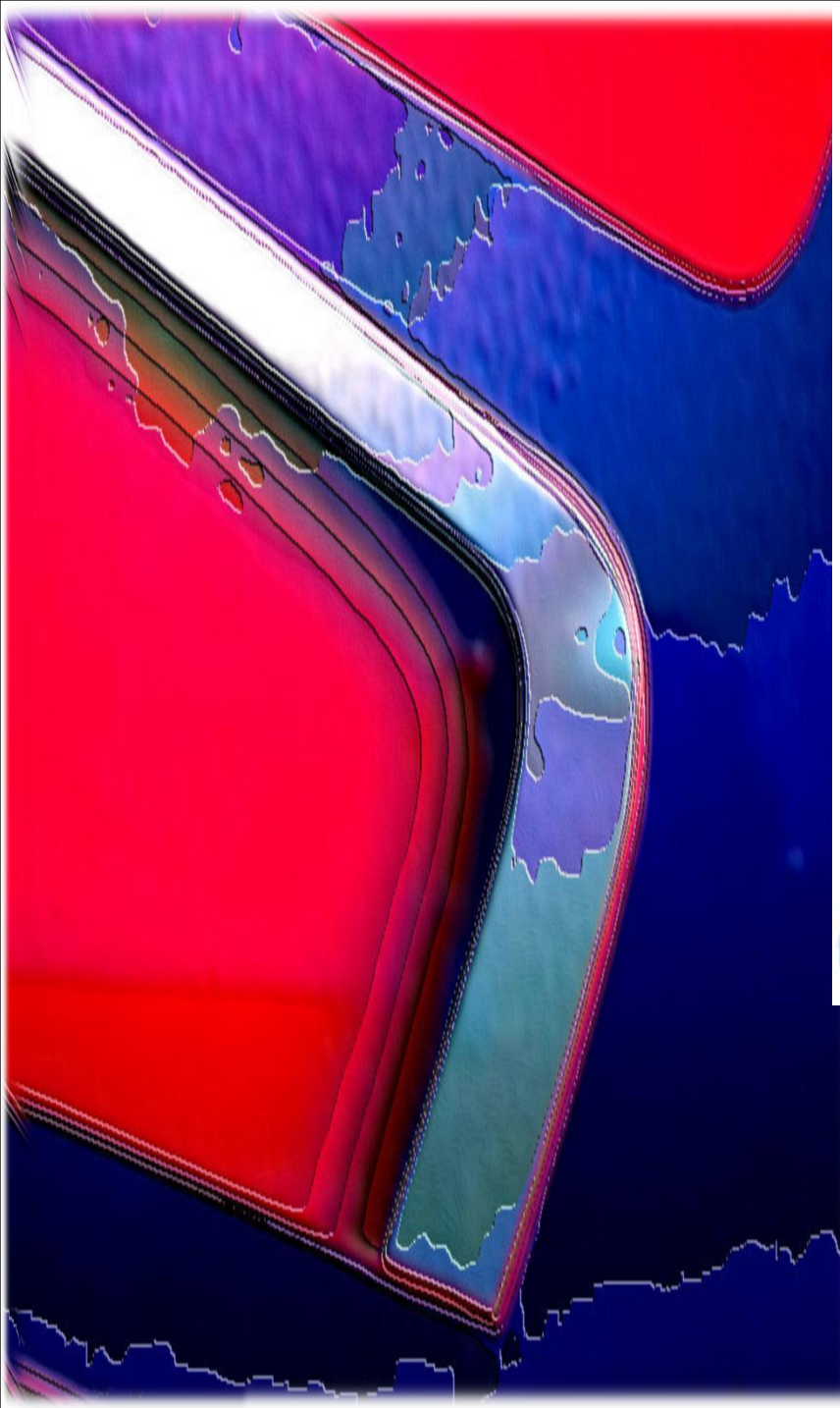
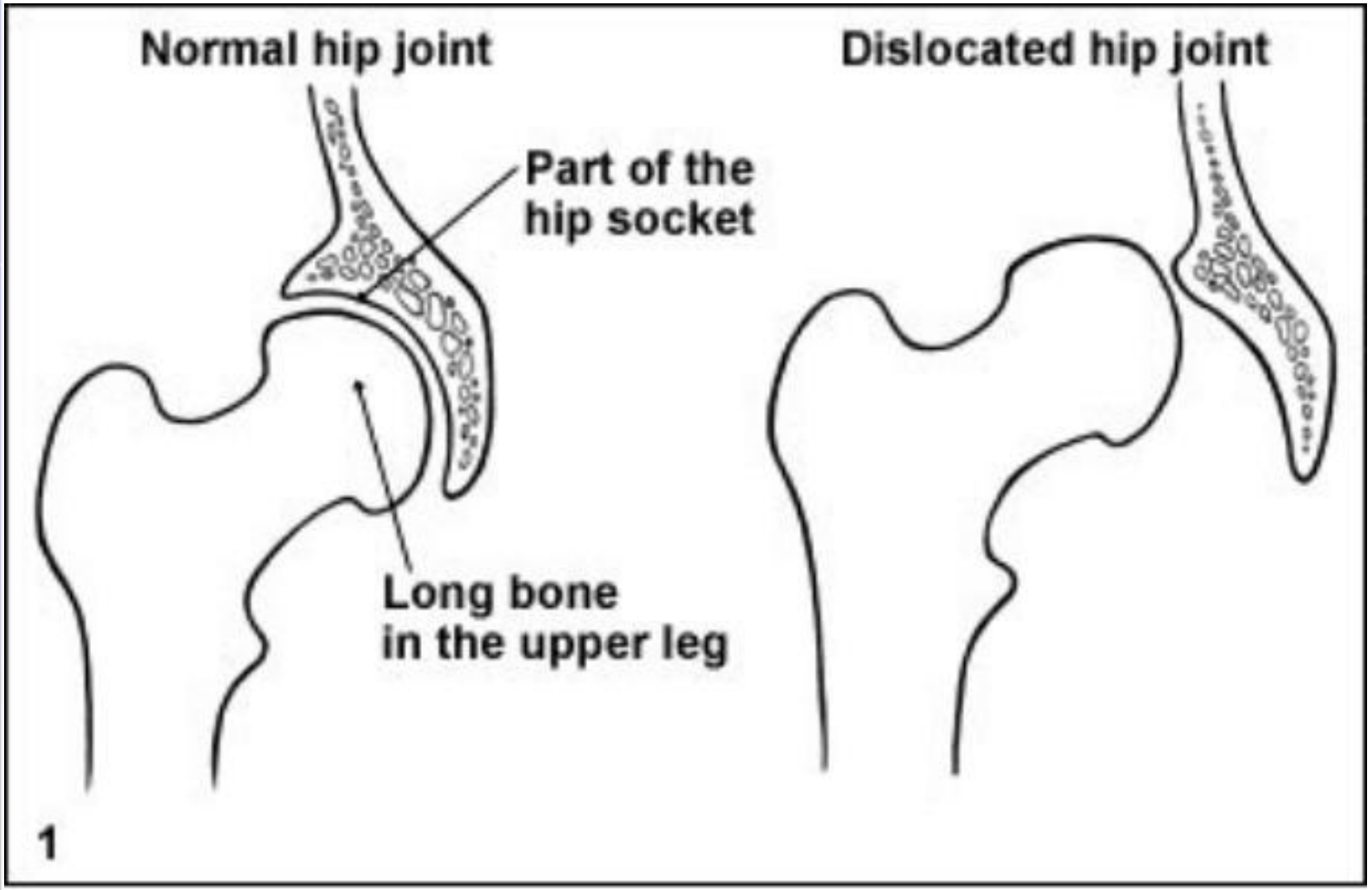


Developmental Dysplasia of the Hip

Dr. Manju Kannan

Congenital hip dysplasia is a condition of abnormal development of the hip, resulting in hip joint instability and potential dislocation of the head of femur from the acetabulum.

This condition has been in the early 2000s been termed developmental hip dysplasia, because it often develops over the first few weeks, months, or years of life.


Normal hip joint
Dislocated hip joint
Part of the hip socket
Long bone in the upper leg
1

Developmental dysplasia of the hip

- **Definition**

It is a congenital or acquired deformation or misalignment of the hip joint

At birth, the hips are usually not dislocated but rather "**dislocatable**".

Developmental dysplasia of the hip

- **Classification**

1. Typical.
2. Teratologic.

Developmental Dysplasia of the Hip

Types:

1. Complete hip dislocation.
2. Partial hip subluxation.
3. Hip dysplasia (incomplete development).

Developmental Dysplasia of the Hip

Incidence:

1. 5 – 20 per 1000
2. Female predominance→ 7 times more likely.
3. Depends on race and geographical variations.

Incidence

- 5 - 20 per 1000 live births
- 7 : 1 Females : Males
- Left hip more affected than the right
- Bilateral in 1 in 5 cases

SEVERAL THEORIES HAVE BEEN PROPOSED

Genetic

Hormonal

Primary acetabular dysplasia

Mechanical

ETIOLOGY

- Generalized relaxation of the hip joint.
  - Family history.
  - Generalized ligamentous Laxity; due to maternal estrogen and other hormones “which prevents the maturation of collagen”.
- Primigravida.
- Breech presentation.
- Oligohydramnios.
- Adduction and Extension postnatally.

3 periods during intra-uterine life, when risk of DDH is high

- 12th week
- 18th week
- Final 4 weeks of gestation

12th week of gestation:

- 1st major positional change – medial rotation takes place.
- If neuro-muscular mechanism do not develop in synchronised manner then chance of dislocation is high.
- Acetabulum becomes shallow due to lack of growth stimulus

18th week of gestation

- Active motion of the hip joint develops.
- Under developed limbus
- Shallow acetabulum
- Capsular weakness
- Asynchronous muscle innervation

Final 4 weeks of gestation

- Mechanical factors concerning position of fetus play crucial role:
- Breech position with extended legs
- Oligohydamnios
- Hormonal action
- Common denominator- genetically induced abnormal collagen distribution in capsule and ligaments of hip joint.

RISK FACTORS

- Female
- First born
- Familial
- Faulty position

4 Fs

Aetiology and Pathogenesis

- **Genetic :-**
  - Tends to run in families and certain populations
  - Common in whites than in coloured races
- **Heritable features : -**
  - Generalised joint laxity (dominant trait)
  - Shallow acetabuli (polygenic trait)

