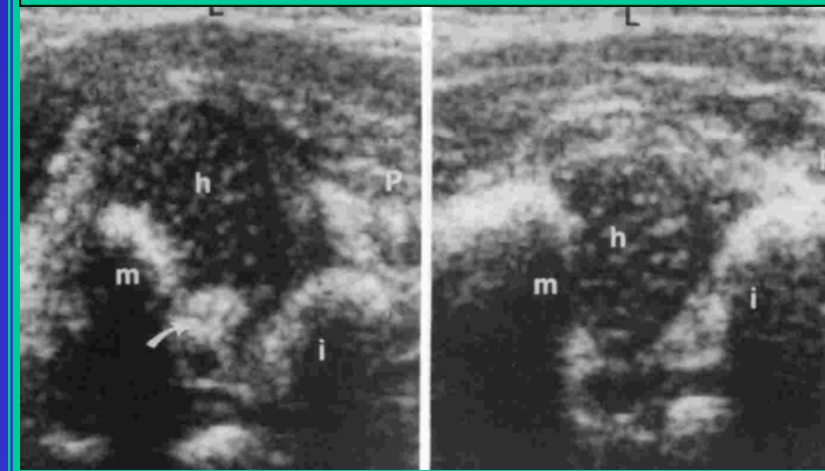


HARCKE'S METHOD

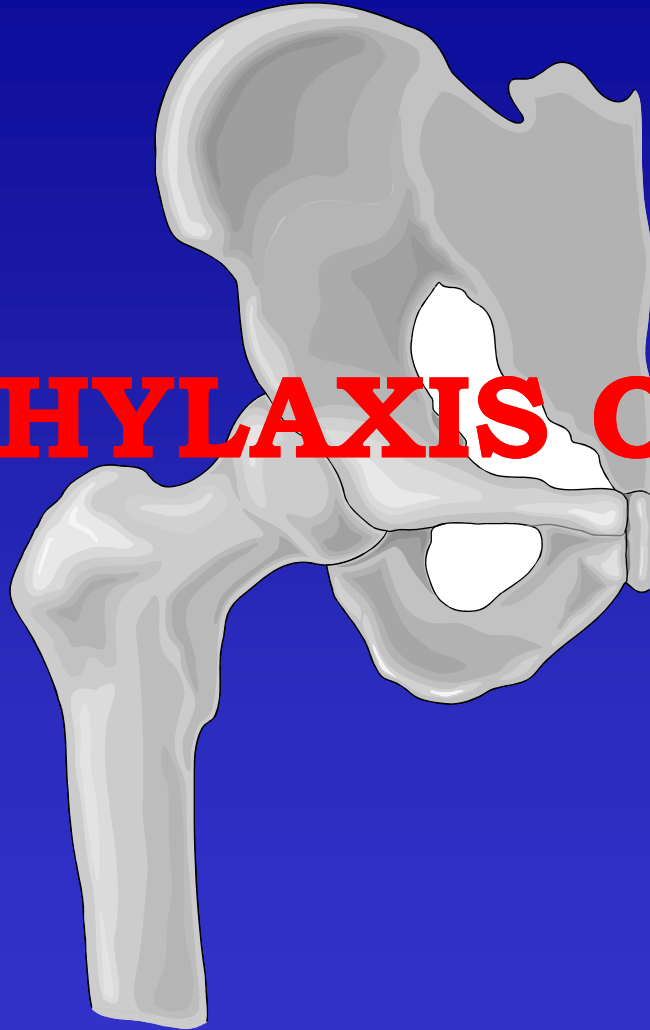
DYNAMIC



TRANSVERSE FLEXION



PROPHYLAXIS OF DDH

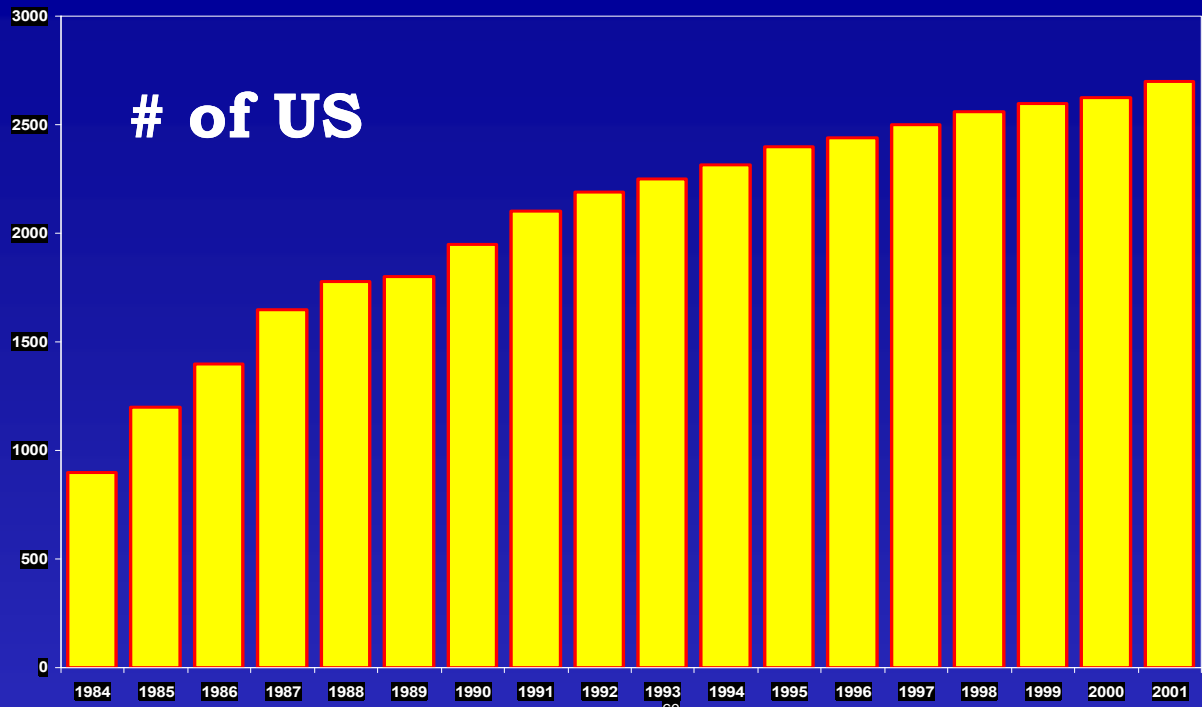


PROPHYLAXIS

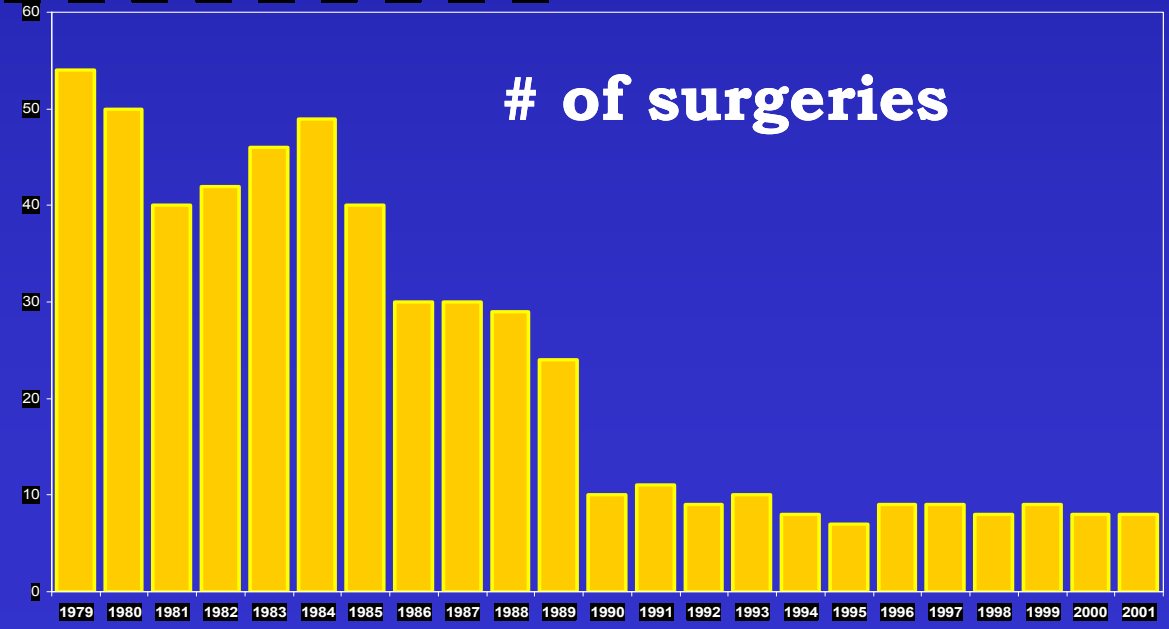
- * **Every child**
- * **Training for US technique**
- * **Information about DDH**

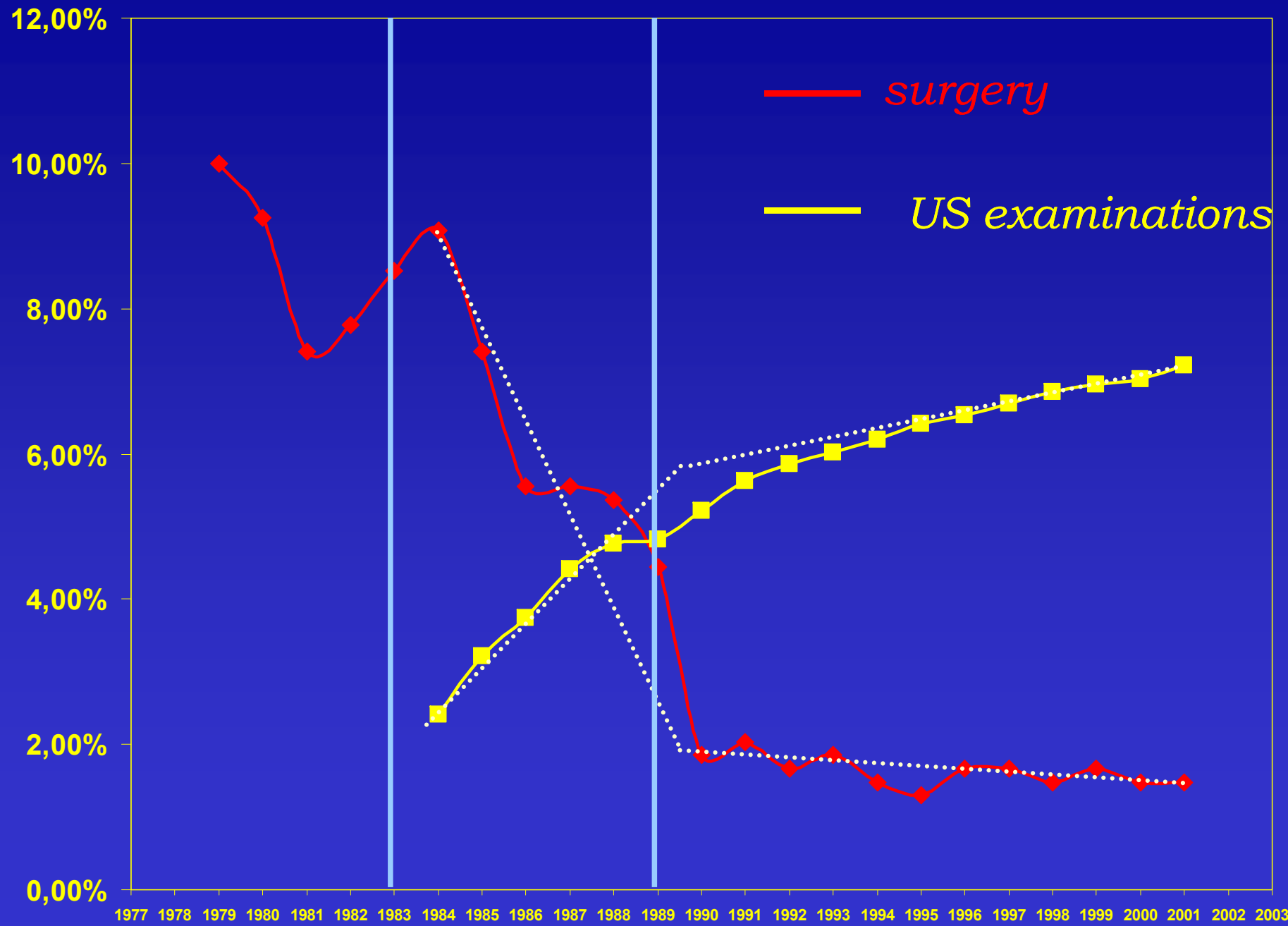
EARLY DIAGNOSIS :

- * **Early treatment**
- * **Easy treatment**
- * **Treatment more friendly for child and family**
- * **Decrease # of surgical cases**