Hormonal factors

Maternal hormones , Oestrogen, Progesterone and Relaxin

↓

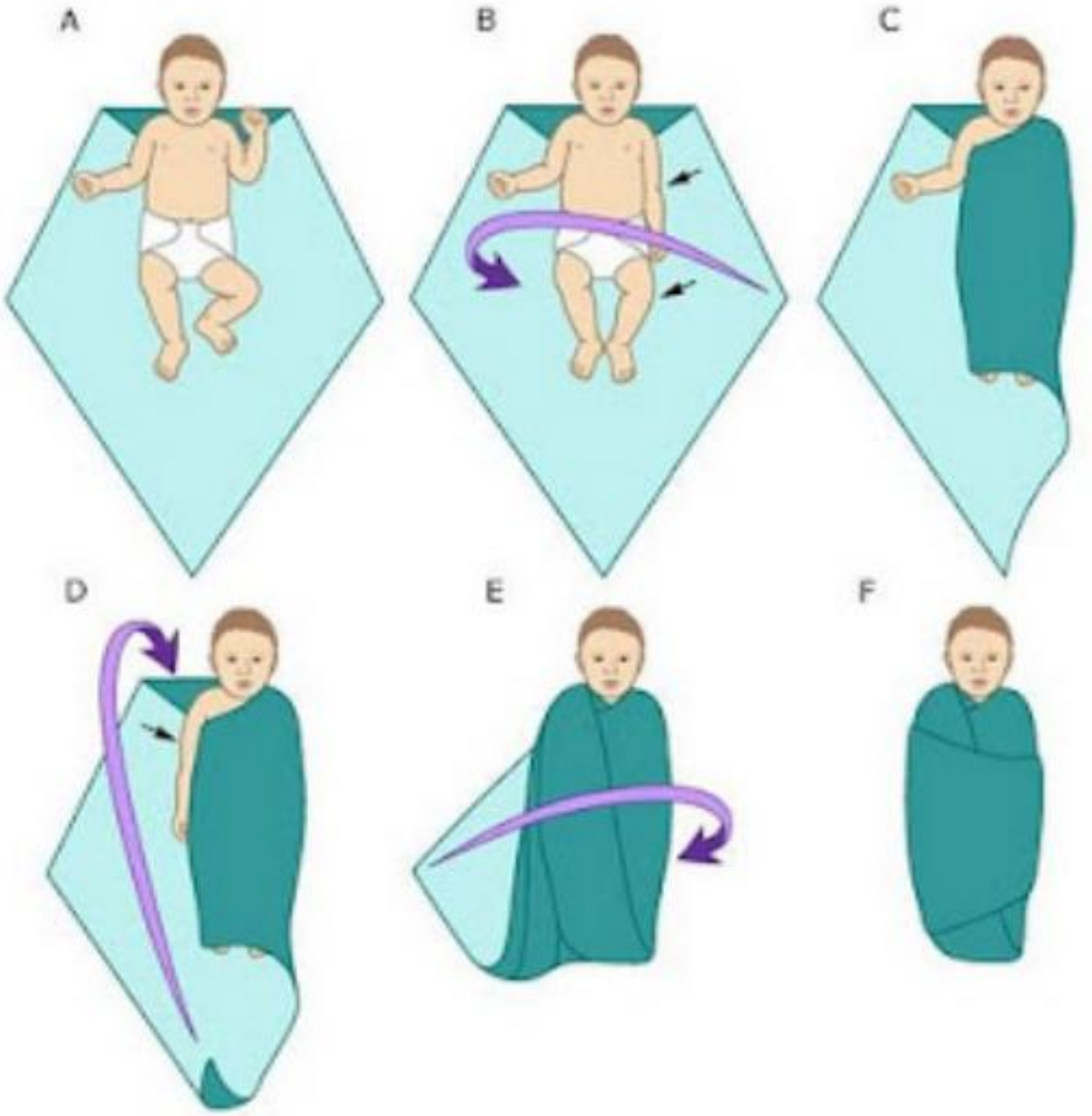
Increased ligament laxity in the infant

Wide spectrum of disorders

- Acetabular dysplasia
- Subluxation or dislocation
- Is it primary acetabular dysplasia leading to dislocation ?
- The malposition of the head affecting acetabular development ?

Environmental factors

- Intra uterine mal position – extended breech presentation
- Common in countries, where infants are carried wrapped up with hips and knees extended


A
B
C
D
E
F

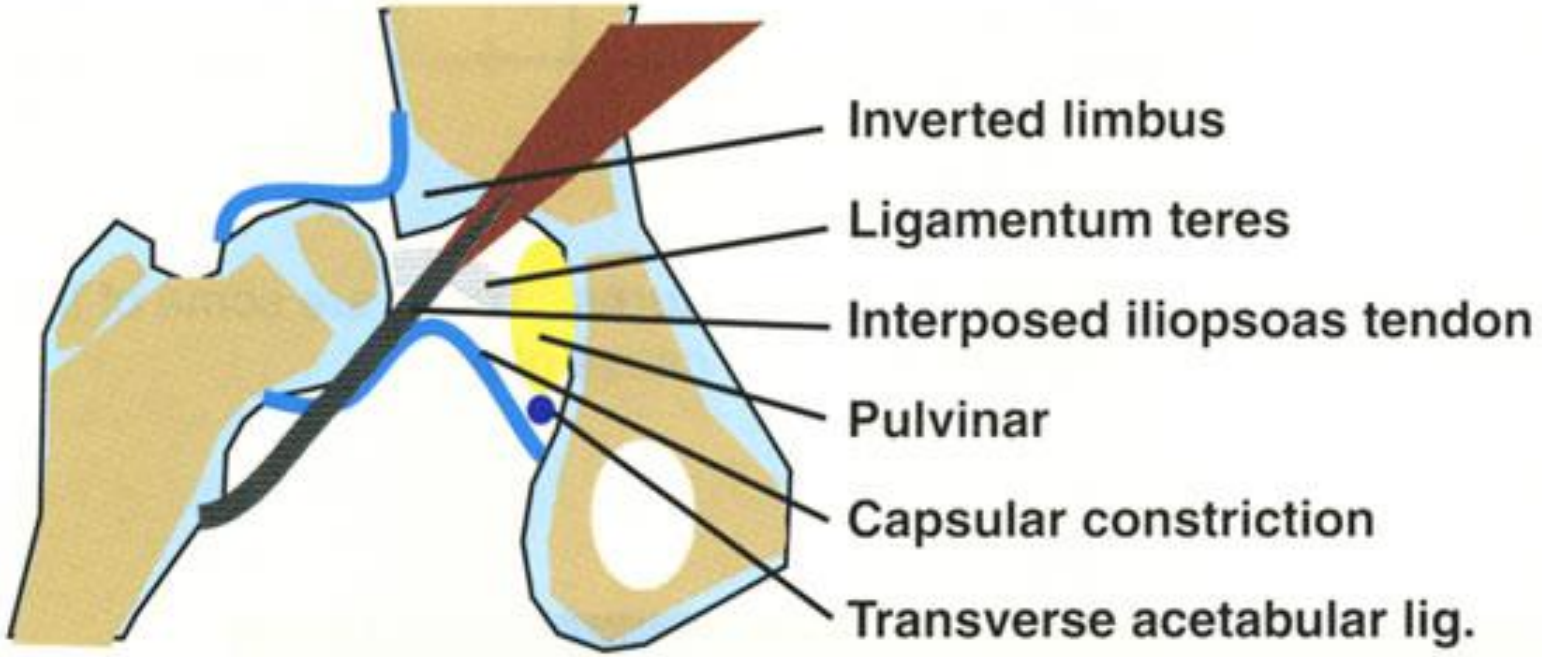
Pathology

At birth :-

- Unstable with stretched and redundant capsule, the head of femur may be dislocated or dislocatable

During Infancy

- Adaptive changes reflecting the dysplasia of acetabulum and persistent instability and abnormal loading
- Posterosuperior dislocation of the head
- Anteverted shallow acetabulum
- Delayed appearance of ossific nucleus
- Elongated hyertrophied lig. teres
- Inverted limbus


Inverted limbus
Ligamentum teres
Interposed iliopsoas tendon
Pulvinar
Capsular constriction
Transverse acetabular lig.

Late childhood

- Increased anteversion of acetabulum and femoral head
- Formation of a false socket above the shallow acetabulum
- Adaptive shortening of muscles

Diagnosis

- Ideally, cases should be diagnosed at birth
- Screening at birth for signs of instability

At risk group

- Family history
- Breech presentation
- Presence of other congenital anomalies

Clinical Manifestations

- Girls are affected 5-7 times more than boys.
- The left hip is affected in 45%, right one 20% and 35% of the cases are bilateral.

Clinical Manifestations

- 2 facts about DDH:
  1. Not all hip dislocation are present at birth. But they all occur before the age of 3 months
  2. Newborns have hypotonic muscles in the 1st 6 wks till 3 m. So not all cases of DDH can be diagnosed at that time.

To diagnose DDH we have many method:

1. **Barlow test.**

   It is a provocative test that attempts to dislocate an unstable hip.

   Flexion ,adduction, posteriorly.

   “Click”

2. **Ortolani test**

   It is a maneuver to reduce a recently dislocated hip.

   Flexion, abduction, anteriorly.

3. **X-rays.**
4. **US**
5. **Galeazzi's sign**

In the neonatal period

Ortolani's test

Hips are flexed and then abducted with thumb medially over the groin and fingers over the trochanter, the abduction is limited if there is dislocation, but with pressure over the trochanter, the hip reduces with a clunk, and hip abducts fully ("the jerk of entry")

ORTOLANI's TEST

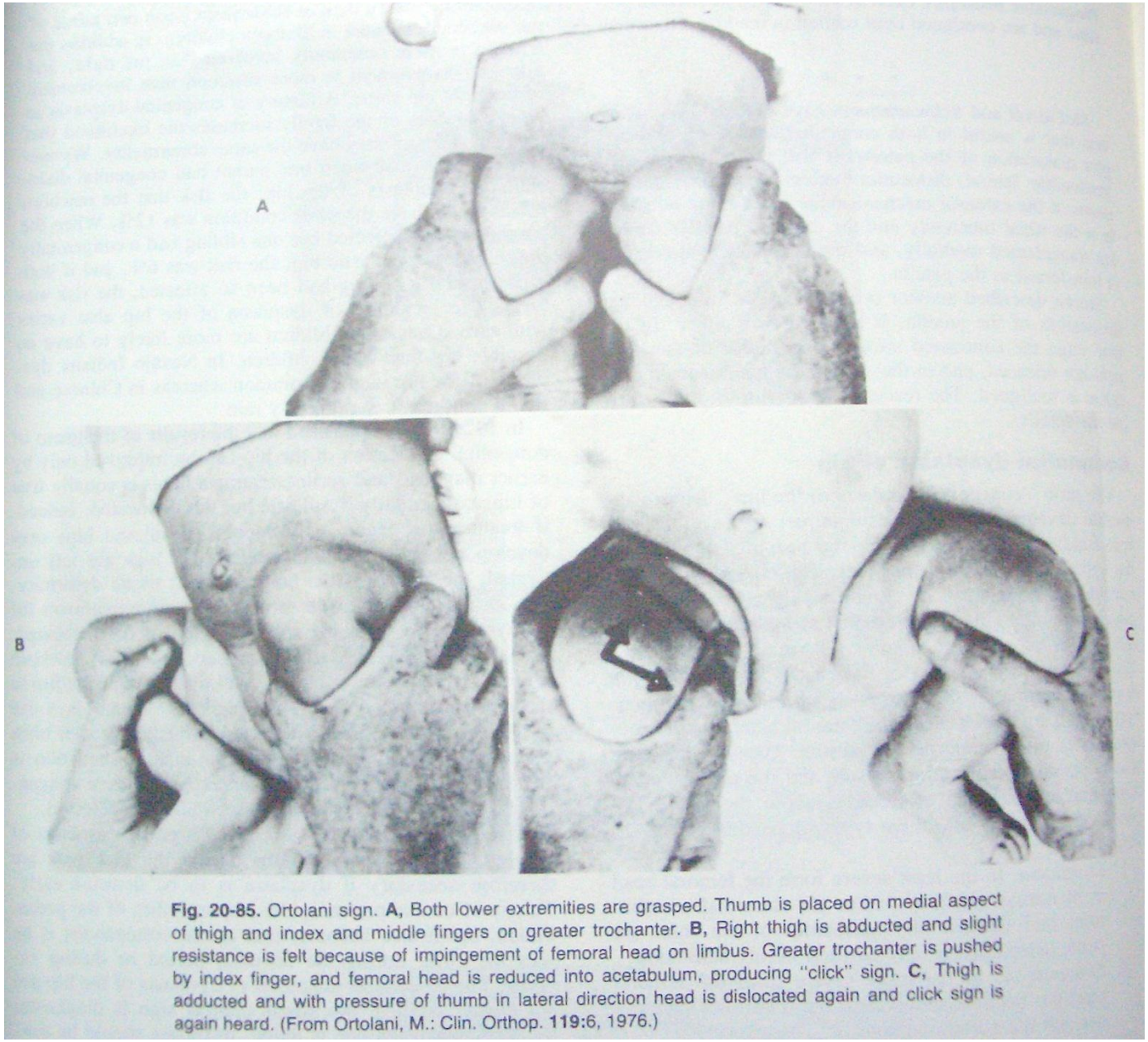
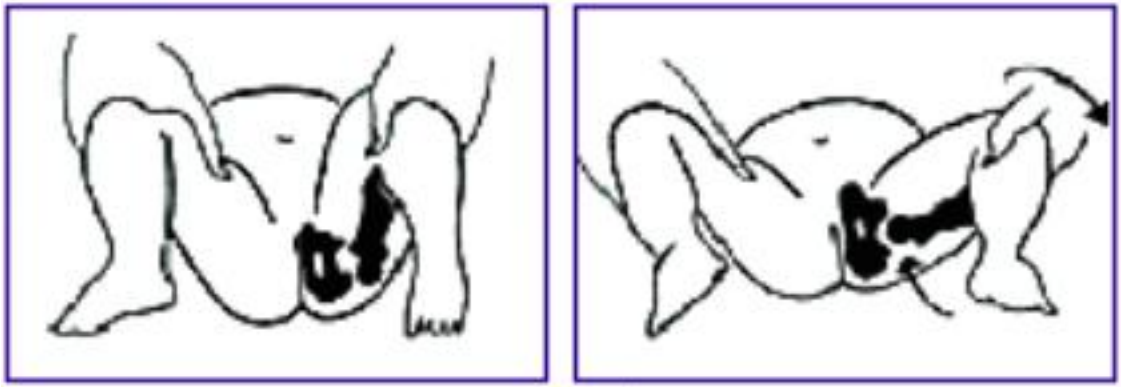