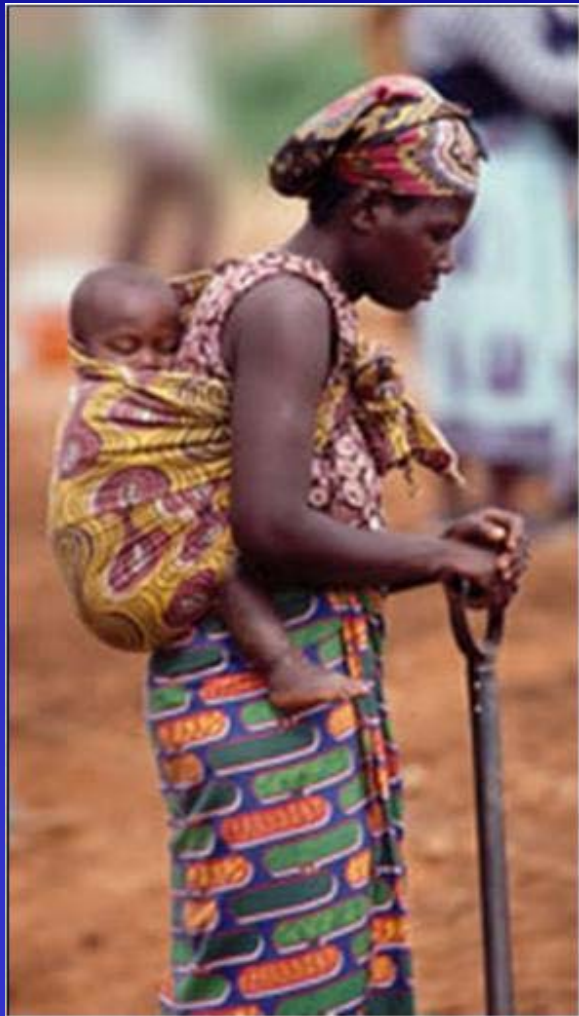


1984-2001
40 000 US
examinations of the
hip joints

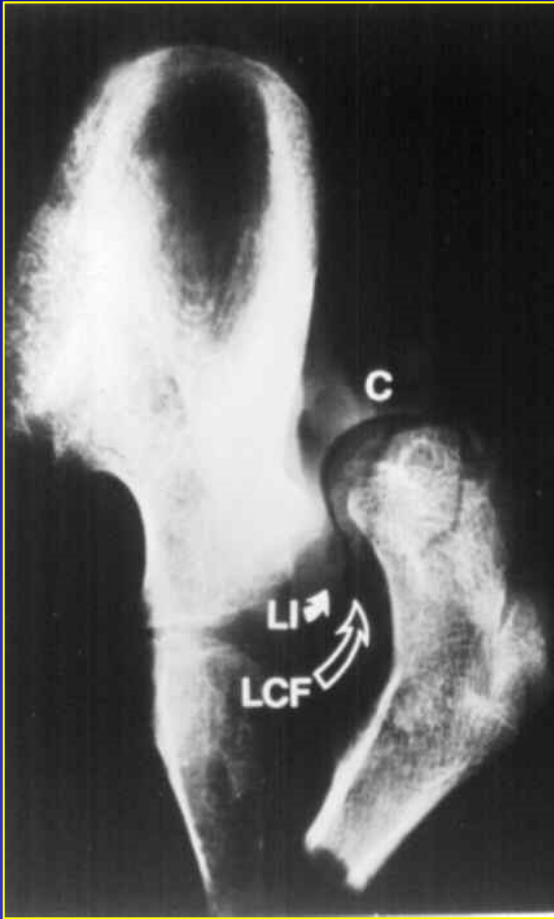




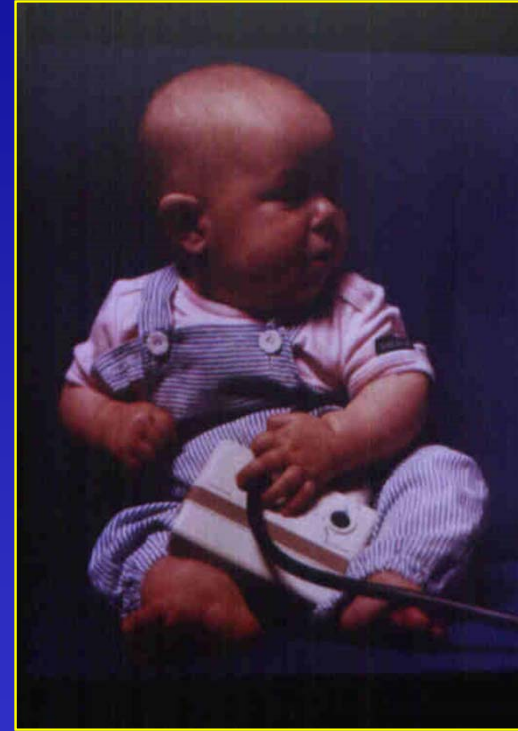
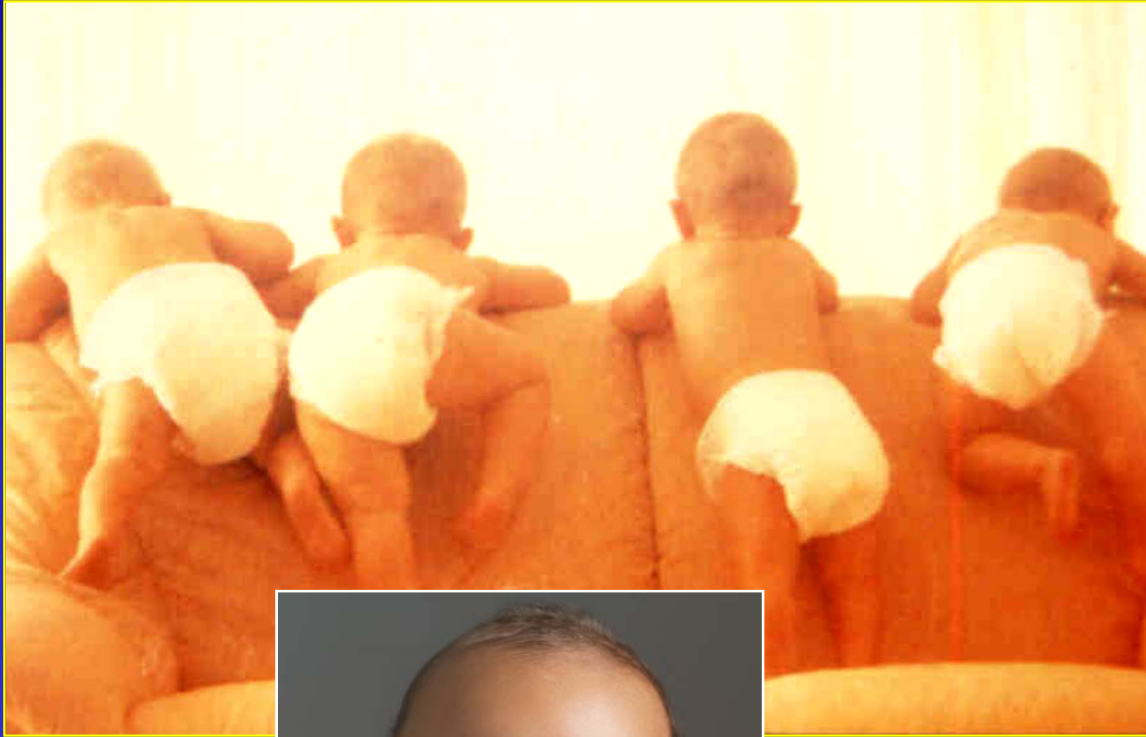
PROPHYLAXIS





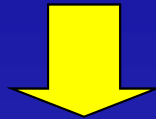


PROPHYLAXIS



DIAGNOSIS

CLINICAL EXAMINATION

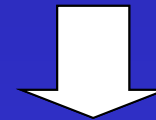


ULTRASOUND = 1 - 3 WEEK



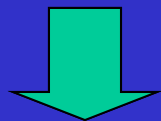
DYSPLASIA

NORMAL



TREATMENT

US AT 4 MONTHS



US MONITORING EVERY 3-4 WEEKS

Hip Ultrasound

- ⇒ **is now a standard in diagnostic procedures of DDH in newborns and infants**
- ⇒ **support clinical examination**
- ⇒ **enable detailed description of the development of the hip joint**



DIAGNOSIS

- *Who should be examined ?*

Every child after birth

Who should be examined by ultrasound :

- 1. Infants with abnormal
physical examination**
- 2. Infants with increased risk
of DDH**

Why ultrasound ???

DDH

without any clinical signs

6 – 8 %

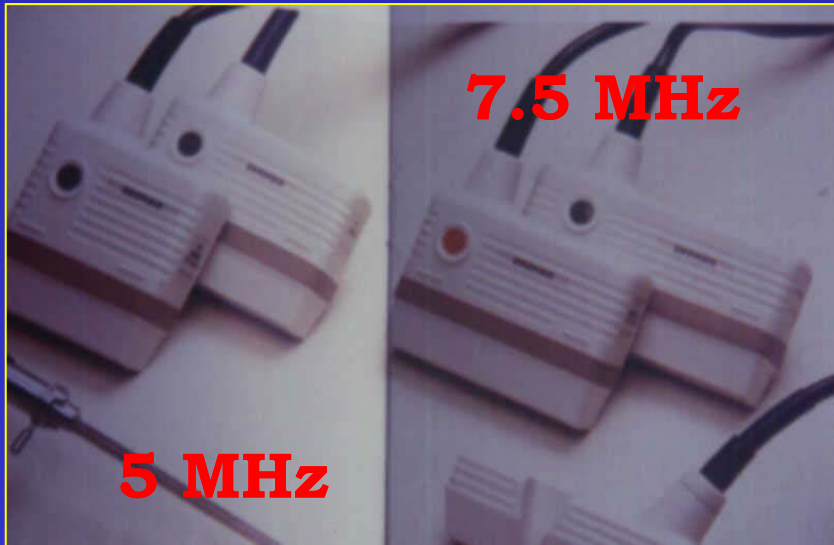
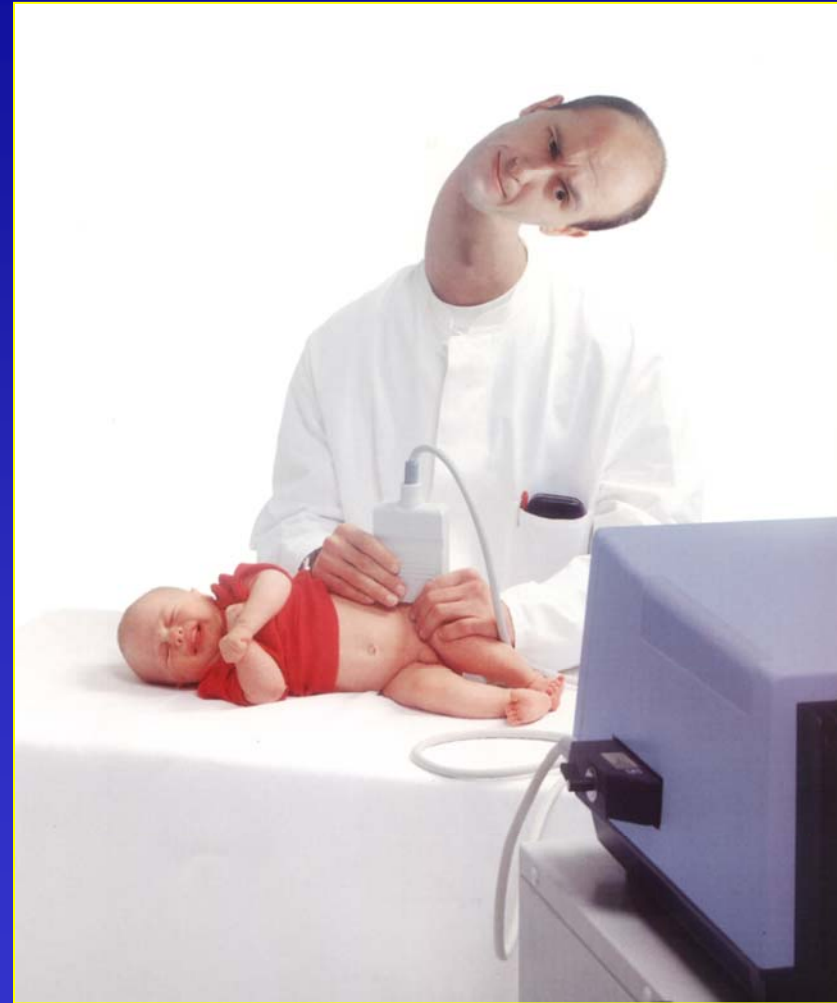
WHY ULTRASOUND ?

- **Early diagnosis**
- **Easy**
- **Not expensive**
- **Differential diagnosis with other hip diseases (synovitis, coxa vara ...)**

Who should perform ultrasound examination ?

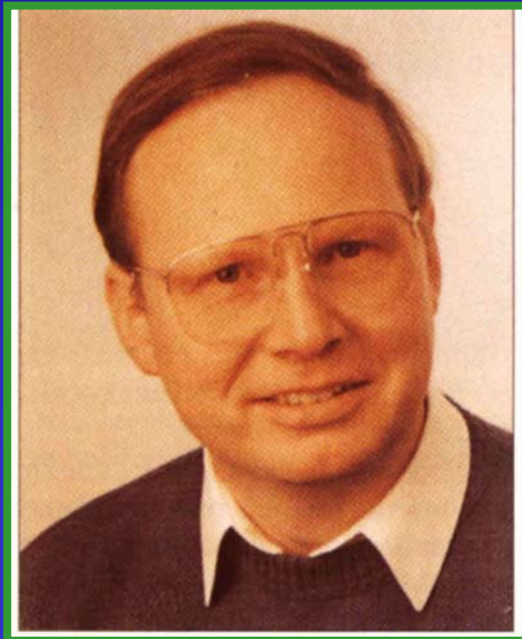
- **Orthopaedic surgeon**
 - **Pediatrician**
 - **Radiologist**

ULTRASOUND EQUIPMENT



*Different
US techniques*

Reinhard GRAF



1978

Austria

Graf in Austria

Gomes in France

Dalström in Sweden

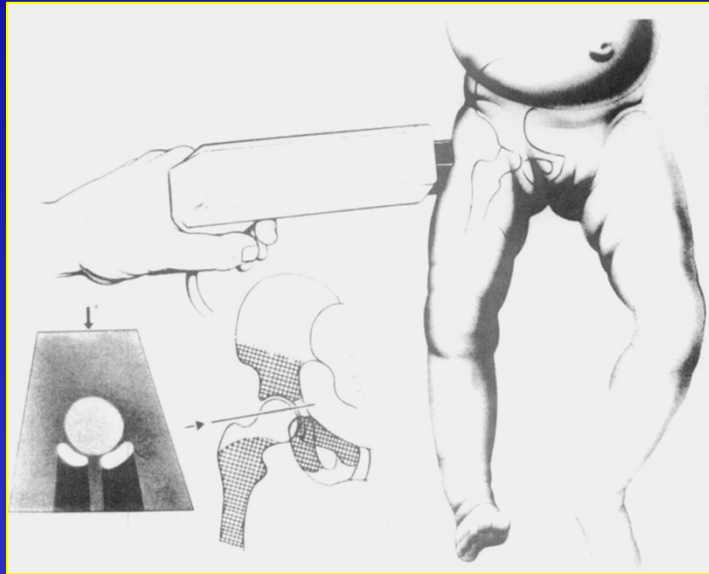
Terjesen in Norway

Harcke in the USA

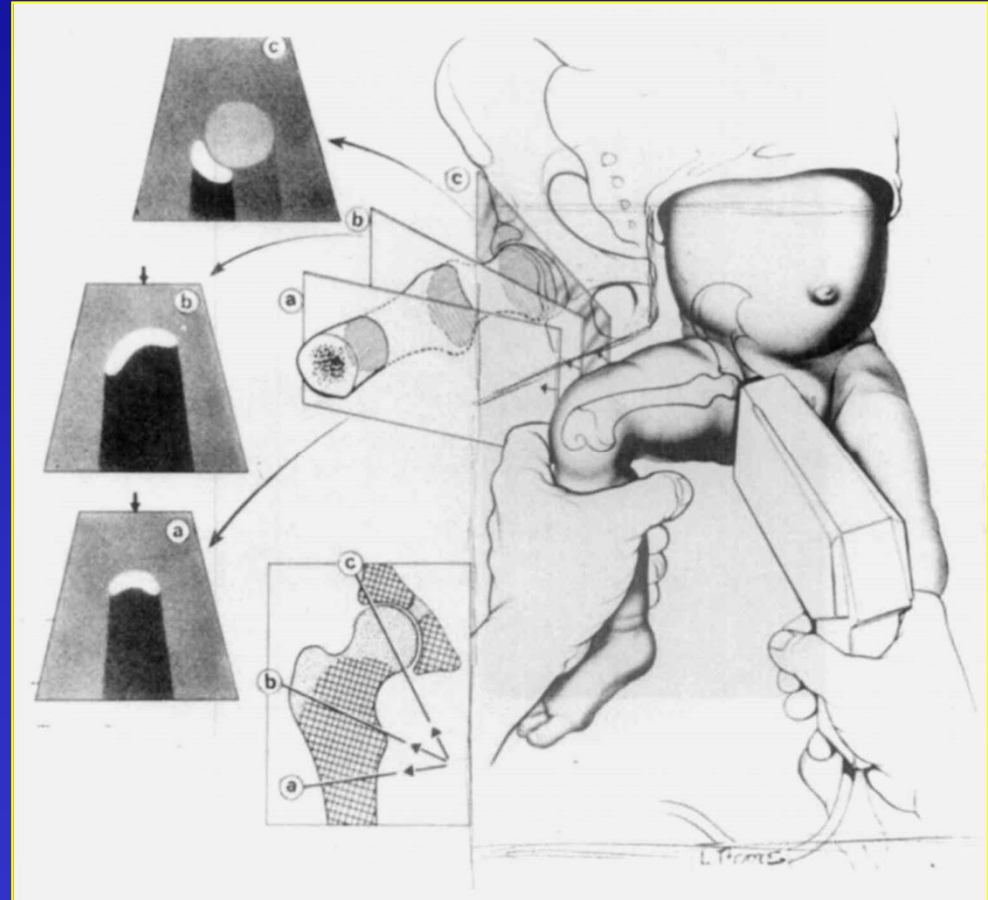
Novick in the USA

Suzuki in Japan

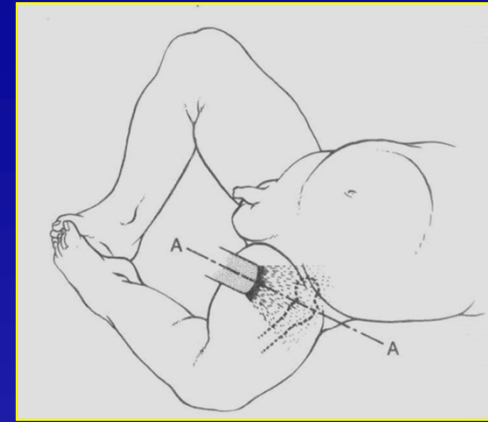
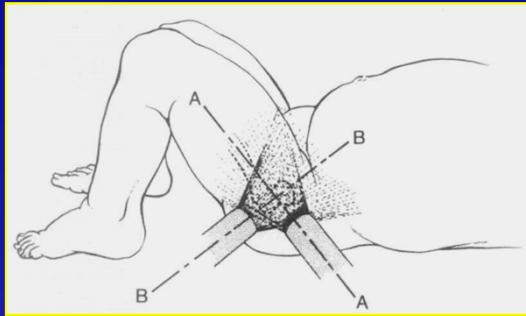
US technique