Fig. 20-85. Ortolani sign. **A,** Both lower extremities are grasped. Thumb is placed on medial aspect of thigh and index and middle fingers on greater trochanter. **B,** Right thigh is abducted and slight resistance is felt because of impingement of femoral head on limbus. Greater trochanter is pushed by index finger, and femoral head is reduced into acetabulum, producing "click" sign. **C,** Thigh is adducted and with pressure of thumb in lateral direction head is dislocated again and click sign is again heard. (From Ortolani, M.: Clin. Orthop. **119**:6, 1976.)

Ortolani test

Performed by gently abducting and adducting the flexed hip to detect any reduction into or dislocation of the femoral head from the true acetabulum.



Ortolani Test

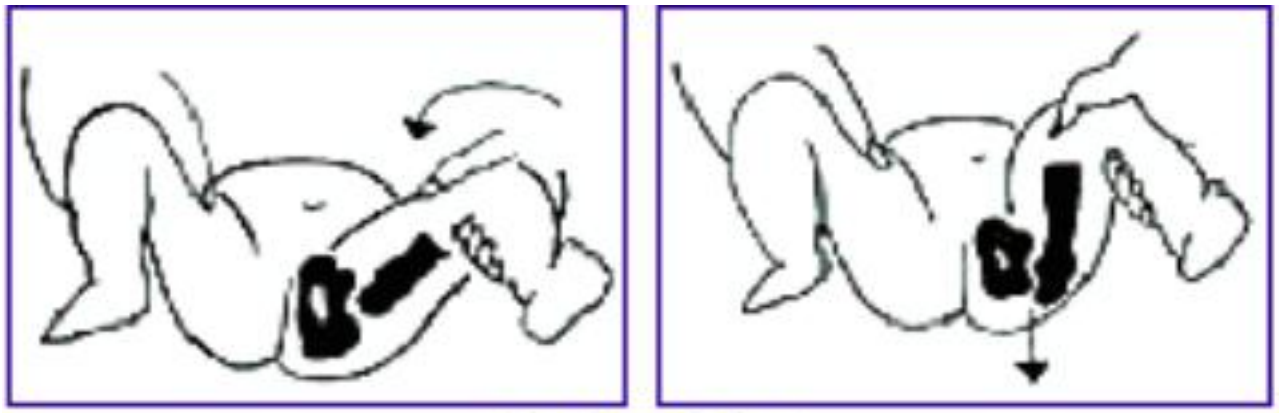
Should not be repeated more than few times – damages articular cartilage

Barlow's test

- The hip can be made to enter the acetabulum on ABDuction, if it is dislocated and made to dislocate on ADDuction, if it is in the reduced position {"dislocatable or unstable hip"}

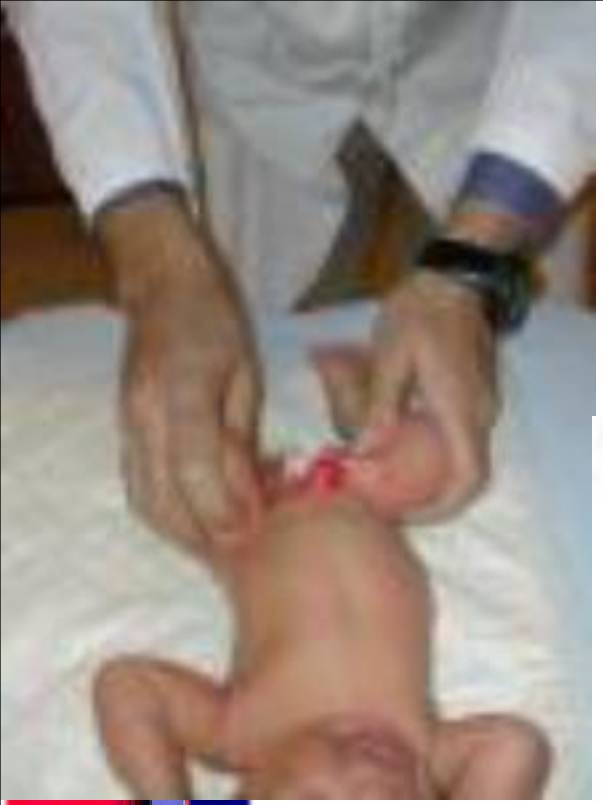
Barlows provocative test

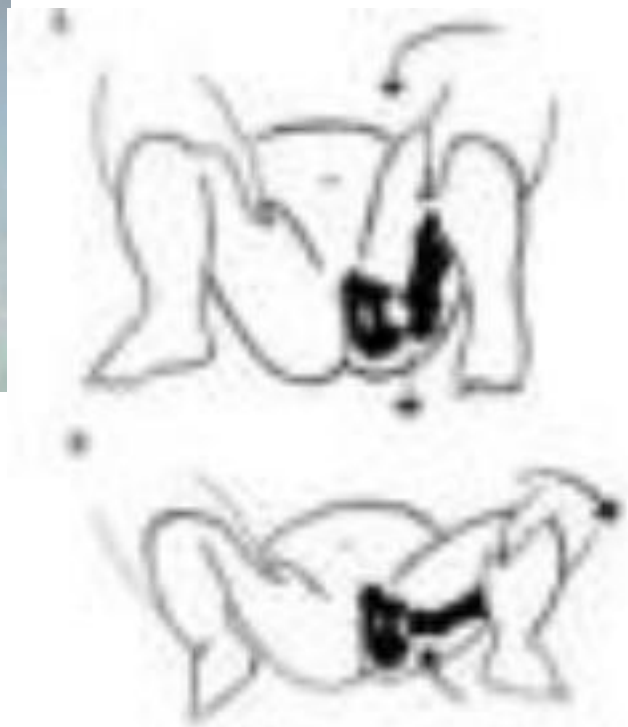
Detects any potential subluxation or posterior dislocation of the femoral head by direct pressure on the longitudinal axis of the femur while the hip is in adduction

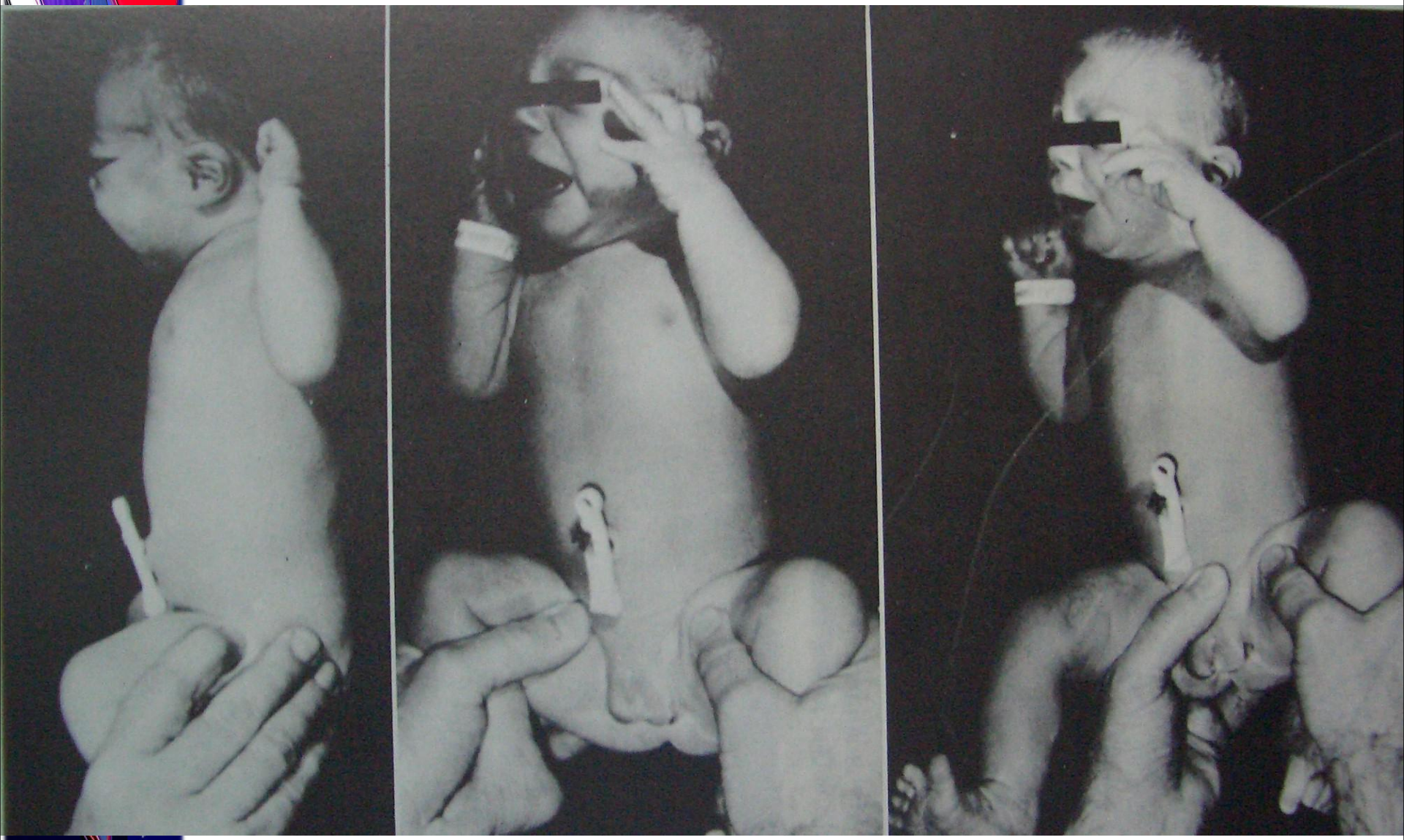


Barlow Test

Can be performed twice at the most – potentially unstable hip can become unstable







Clinical Manifestations

In newborn:

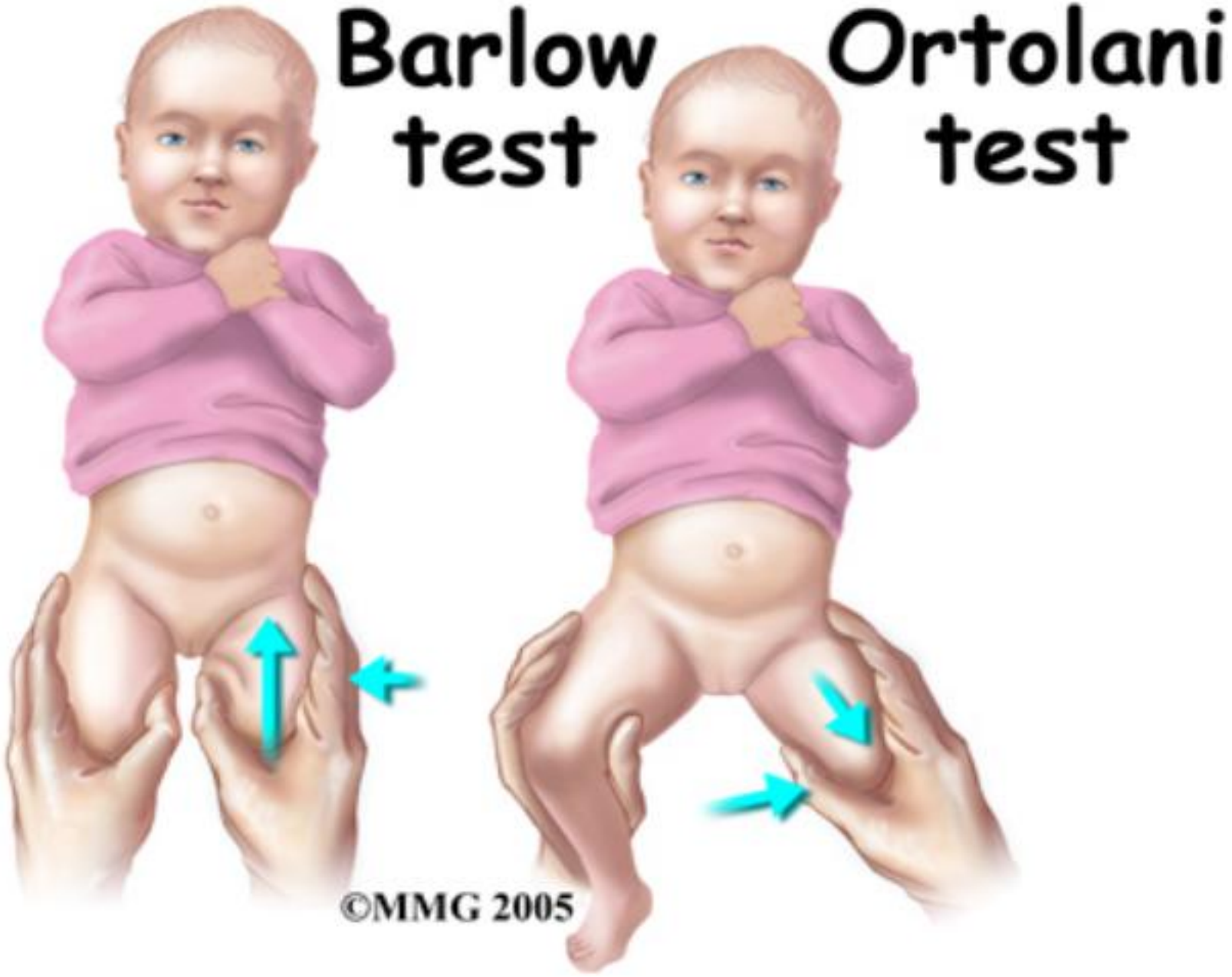
- We can diagnose DDH in this period by +ve Ortolani test.
- Asymmetry of the skin fold may help, but its not specific.
- Shortening of the limb at this age doesn't exist.
- We can't use X-rays because the acetabulum and proximal femur are cartilaginous and wont be shown on X-ray.
- USG is the best method to Diagnosis.

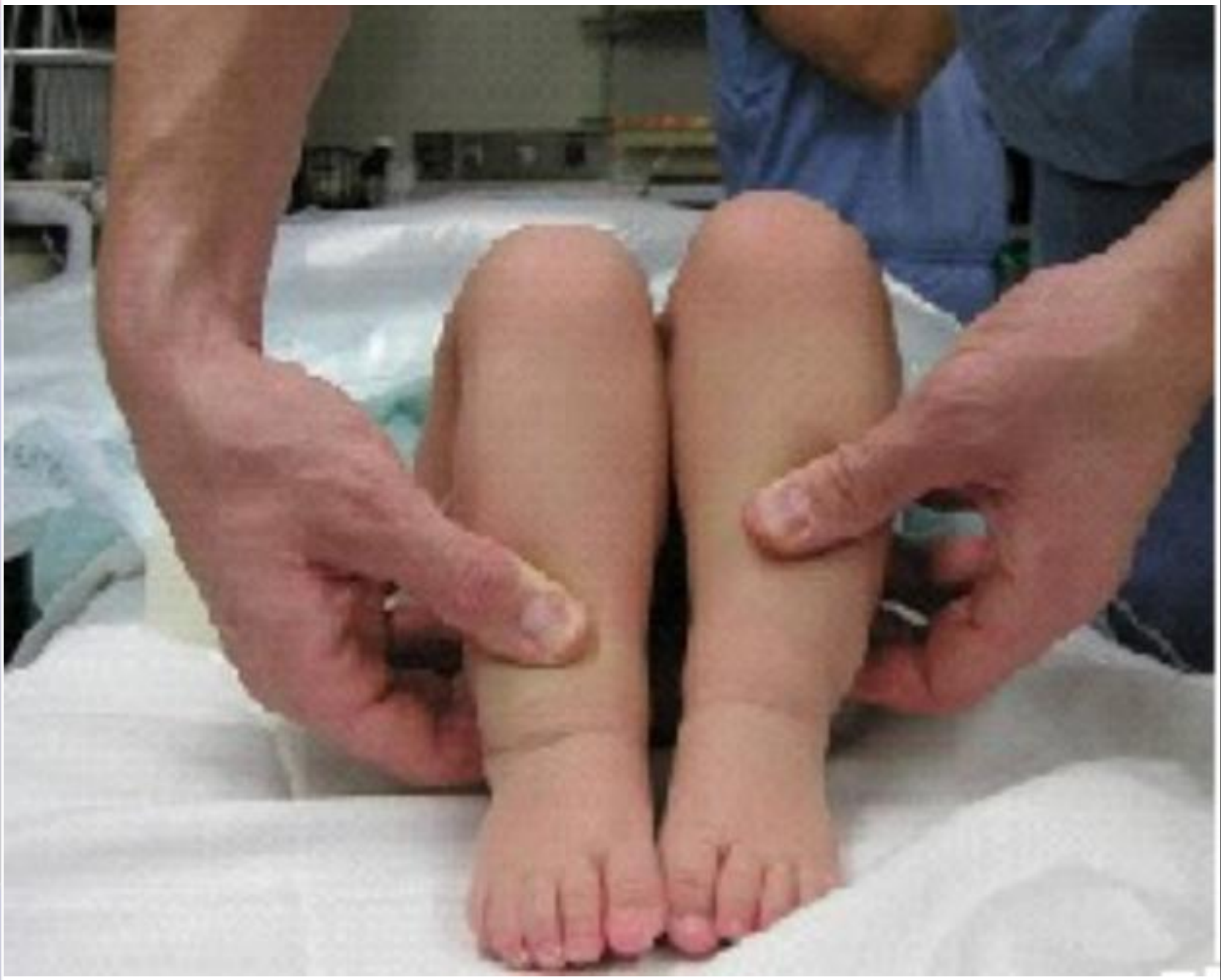
In the intermediate age (after 3 months):

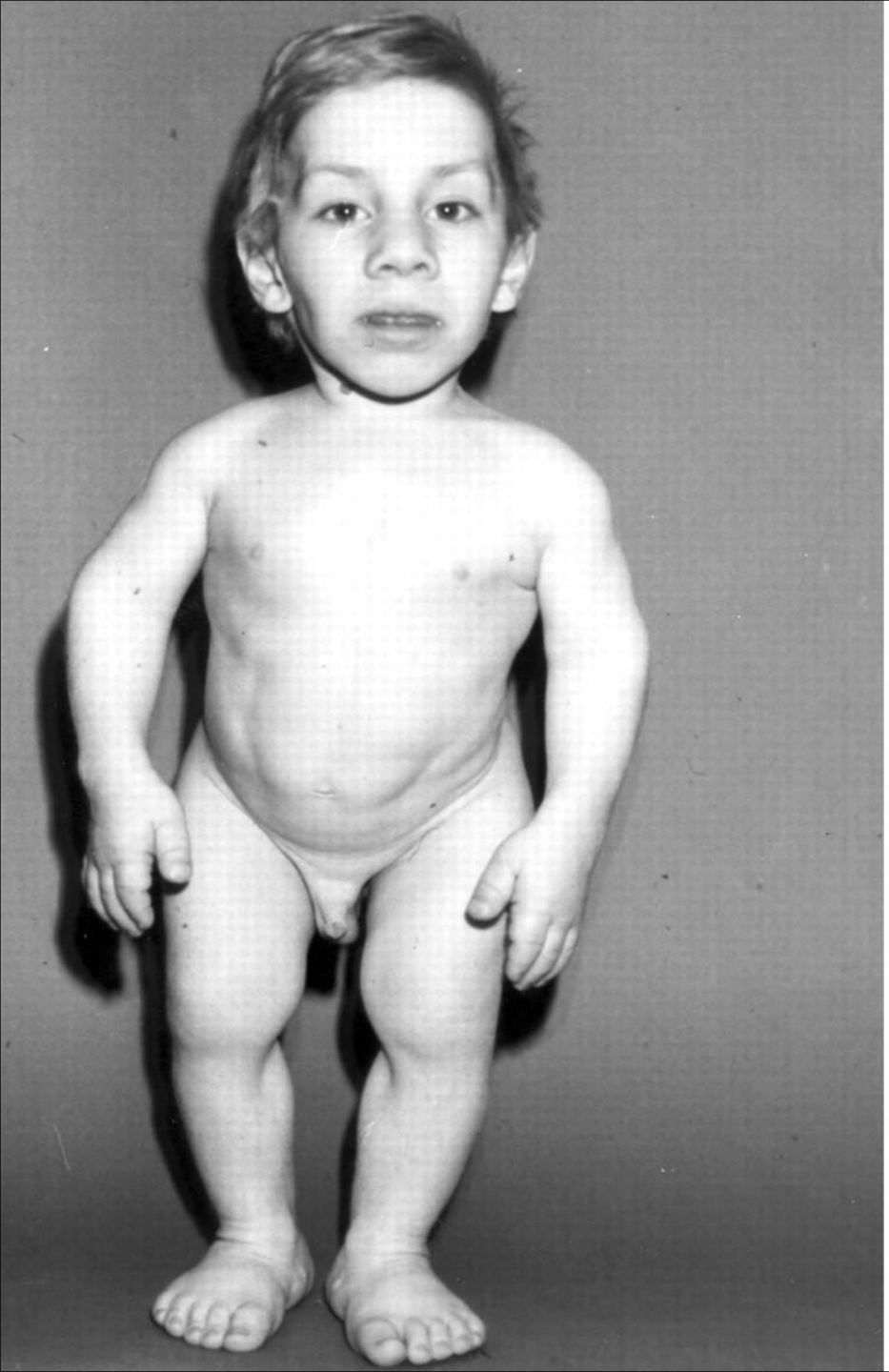
- The most diagnostic sign is Ortolani's limitation of abduction.
- Abduction less than 60^0 is almost diagnostic.
- Shortening of the limb is more obvious now.(Galeazzi's test)
- X-rays after the age of 3 months can be helpful esp. after the appearance of the ossific nucleus of the femoral head
- USG is 100% diagnostic.

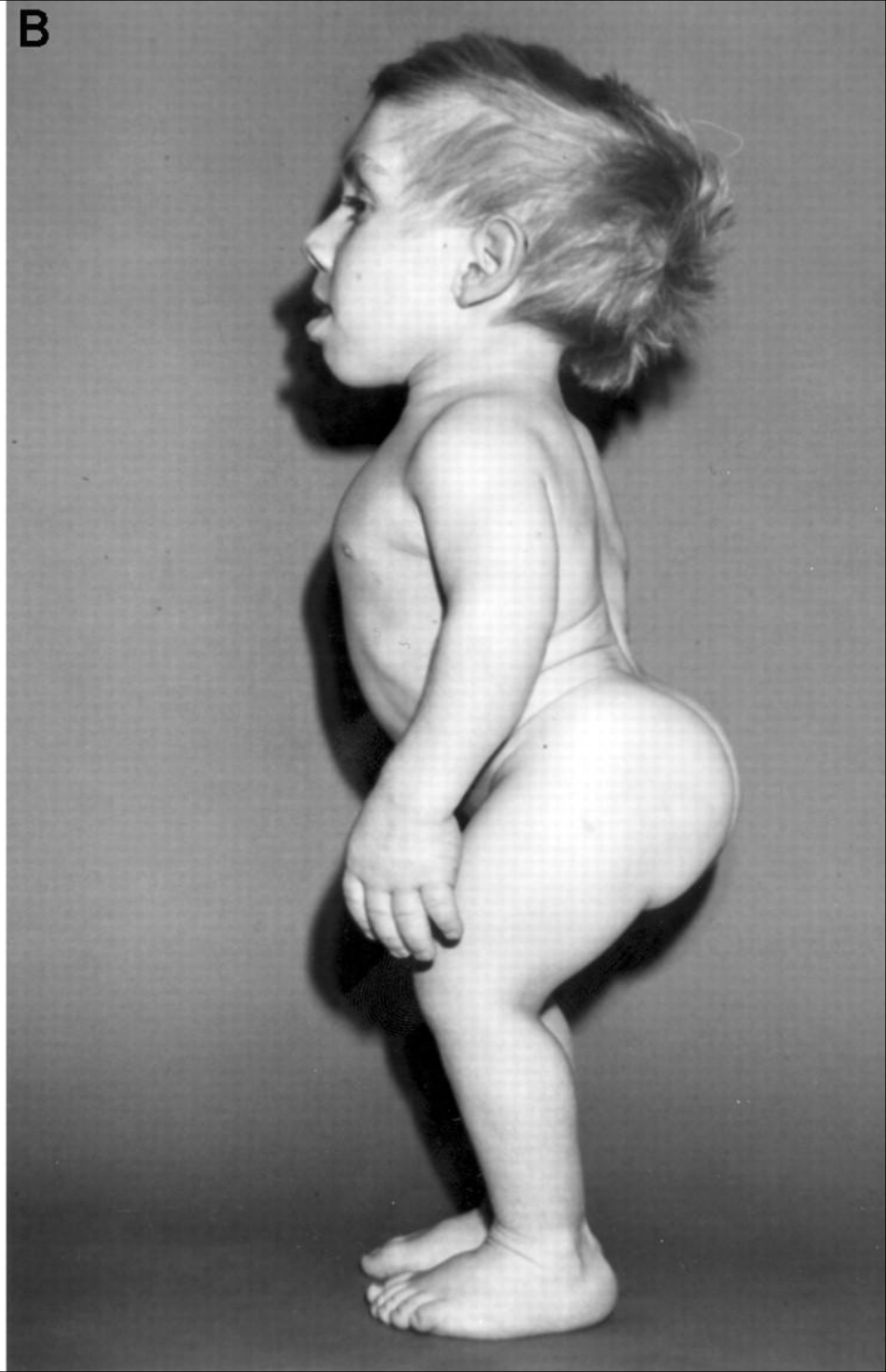
In older children:

- Complaints of
  - Limping
  - Waddling (bilateral DDH)
  - Lumbar Lordosis
  - Limitation of hip abduction
  - Toe-walking
  - Wide perineum, etc…


Barlow test
Ortolani test
©MMG 2005



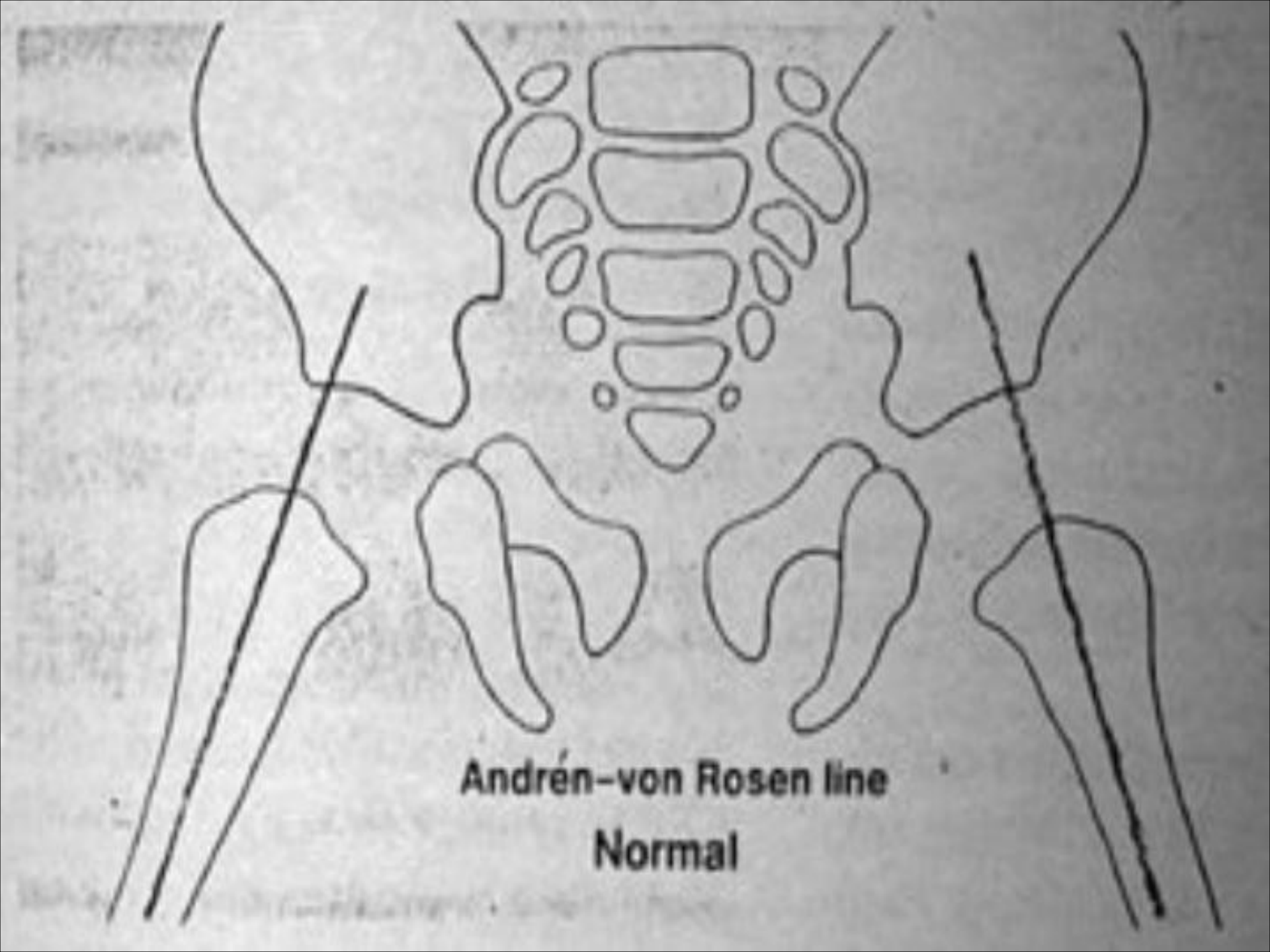



B

X-rays

von Rosen view:

- Hips abducted 45º &medially rotated.
- Anteroposterior.
- We draw a line through the central axis of the femoral shaft.
  - In normal hip (ossific nucleus)will be inside the acetabulum.
  - In dislocated hip it will be above acetabulum.


Andrén-von Rosen line
Normal

X-rays

- Horizontal line of Hilgenreiner:

  Drawn between upper ends of tri-radiate cartilage of the acetabulum.

- Vertical line of Perkins:

  Drawn from the lateral edge of the acetabulum vertical to horizontal line.

- 4 quadrants:

  Normal hip: the ossification center of the femoral hip lower medial quadrant.

  Dislocated hip: upper lateral quadrant.

X-ray

- **Acetabular index:**

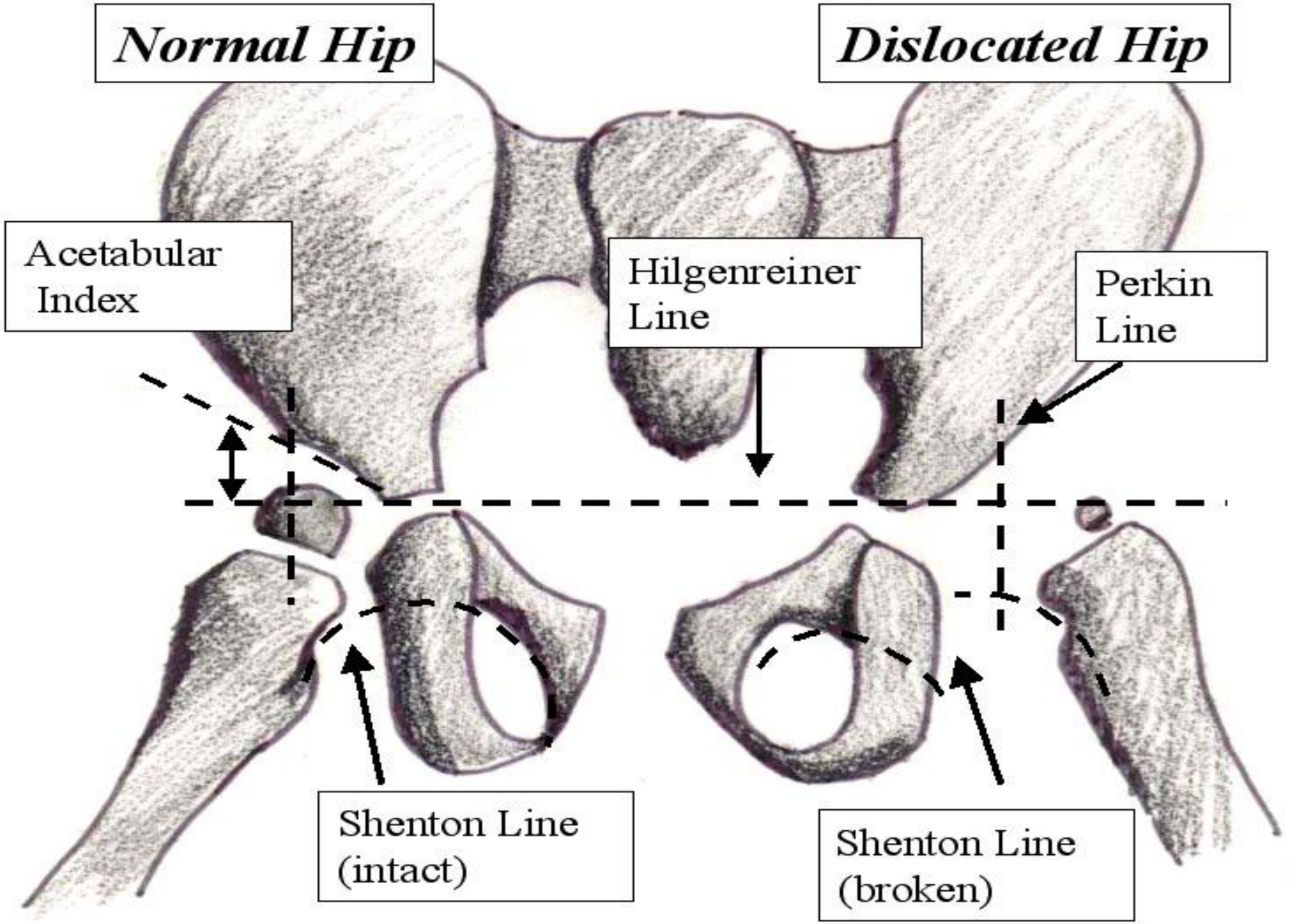
Angle between horizontal line of Hilgenreiner and the line between the two edges of the acetabulum.