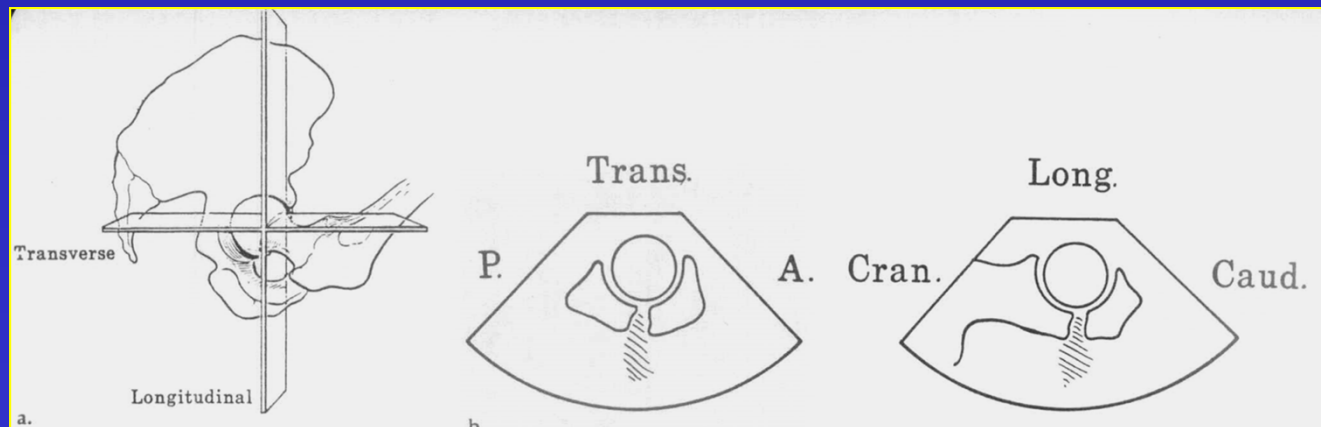
Gary Novick New Haven, CT



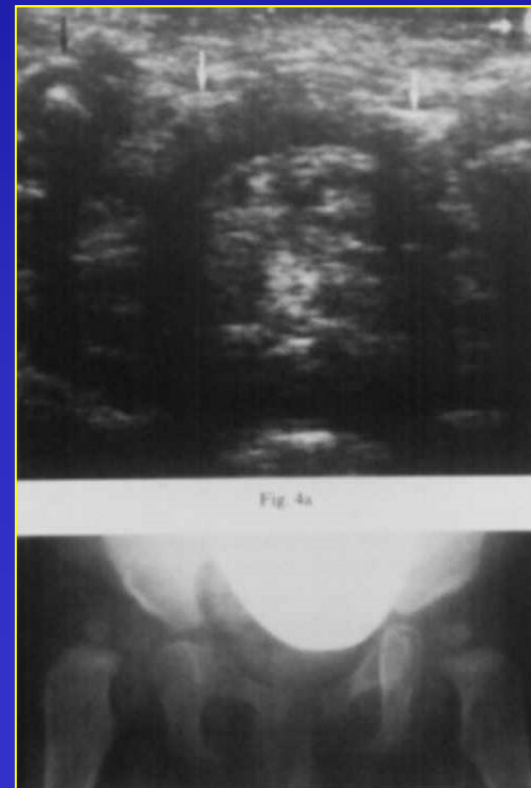
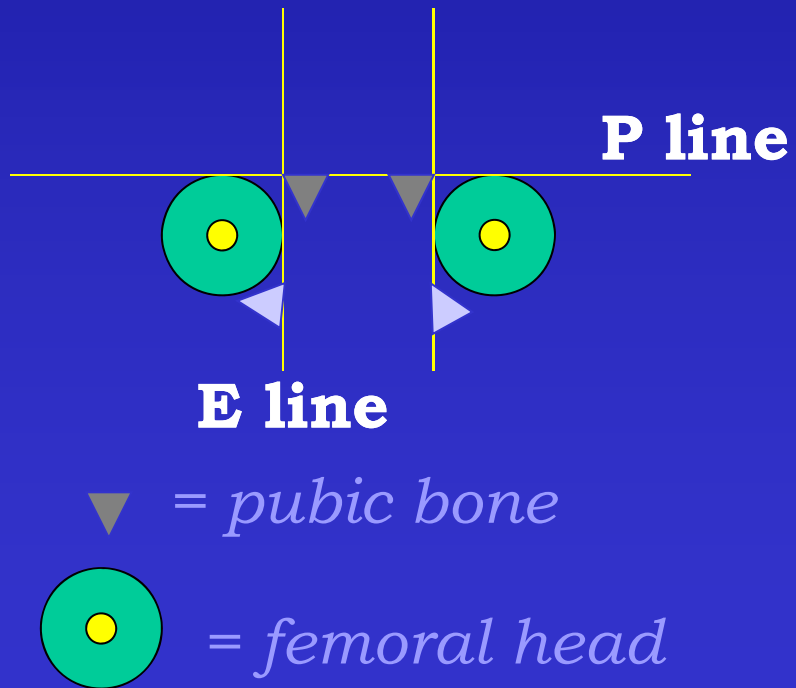
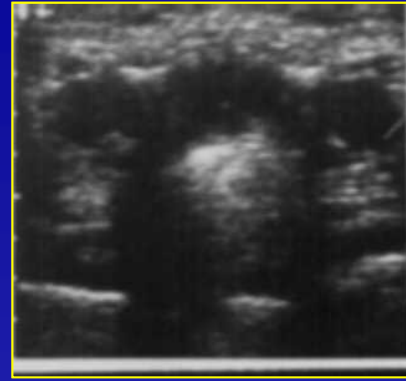
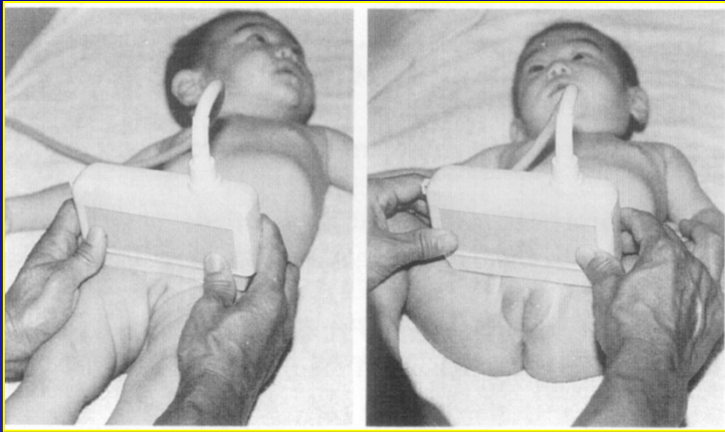
US technique



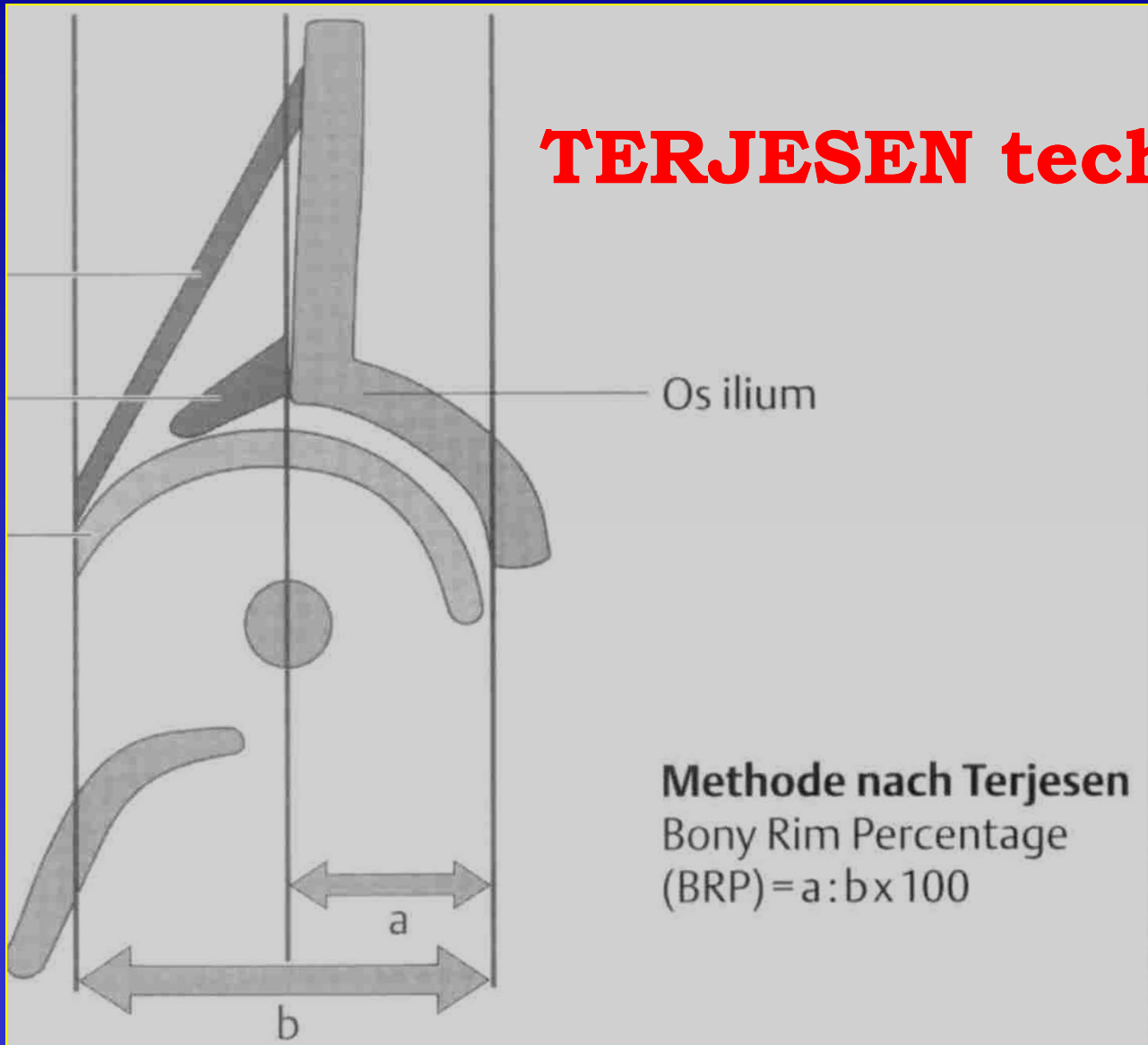
Schwenkter - PA



US technique

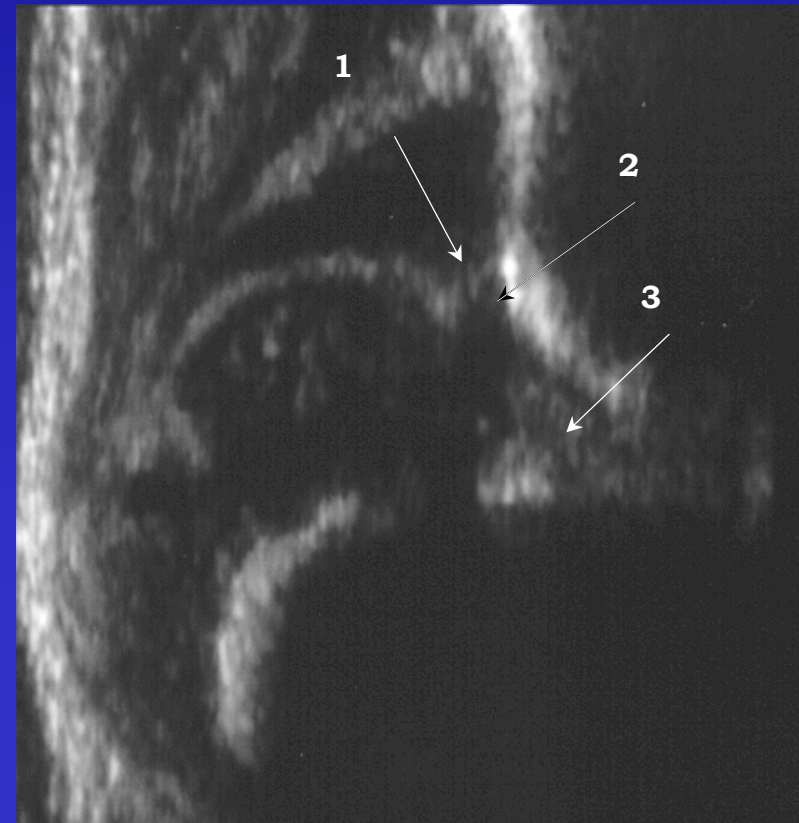
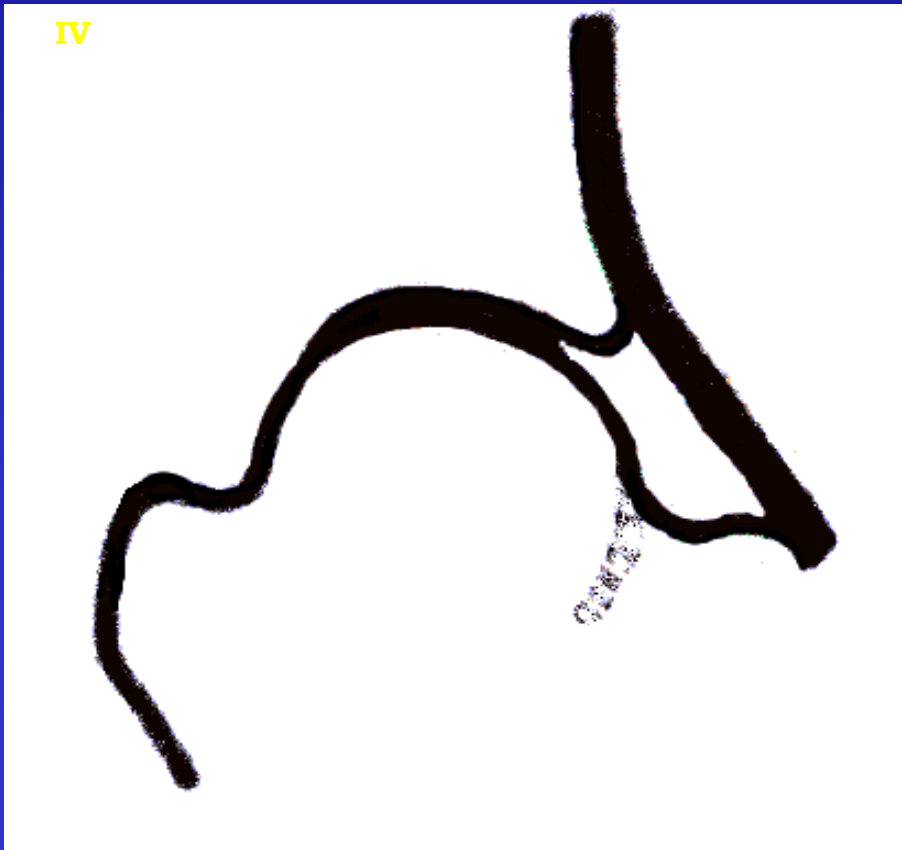


TERJESEN technique

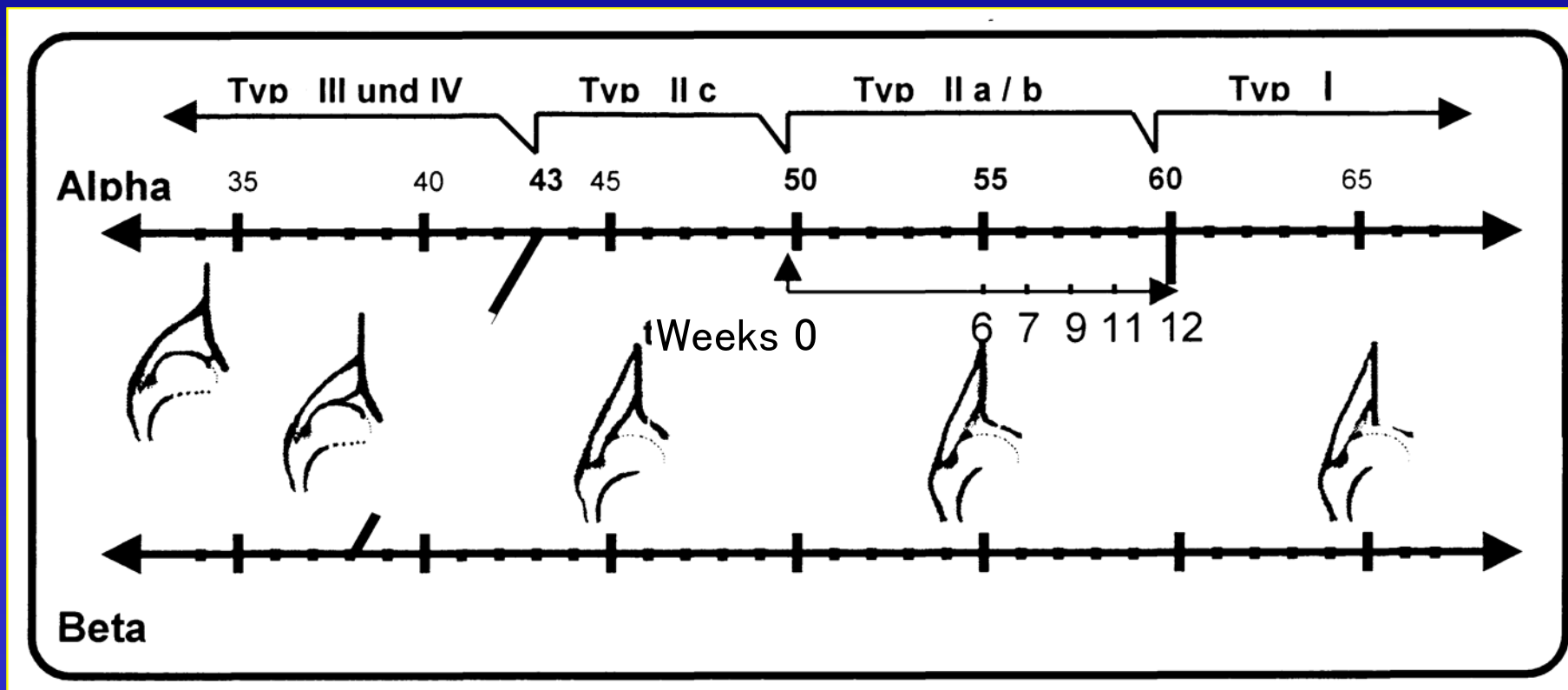


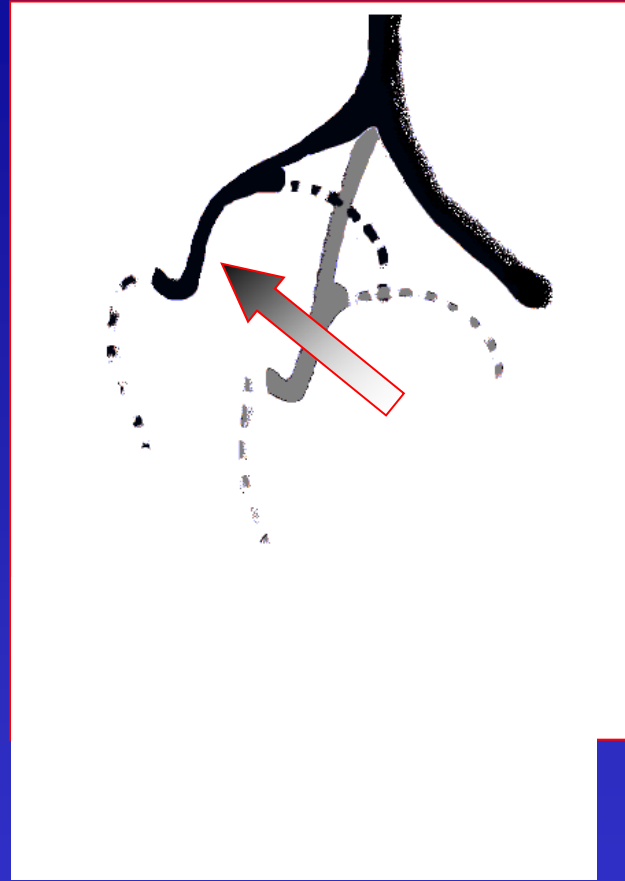
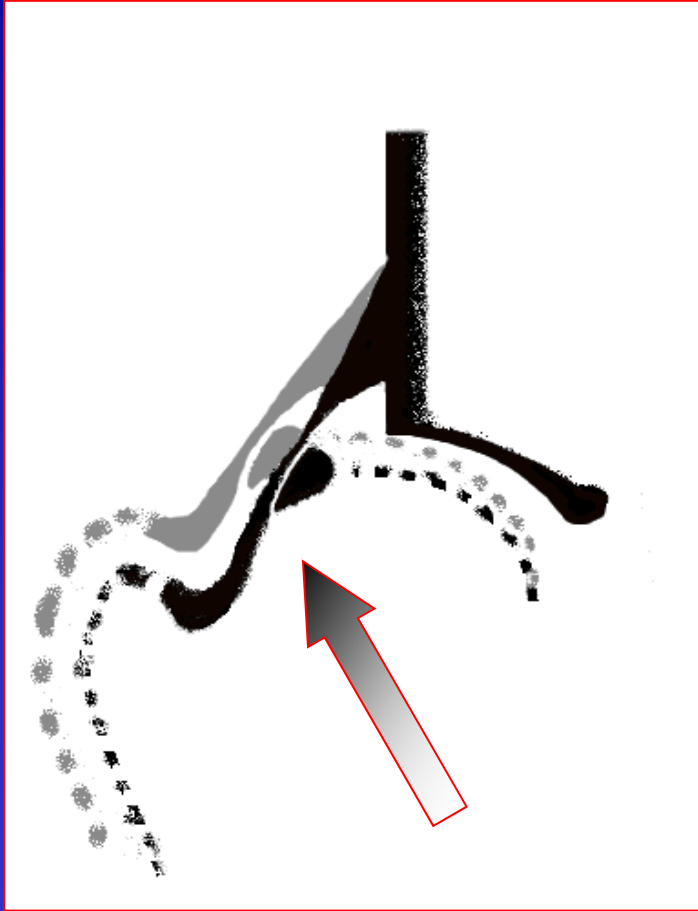
TYPE IV

dislocation



SONOMETER





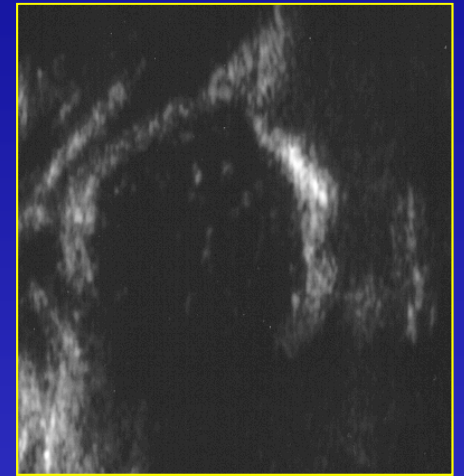
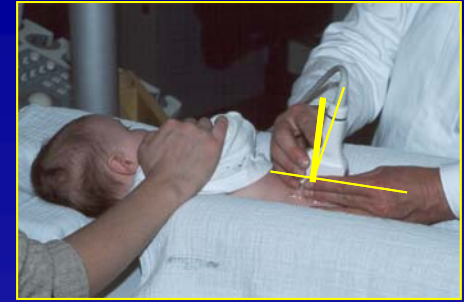
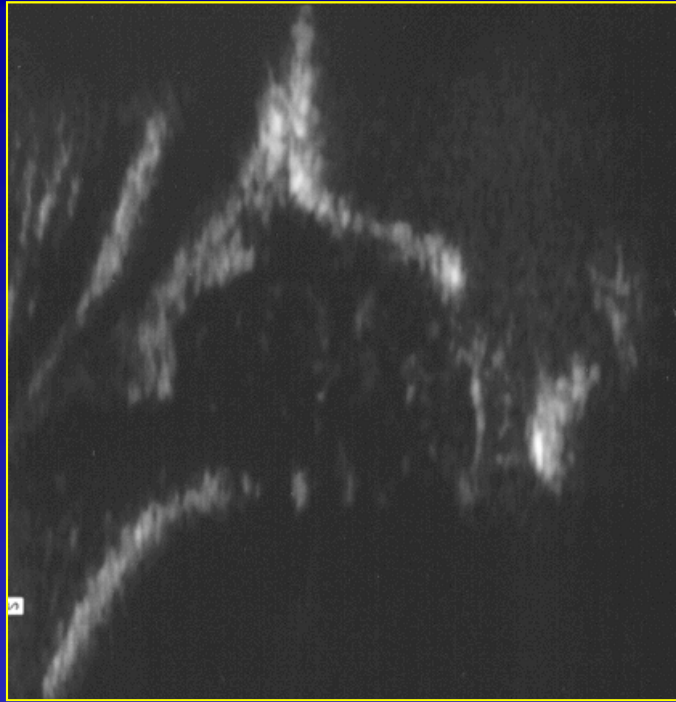
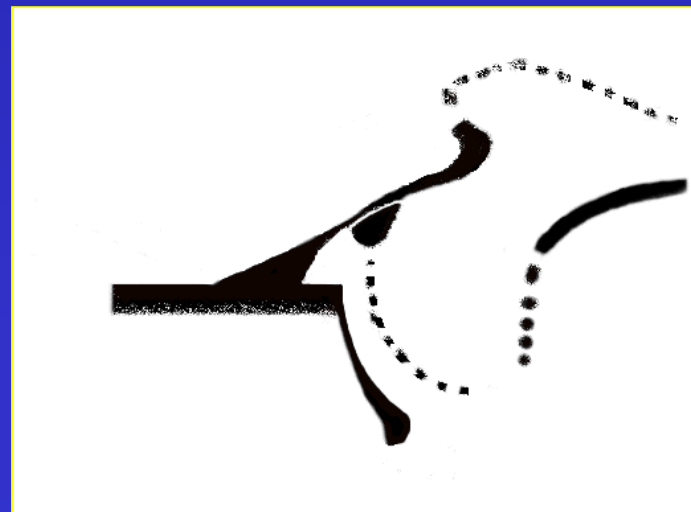
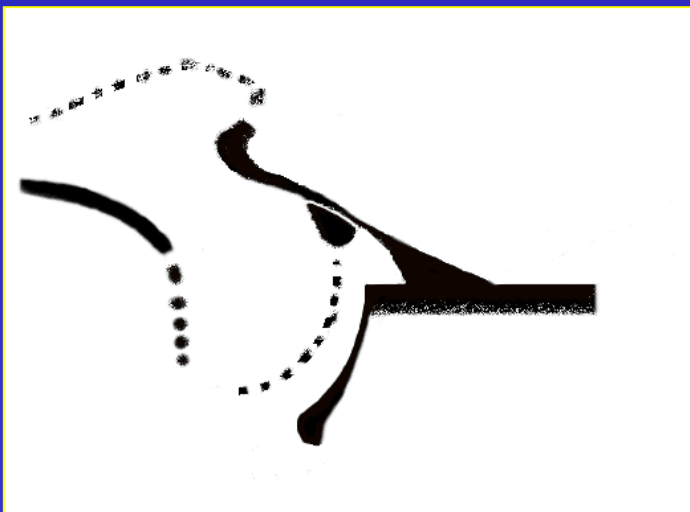
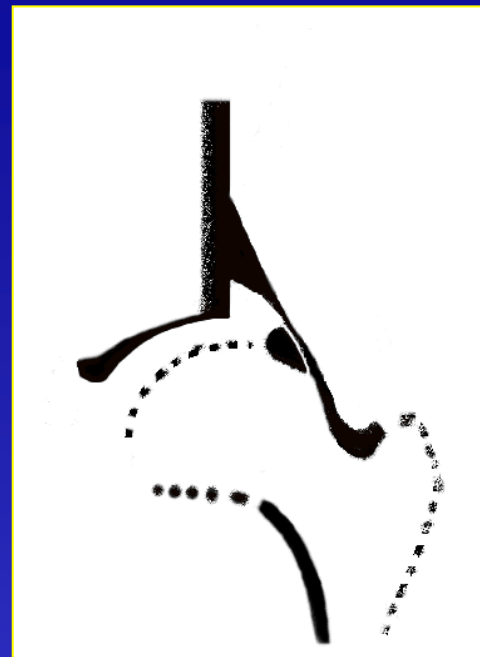
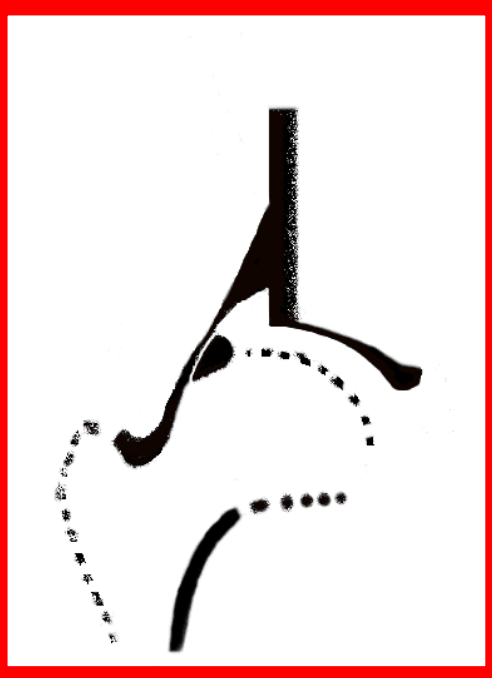
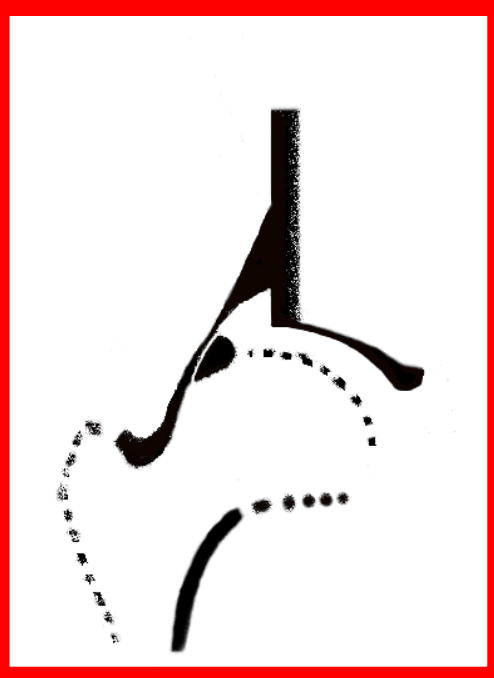