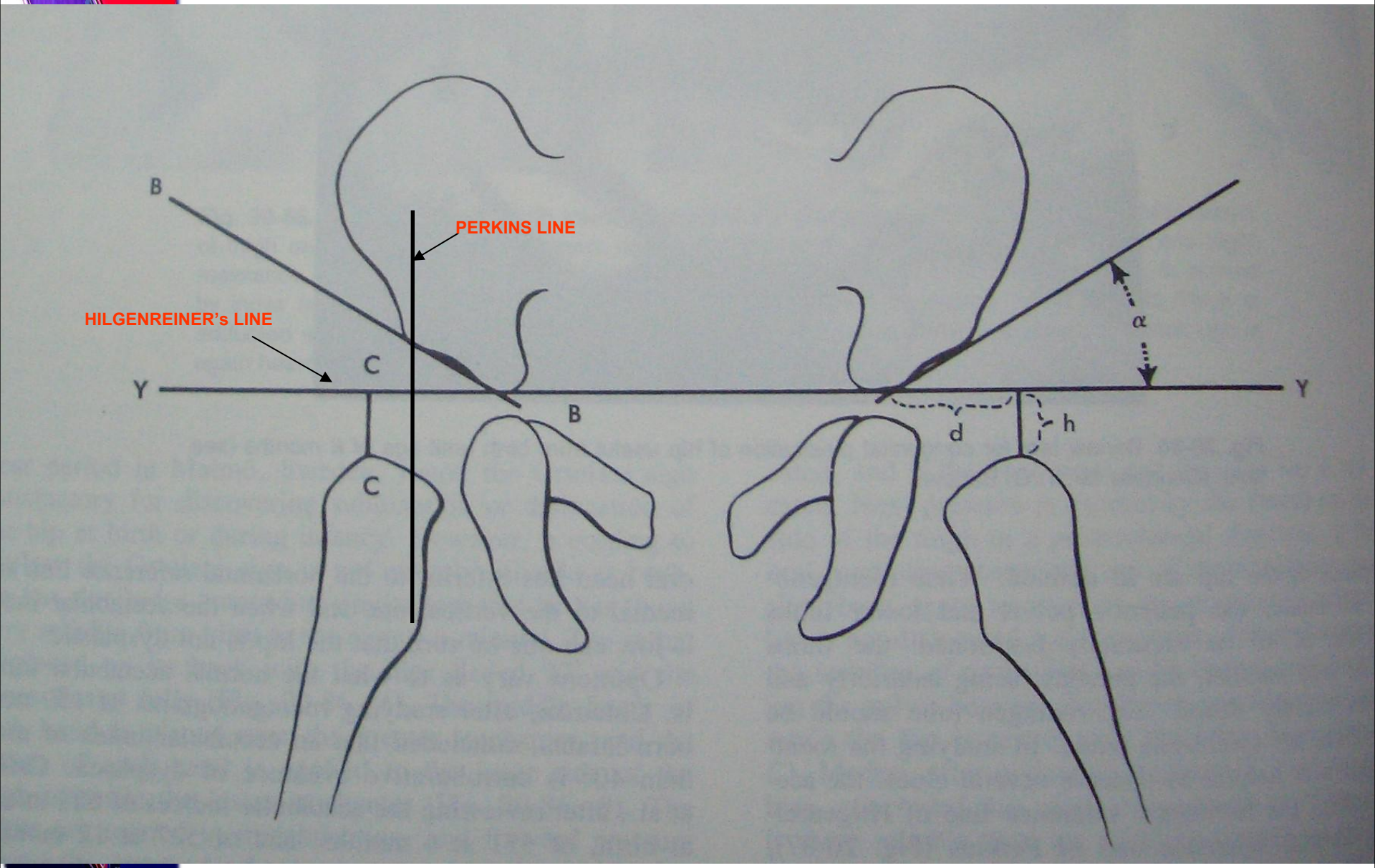
Normal hip 20º to 30º

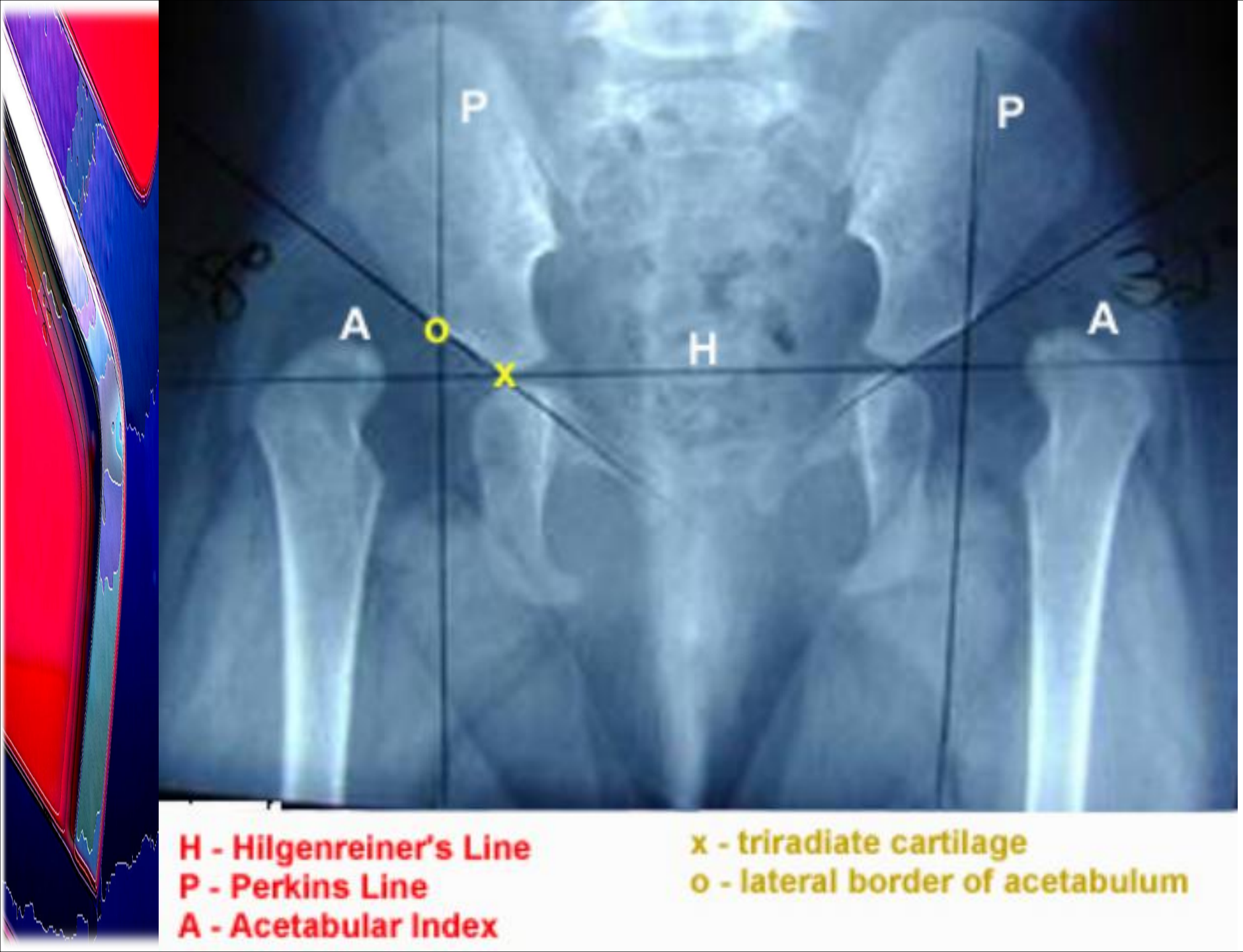
Dislocated or dysplastic hip ≥ 30º

- **Shenton's line:**

Semicircle between femoral neck and upper arm of obturator foramen, in dislocated hip this line is broken.

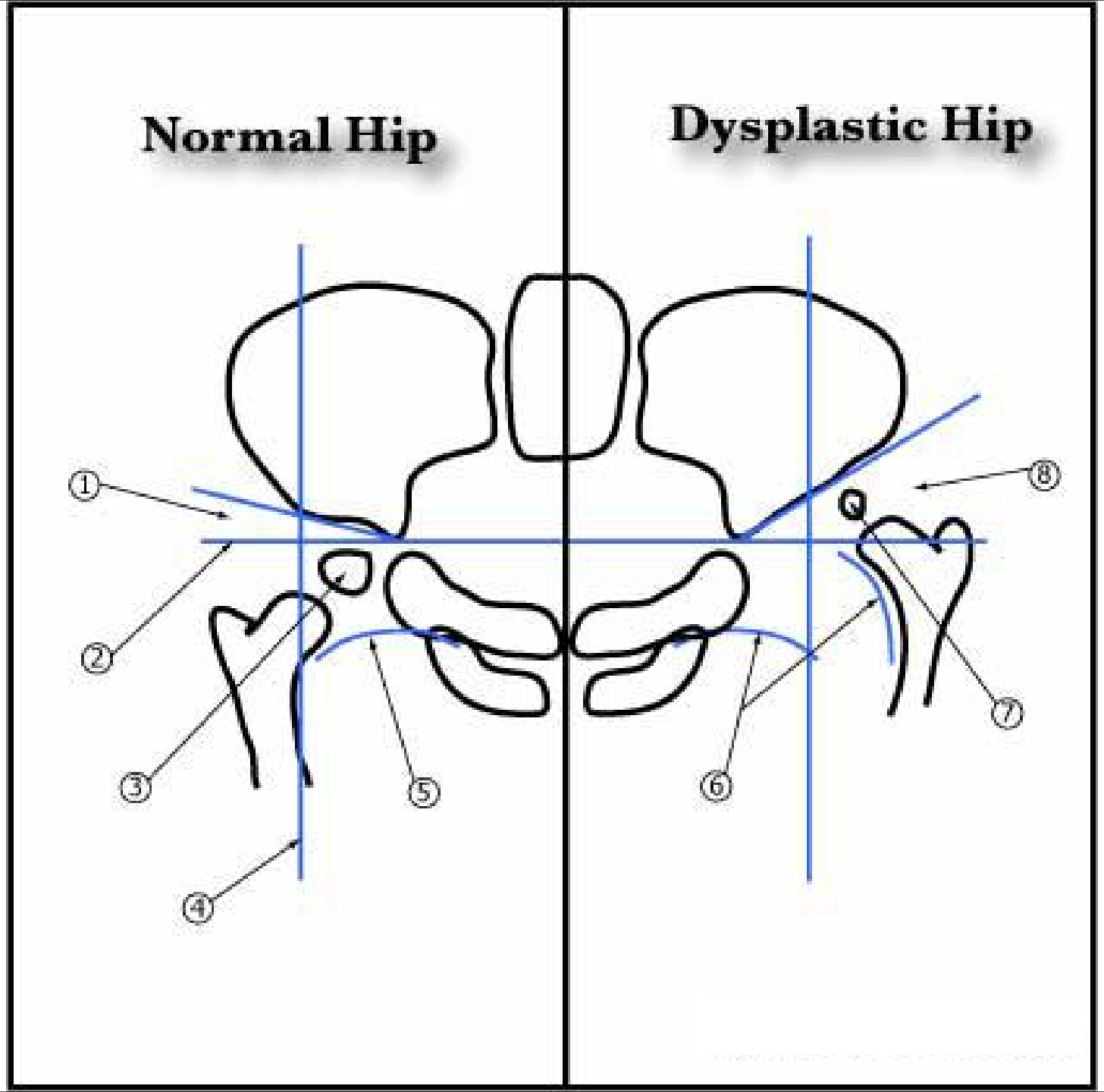

Normal Hip
Dislocated Hip
Acetabular Index
Hilgenreiner Line
Perkin Line
Shenton Line (intact)
Shenton Line (broken)

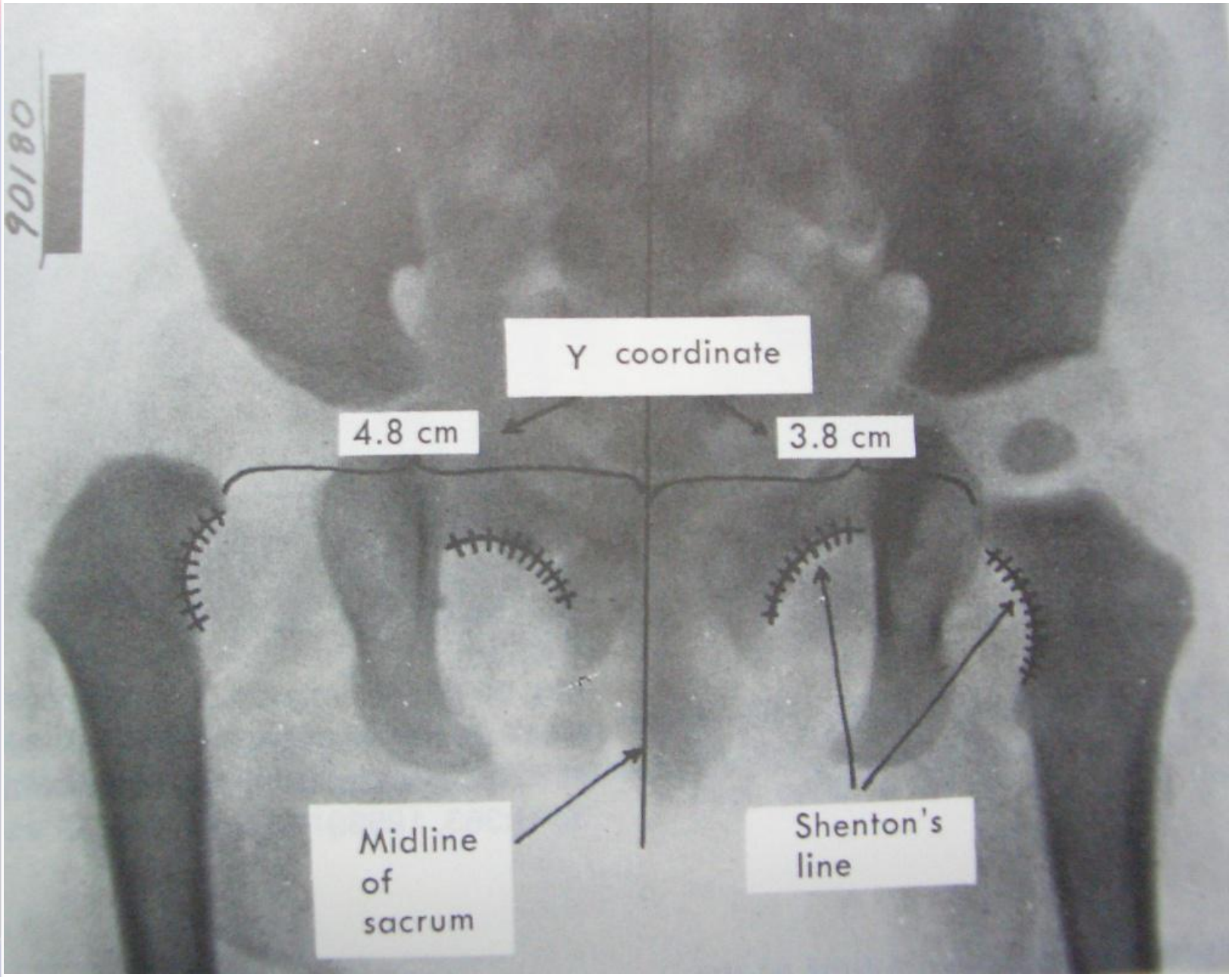

B
PERKINS LINE
HILGENREINER's LINE
C
Y
B
C
α
Y
d
h

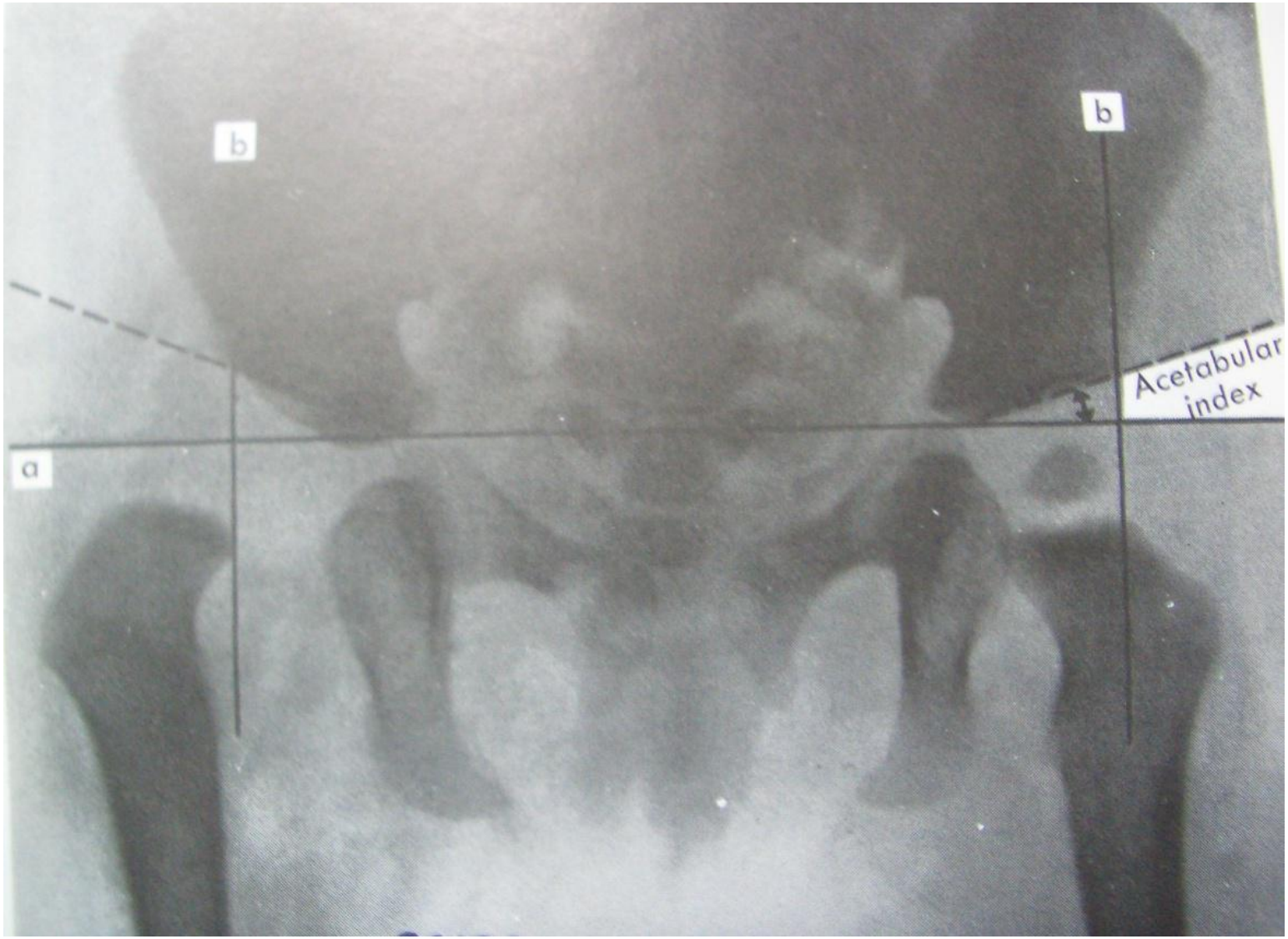


H - Hilgenreiner's Line
P - Perkins Line
A - Acetabular Index

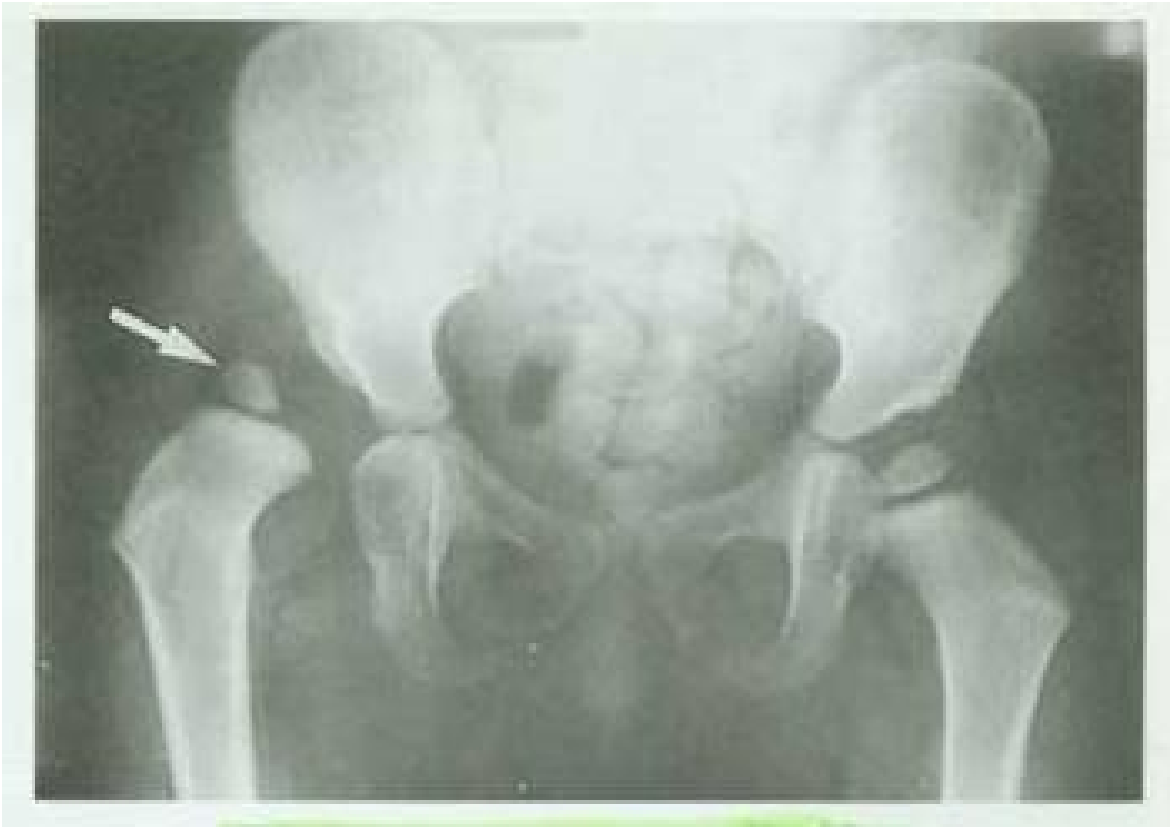
x - triradiate cartilage
o - lateral border of acetabulum


Normal Hip
Dysplastic Hip
1
2
3
4
5
6
7
8
Q


Y coordinate
4.8 cm
3.8 cm
Midline of sacrum
Shenton's line


b
b
a
Acetabular index

Putti's triad



Delayed appearance of a smaller ossific nucleus

Ossific nucleus outside the acetabulum

Sloping acetabulum with increased acetabular index

Ultrasonography

- Shows the shape of the acetabulum and position of the femoral head
  - If abnormal , splint the hip in flexion and abduction and review the child at 3 weeks and 6 weeks
- Hip will be reduced and stable or
- Reduced , but unstable or
- Subluxated or dislocated

Late features

- IN UNILATERAL CASES
  - Limitation of abduction
  - Asymmetry of skin creases
  - Shortening of the limb
  - Limp
- BILATERAL CASES
  - Abnormally wide perineal gap
  - Limited abduction on both sides – difficult diaper change
  - Waddling gait
  - No length discrepancy