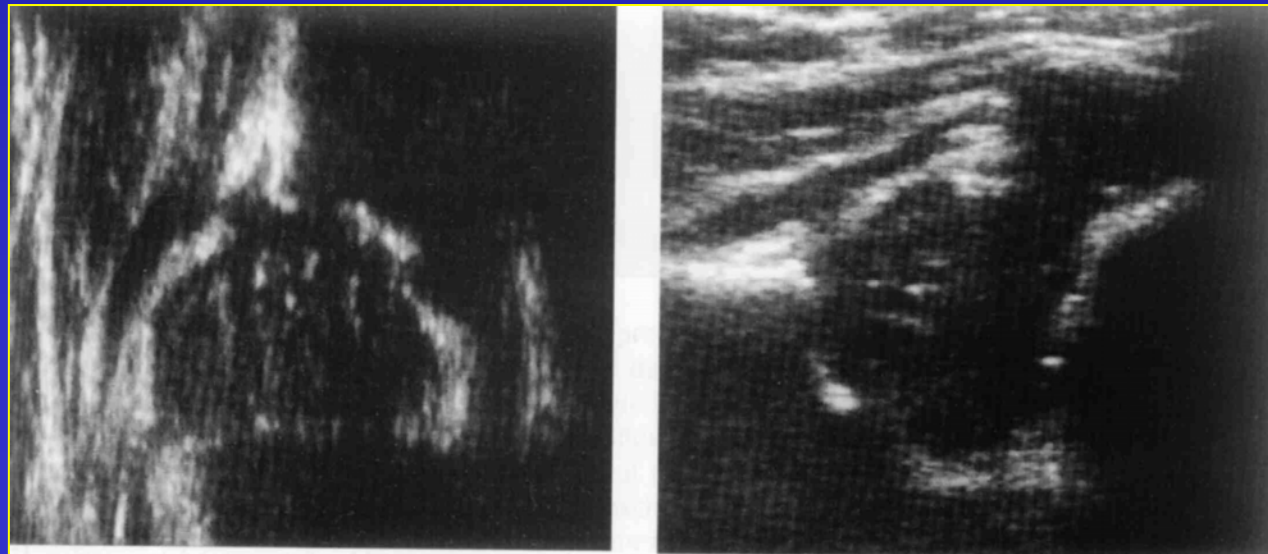
Image projection





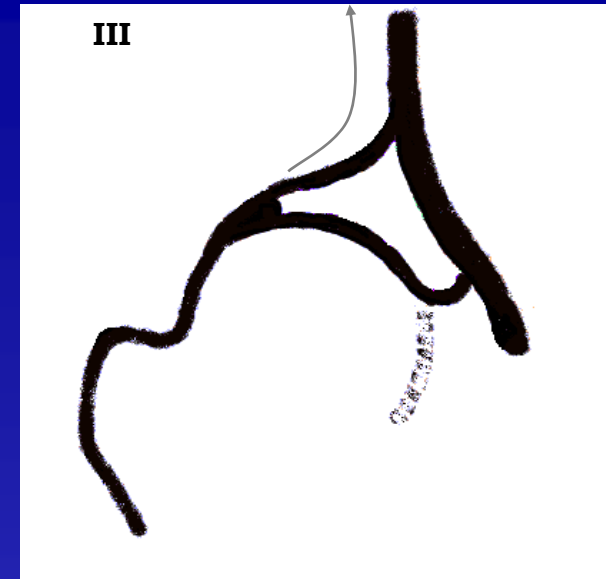
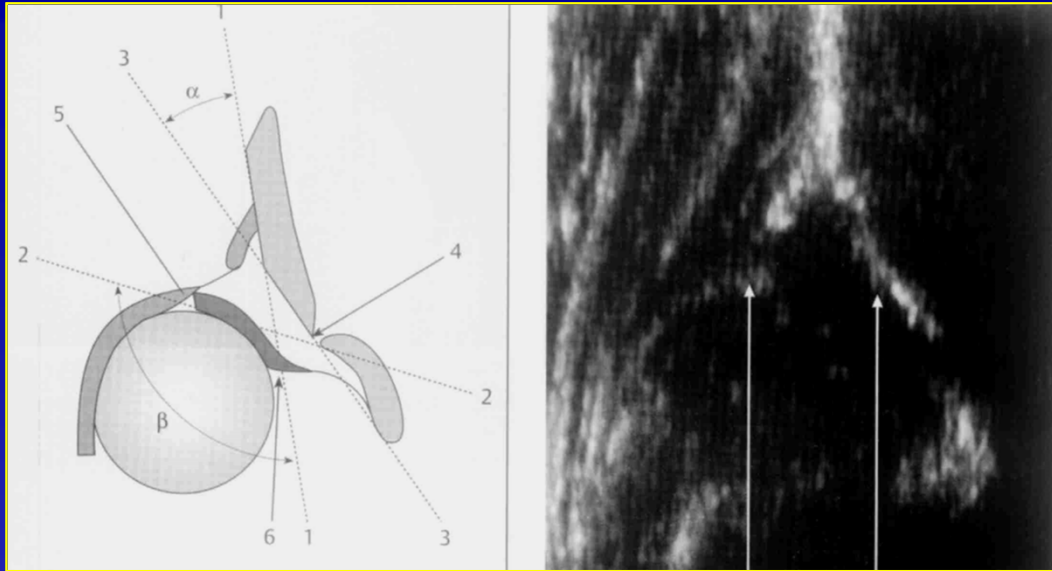
Researchers have shown that this projection is most easily interpreted by brain.

AP view of the right hip.

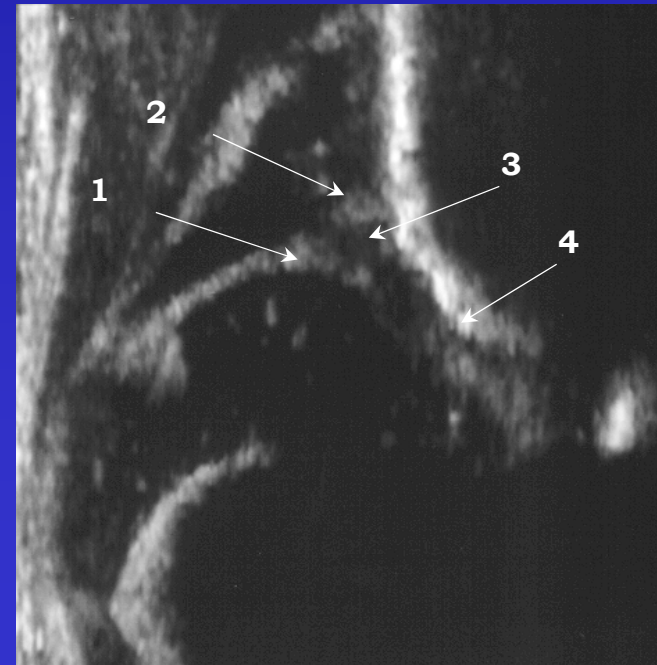
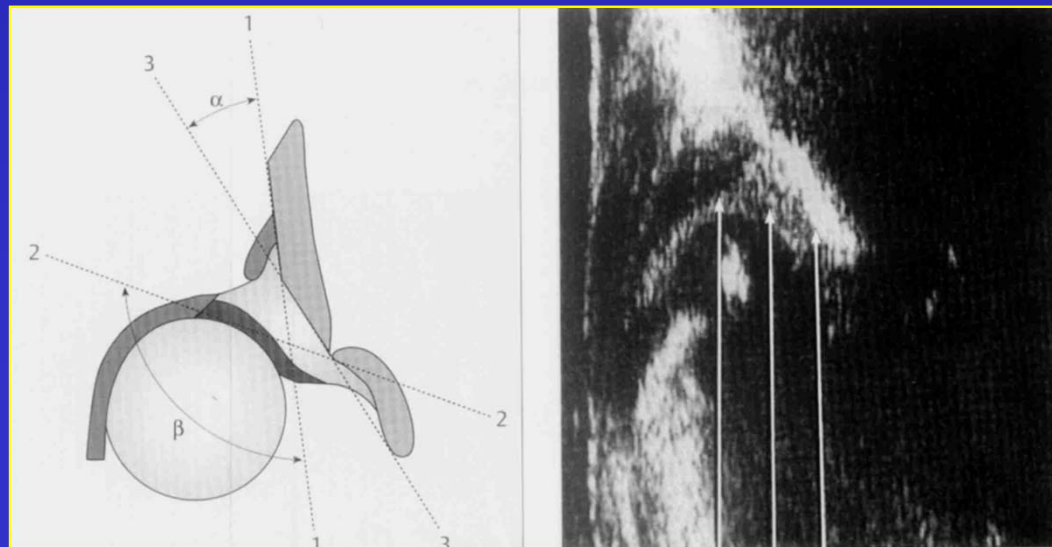


Anatomic projection

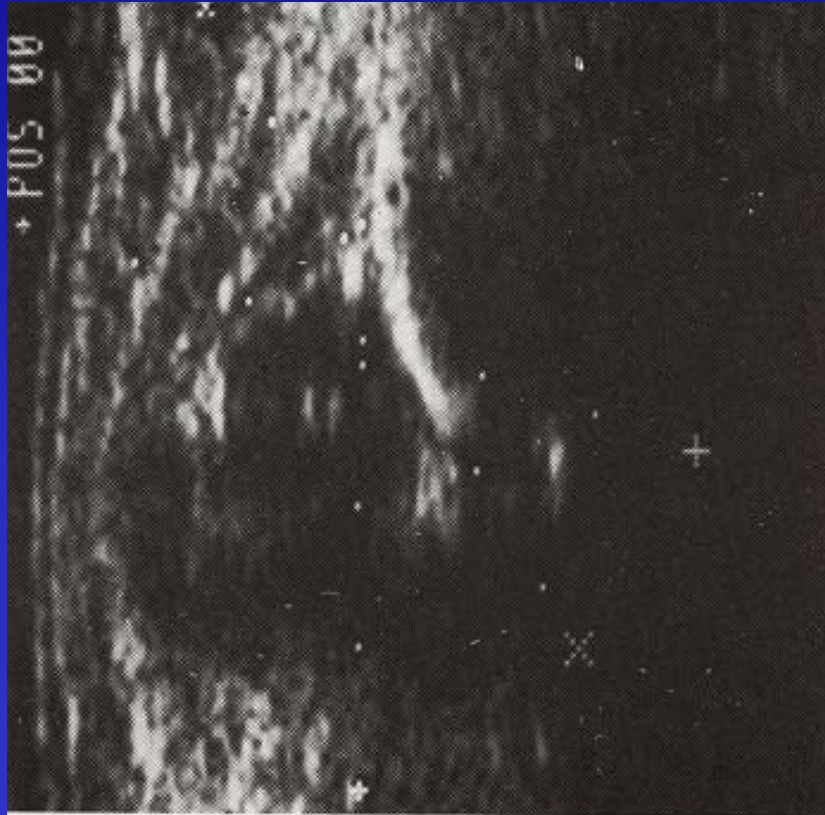
Sonographic projection



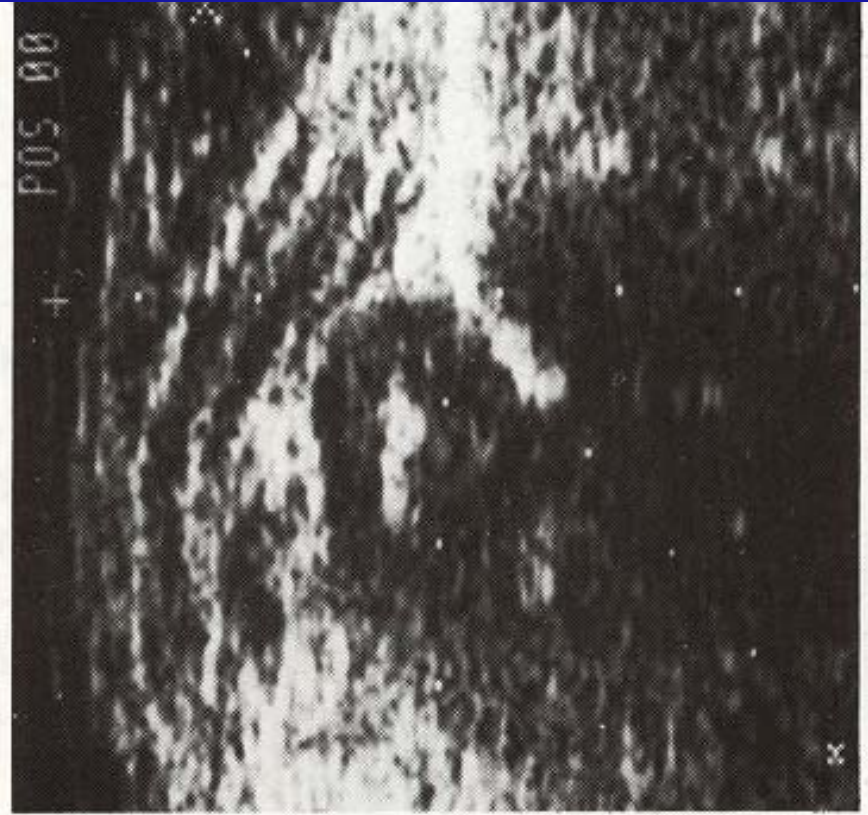
TYPE III

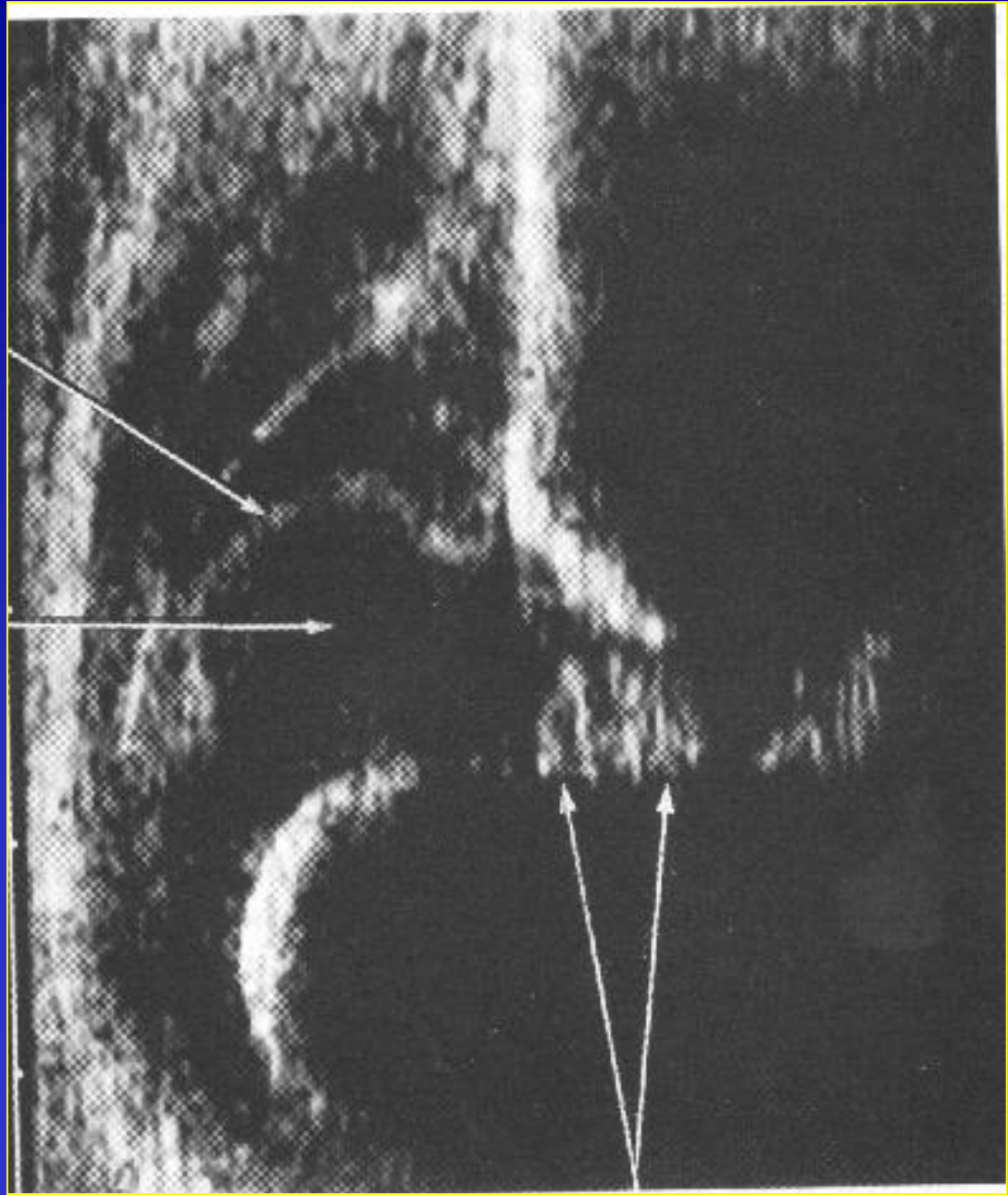


DYSPLASTIC HIP TYPE III



DYSPLASTIC HIP





1993 Graf & Harcke proposed combined examination

Dynamic Standard Minimum Examination

Principles :

- 1. Hip should be examined at rest and when stressed** (*in the coronal plane at rest and in the transverse plane with stress*)
- 2. Assessment should include views in orthogonal planes**
- 3. Assessment should include both stability and morphology**

MATERIAL

- **45 000** NEWOBURNS AND INFANTS
- 1984 - 2003
- FEMALE : MALE = 3 : 2
- **US TECHNIQUES** :
 - GRAF'S & HARCCKE'S METHOD
 - SIEMENS SL 2
 - LINEAR TRANSDUCER - 7.5 & 5 MHz
 - DYNAMIC EXAMINATION FOR HIP STABILITY

MATERIAL

- ***SPECIAL ATTENTION TO :***
 - **FAMILY HISTORY OF DDH**
 - **BREECH DELIVERY**
 - **CLINICAL SIGNS OF DDH**
 - **MOTHER DISEASES DURING PREGNANCY**

MATERIAL

- **THE DDH WAS
DIAGNOSED IN 5% OF
ALL EXAMINED
CHILDREN**

MATERIAL

- **GRAF'S TYPE OF DYSPLASYIC HIP:**

– **II** = **75%**

– **D** = **8%**

– **IIIa** = **6%**

– **IIIb** = **4%**

– **IV** = **7%**



children outside the city

MATERIAL

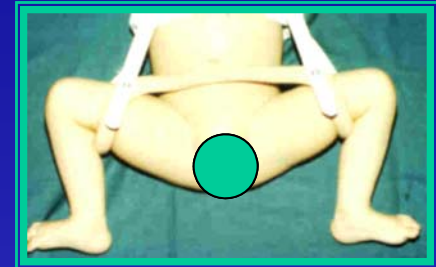
- **80% girls**
- **20% boys**

TIME OF HIP REBUILDING

- **TYPE II** = 4- 6 WEEKS
- **TYPE D** = 6-12 WEEKS
- **TYPE IIIa** = 8-14 WEEKS
- **TYPE IIIb** = 10-16 WEEKS
- **TYPE IV** = 12-24 WEEKS

MATERIAL

- **TREATMENT OPTIONS :**
 - PILLOWS
 - PAVLIK HARNESS
 - ABDUCTION-FLEXION DEVICES
 - OVERHEAD EXTENSION
 - CLOSED REDUCTION



TIME OF HIP REBUILDING

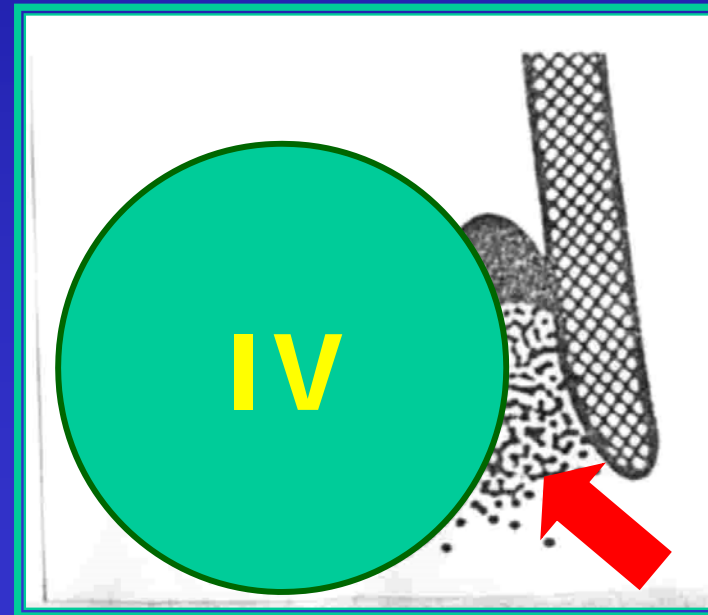
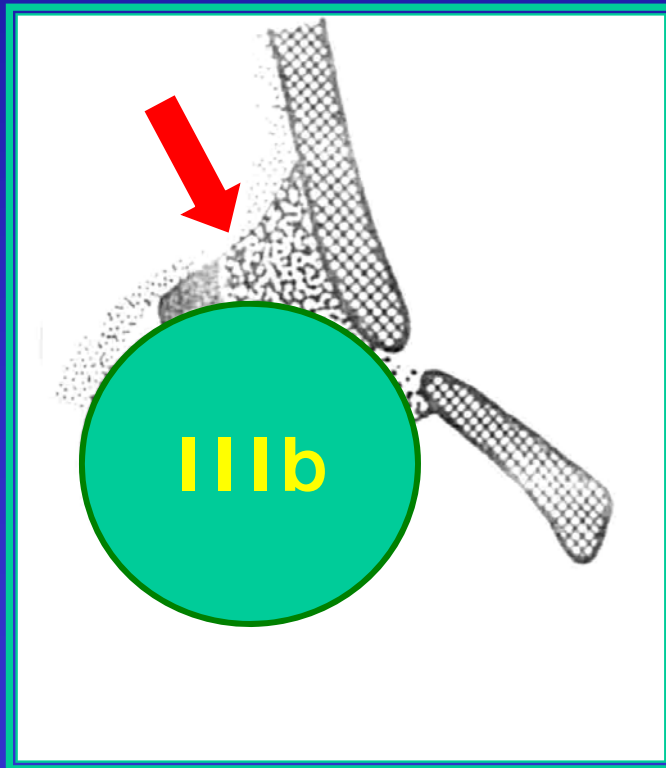
TYPE IIIb = 10-16 WEEKS

TYPE IV = 12-24 WEEKS

**5% OF CHILDREN FROM THESE
GROUPS
REQUIRED SURGERY**

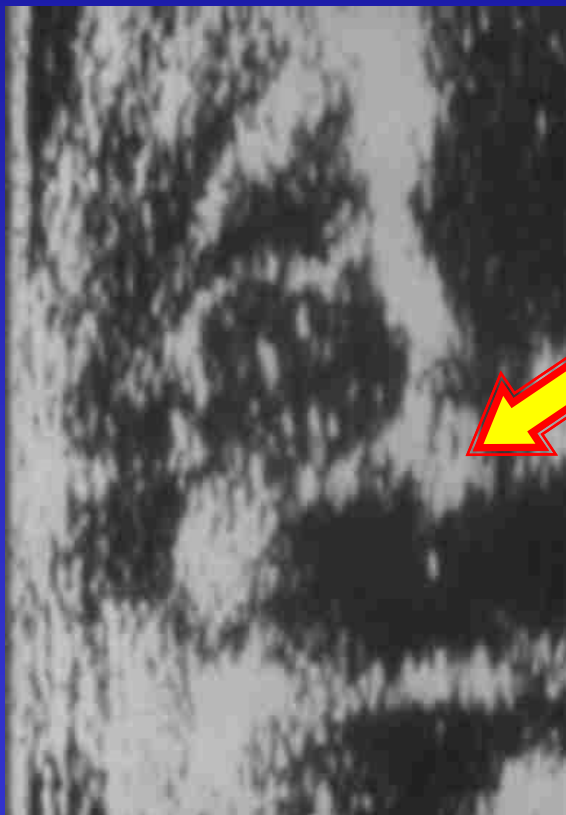
TIME OF HIP REBUILDING

PROBLEMS WITH HIP REDUCTION

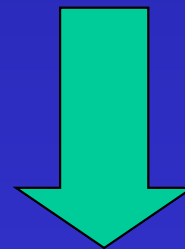


HIP REBUILDING

Type IV



No reduction obtained



Scheduled for surgery

3 months

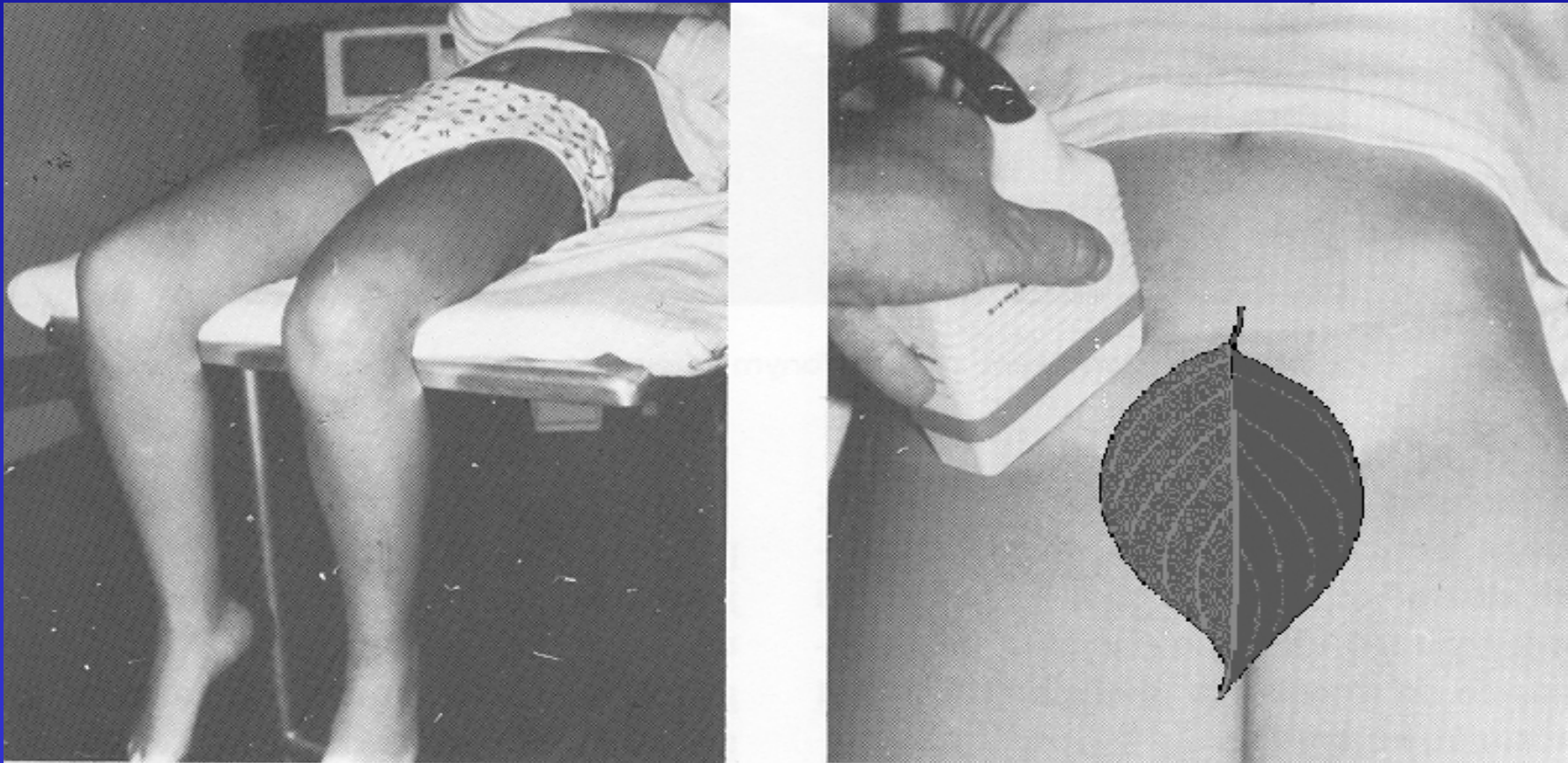
CONCLUSIONS

- **US EXAMINATION IS VERY USEFUL IN THE EARLY DIAGNOSIS OF DDH**
- **US MONITORING ENABLED PROPER TREATMENT**
- **THANKS US DIAGNOSIS THE NUMBER OF CASES WHICH REQUIRED SURGERY SIGNIFICANTLY DECREASED**

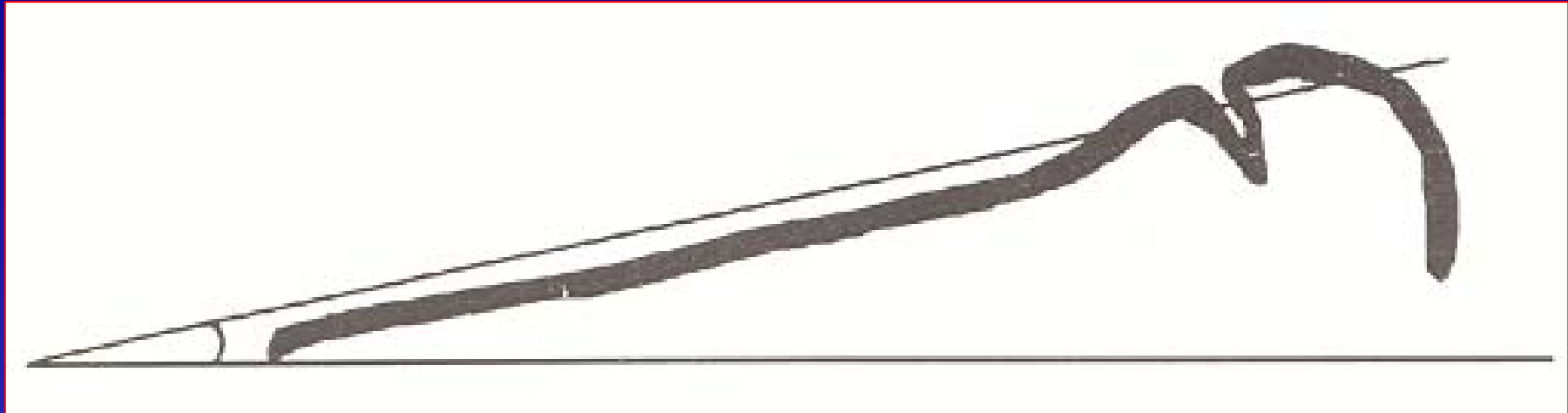
MOTTO :

**Better Ultrasound today
than a limp tomorrow !**

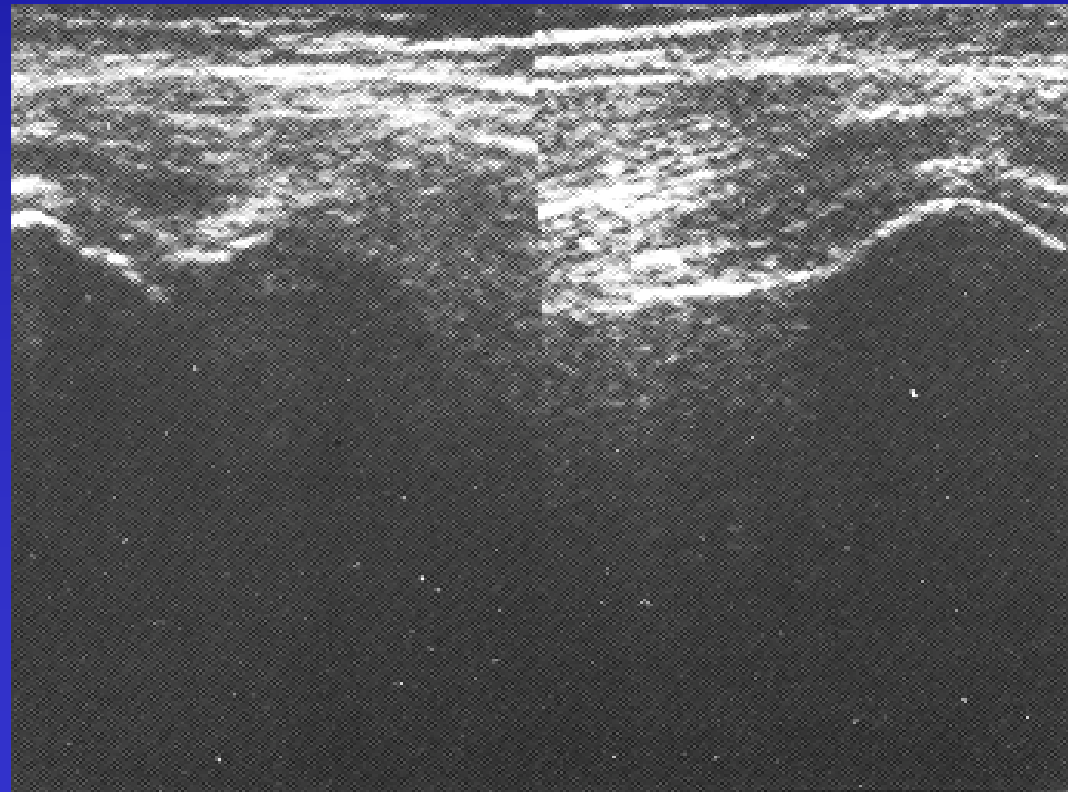
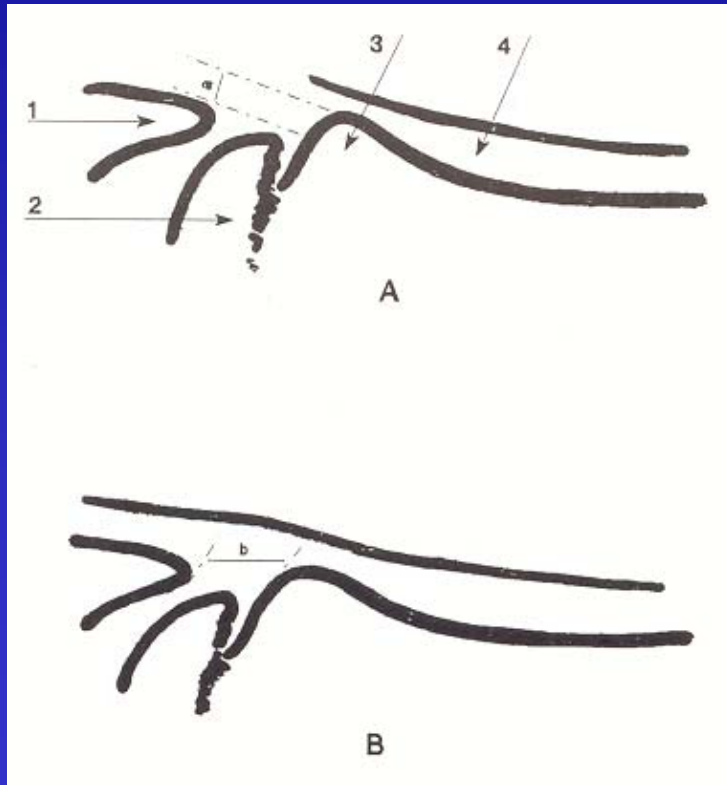
Evaluation of the hip joint in measuring of the antetorsion angle



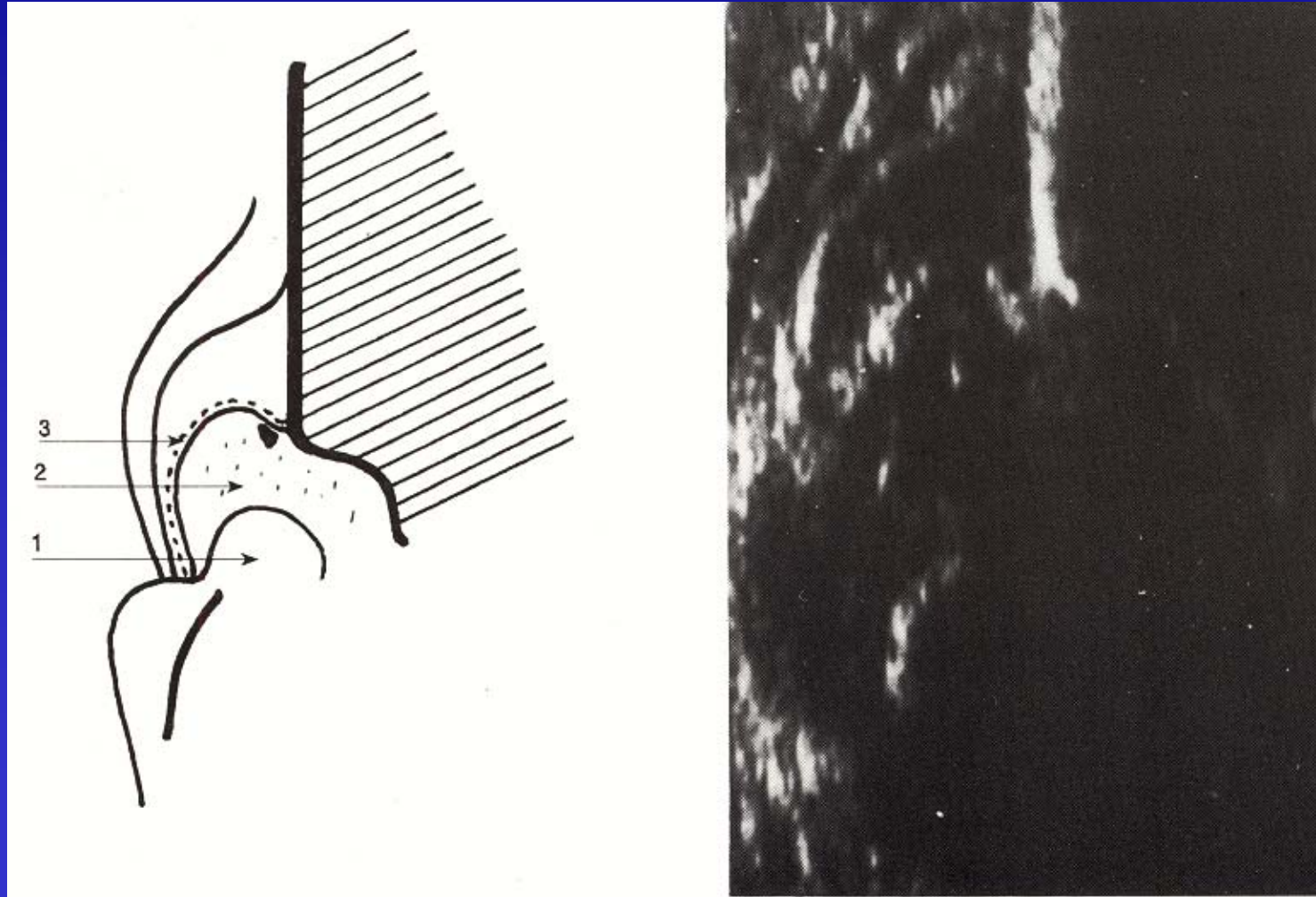
Evaluation of the hip joint in measuring of the antetorsion angle



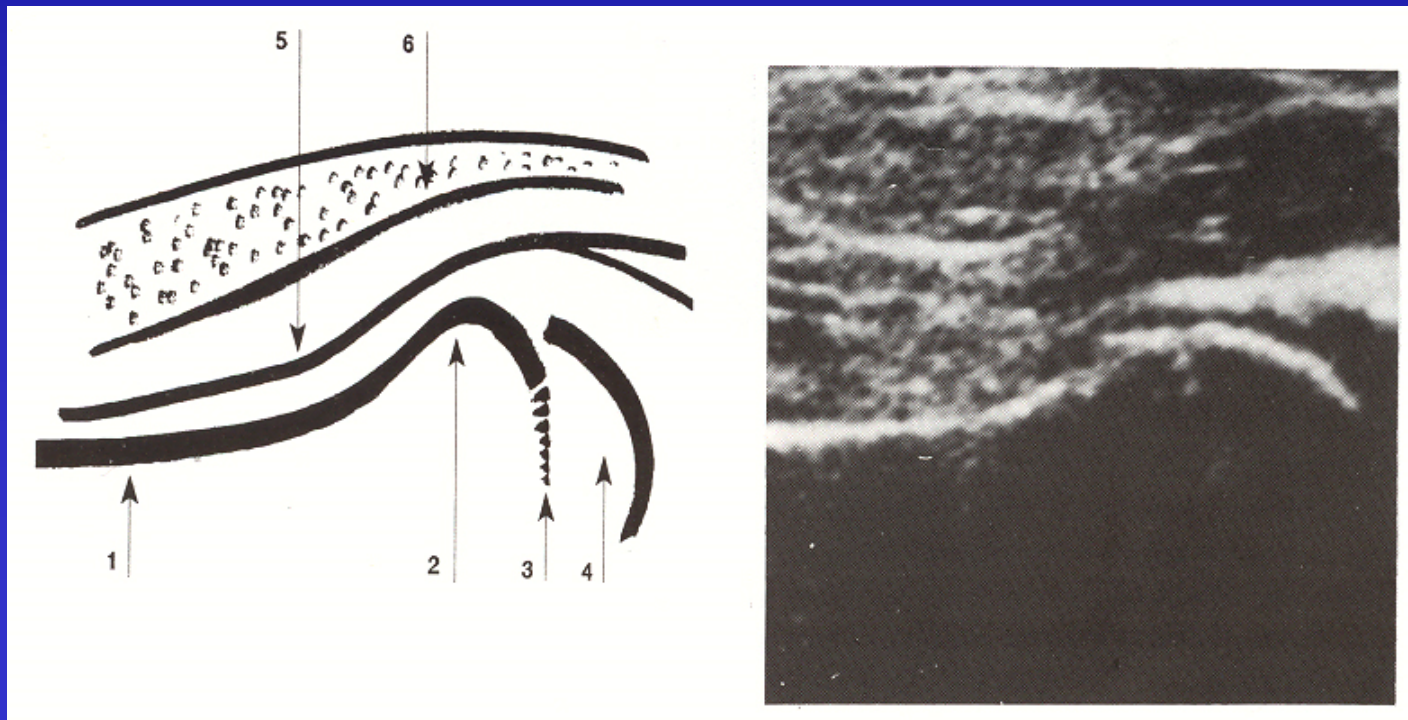
Ultrasound application in evaluation of SCFE



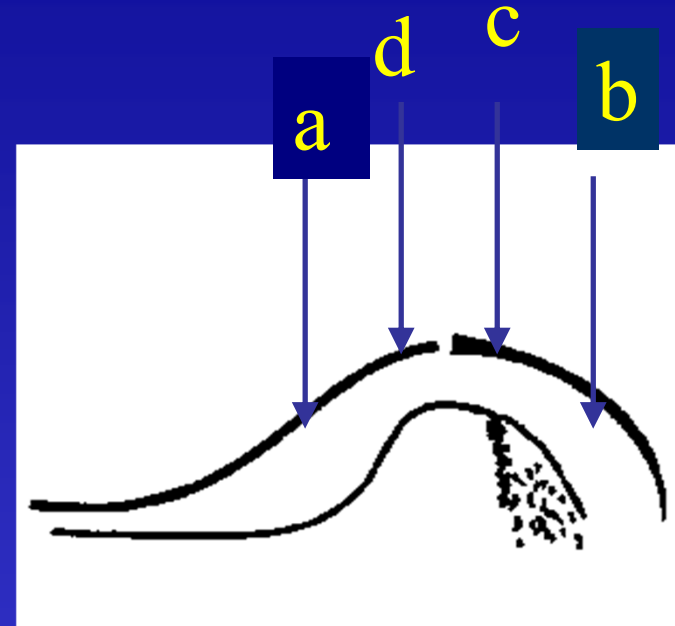
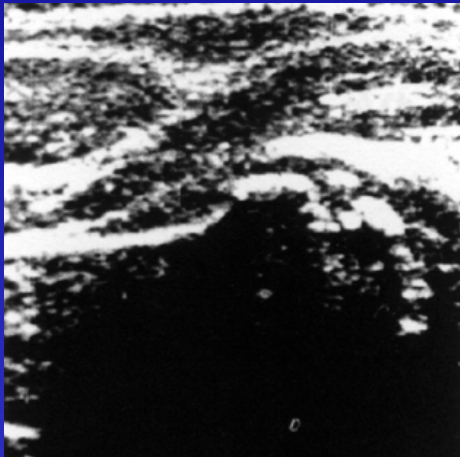
SEPTIC ARTHRITIS



ULTRASOUND APPLICATION IN EVALUATION OF *Coxitis fugax*

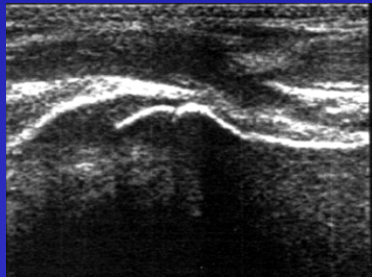


ULTRASOUND APPLICATION IN THE DIAGNOSIS OF PERTHES DISEASE

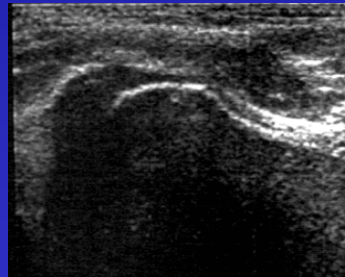


- a) Elevation of capsule
- b) Flattening of femoral head
- c) Irregularity in femoral head
- d) Methaphyseal changes

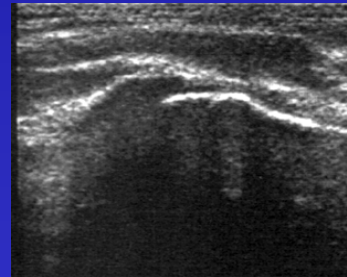
Position of the transducer



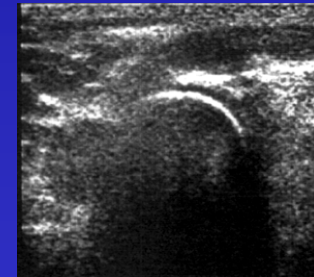
pozycja
pośrednia



rotacja
zewnętrzna



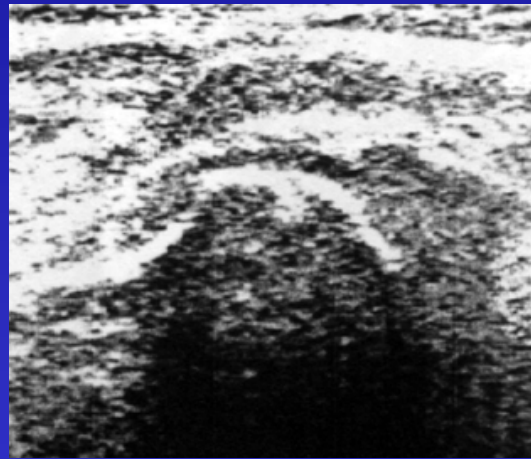
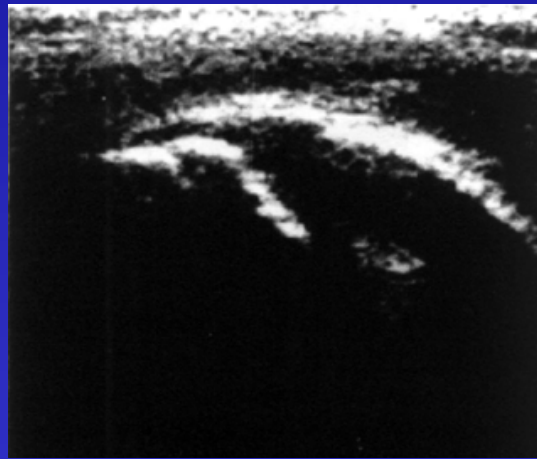
rotacja
wewnętrzna.



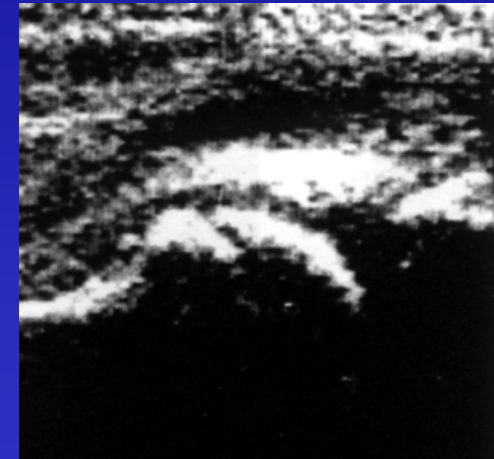
ustawienie
poprzeczne

US monitoring of Perthes disease

6-year-old boy



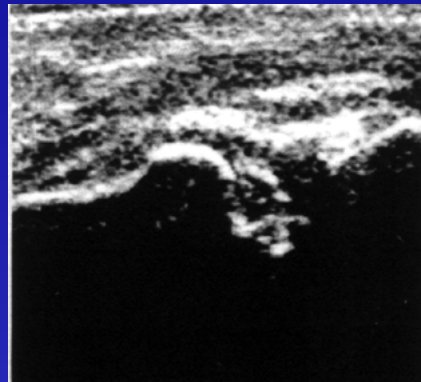
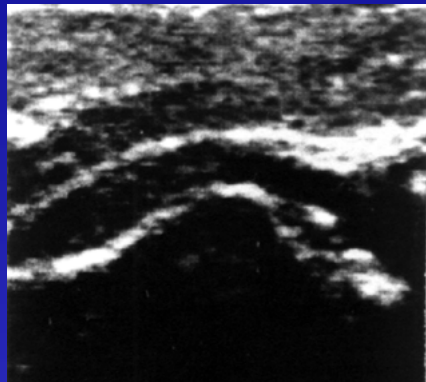
6 m.



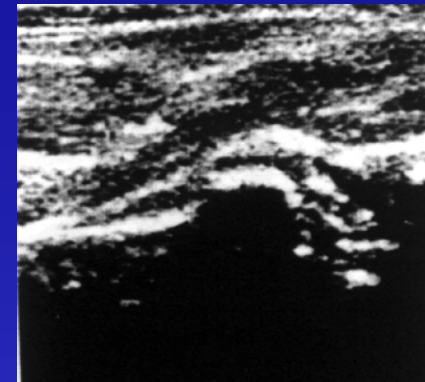
18m

US monitoring of Perthes disease

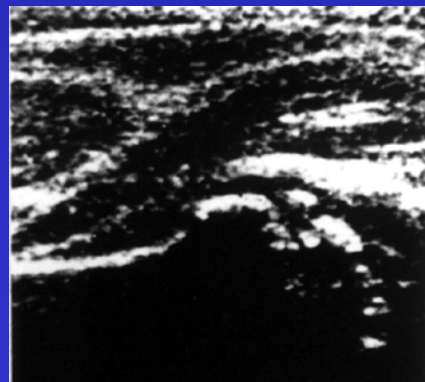
9 year-old girl



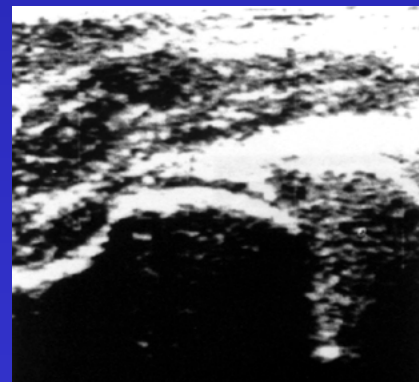
3m



9m

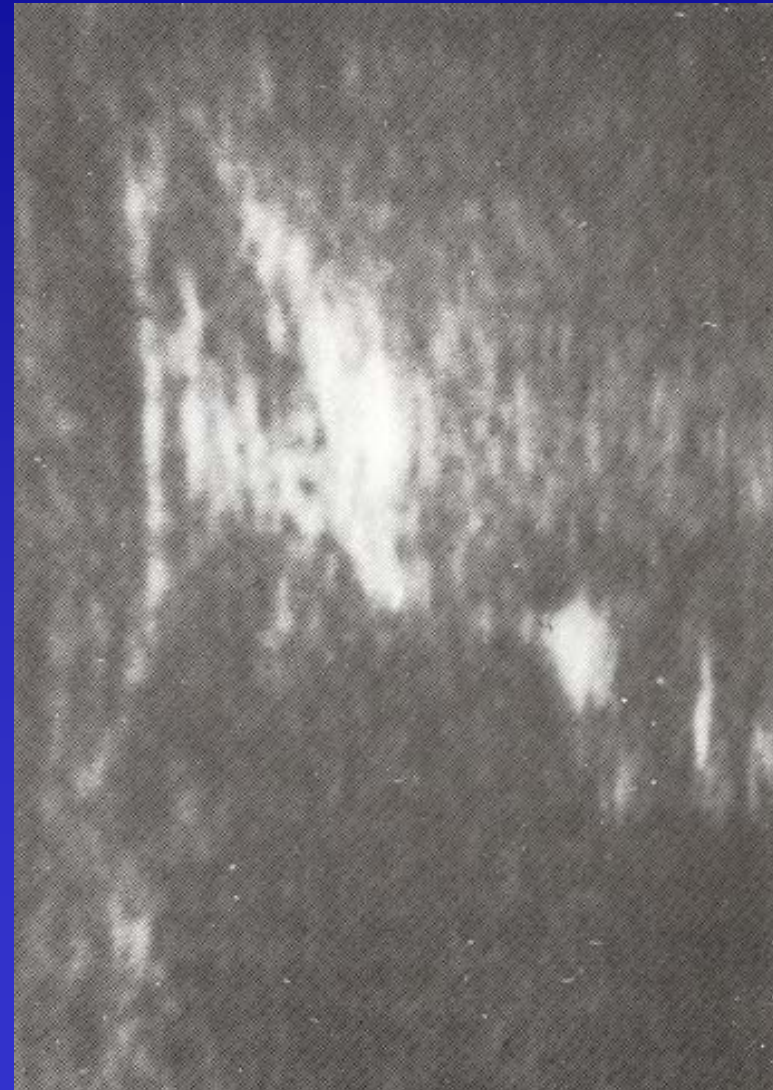
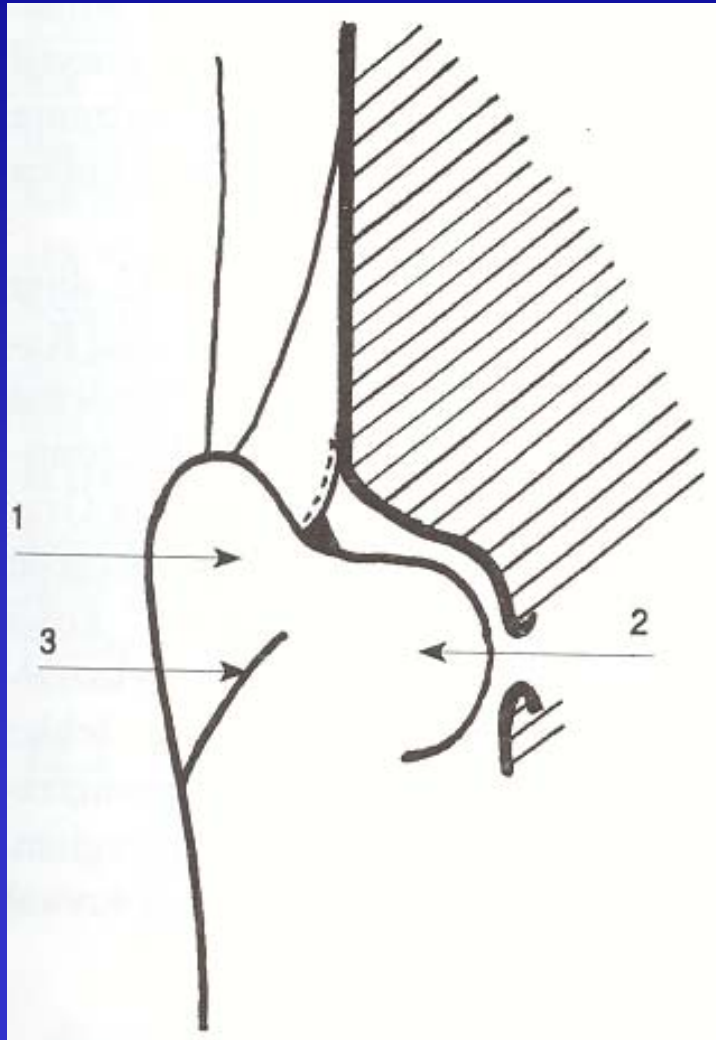


15m

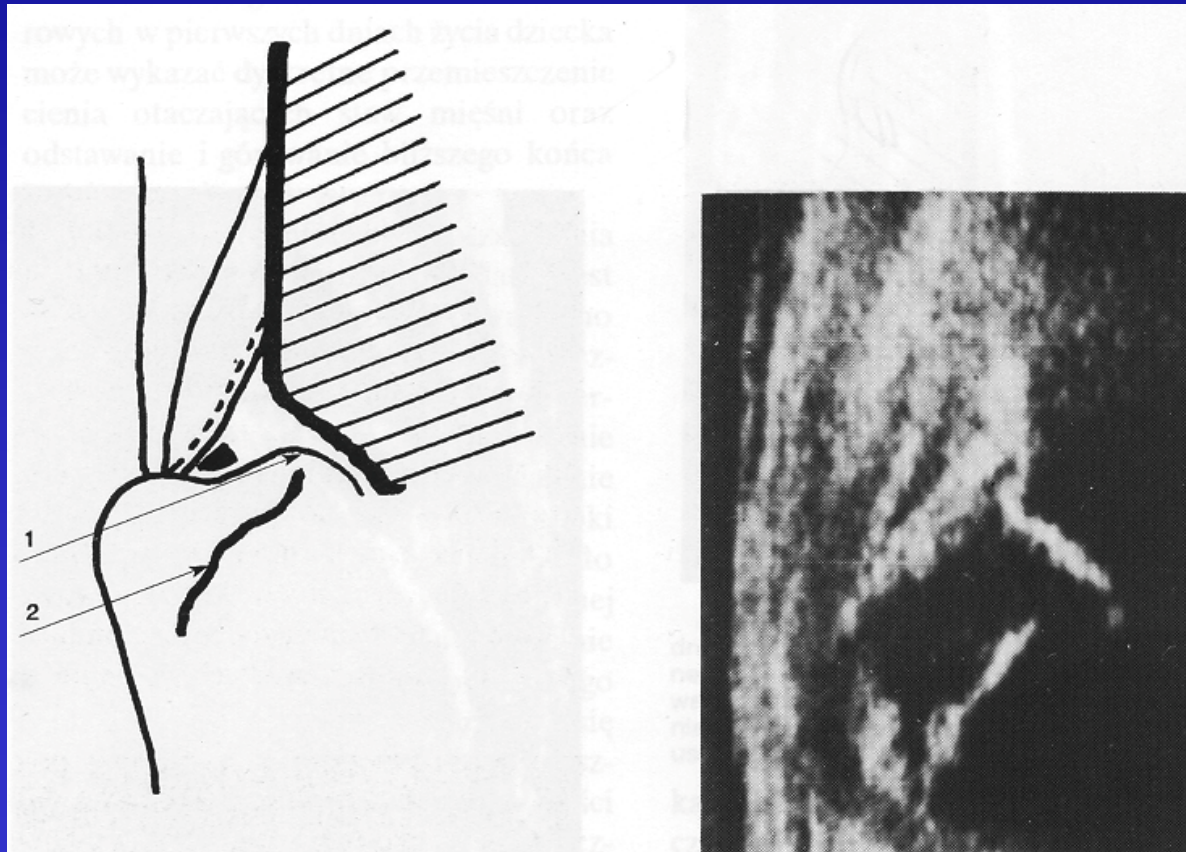


21m

COXA VARA



SEPTIC ARTHRITIS WITHOUT DISLOCATION



PATHOLOGIC DISLOCATION OF THE HIP





Thanks