Management Principles

- Routine neonatal screening by clinical examination and USG for early diagnosis
- To get a concentrically reduced position of the hip and to maintain this position by splinting, so as to facilitate the normal development of the acetabulum and femoral head
- Regular follow-up

0 - 6 months

- Most of the dysplastic hips will stabilize in the neonatal period, so after confirming the diagnosis, these neonates are kept under observation. Keep the hips in abduction with simple devices like double nappies. Repeat examination after three weeks

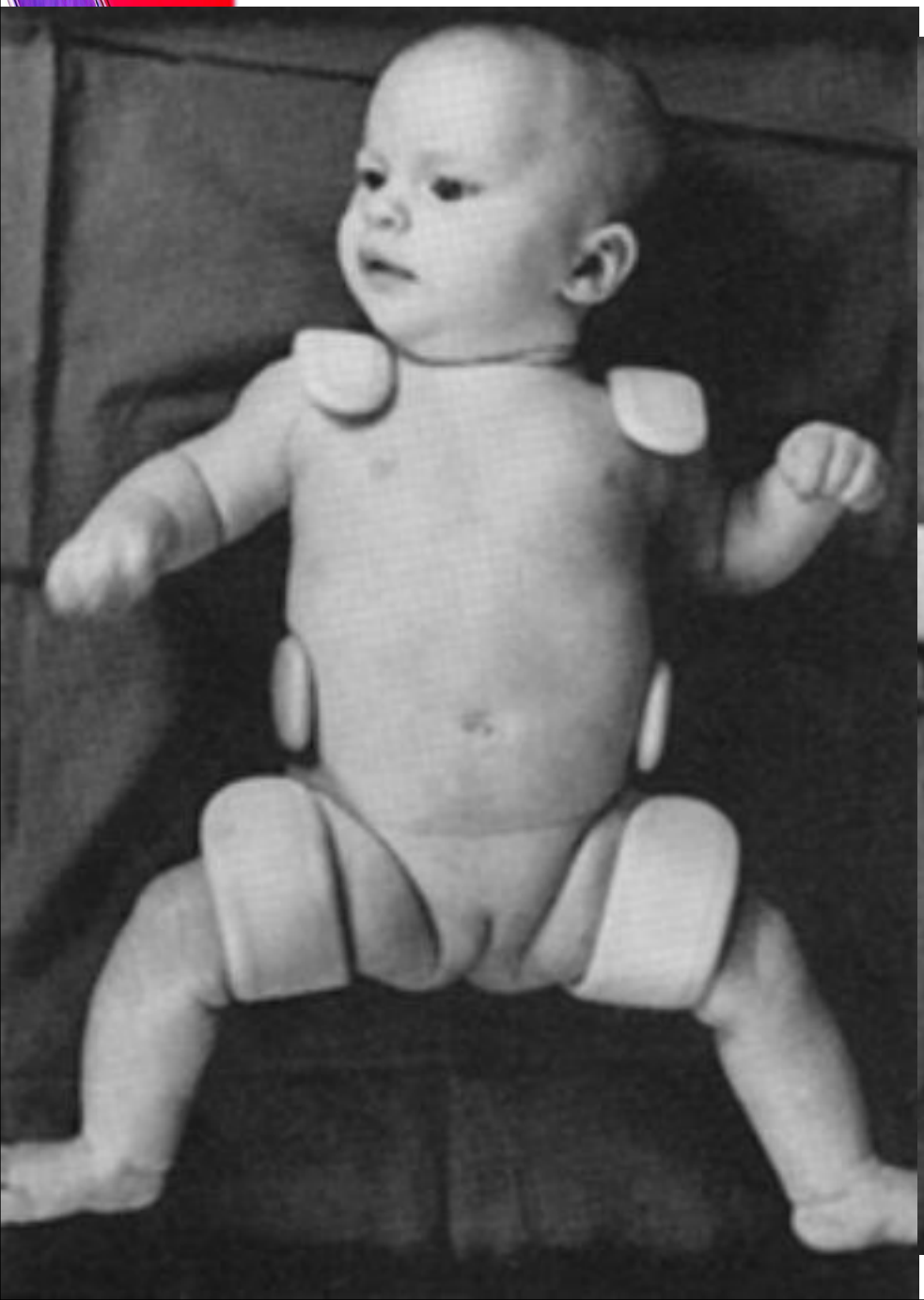
0 - 6 months

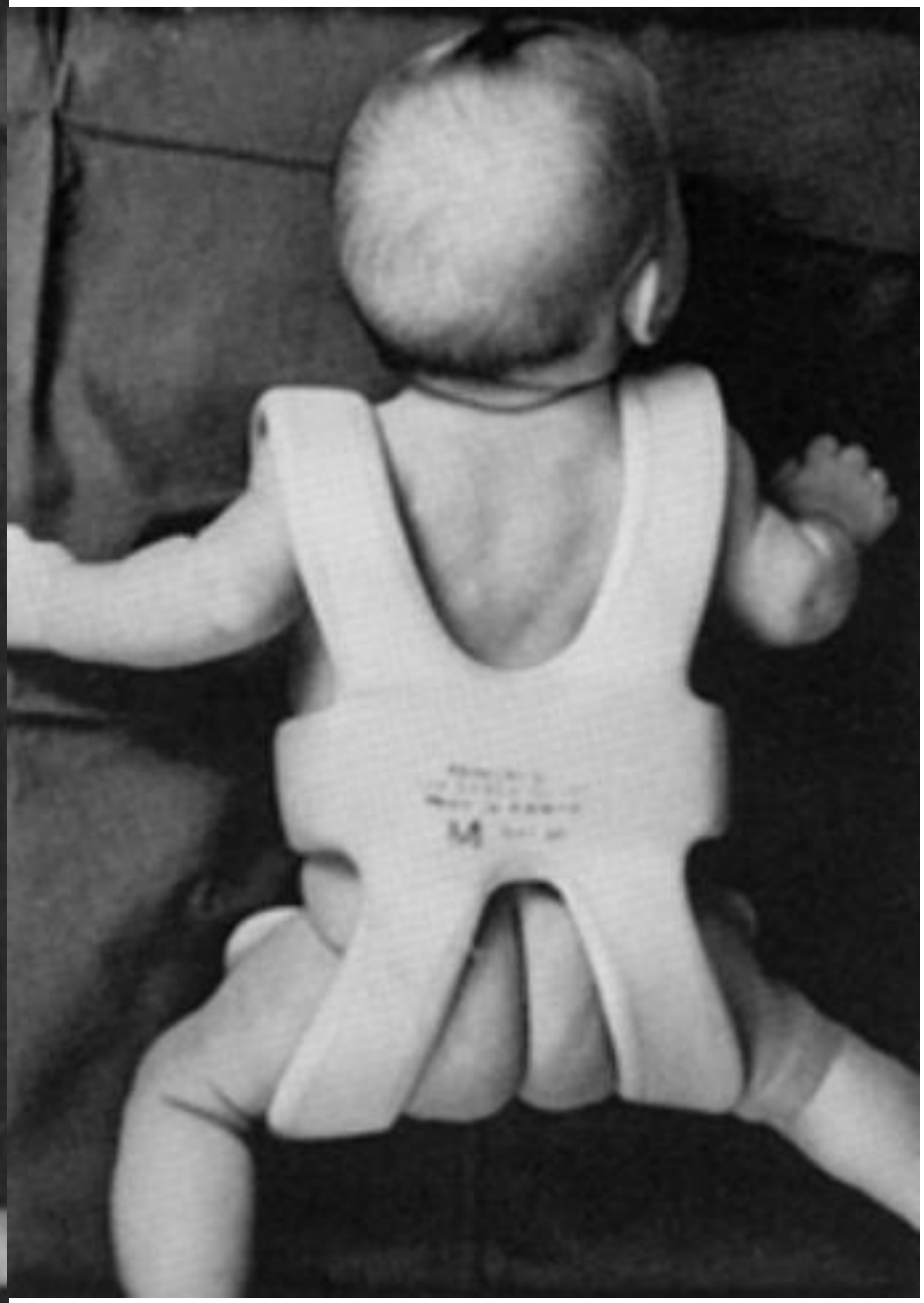
- If the hips remain stable at the end of three weeks, child is left without any treatment and kept being observed at 6 weeks and then at regular intervals till the hip joint is found to be developing normally

If the hip is not stable and remains dislocated or can be dislocated at the end of 3 weeks, then some form of splinting should be done to keep the hip in abduction and external rotation, to be worn till the hip has developed normally

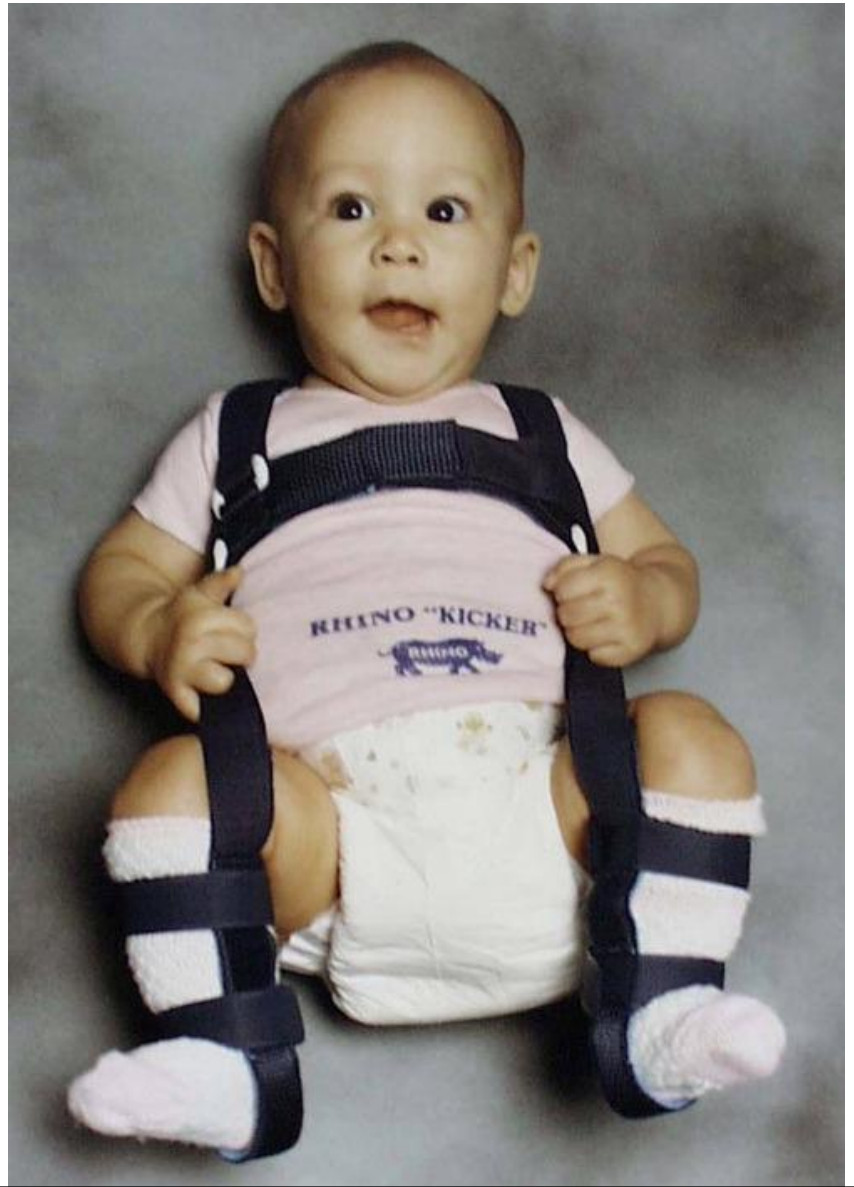
Von Rosen splint

CONTINUE REGULAR FOLLOW UP

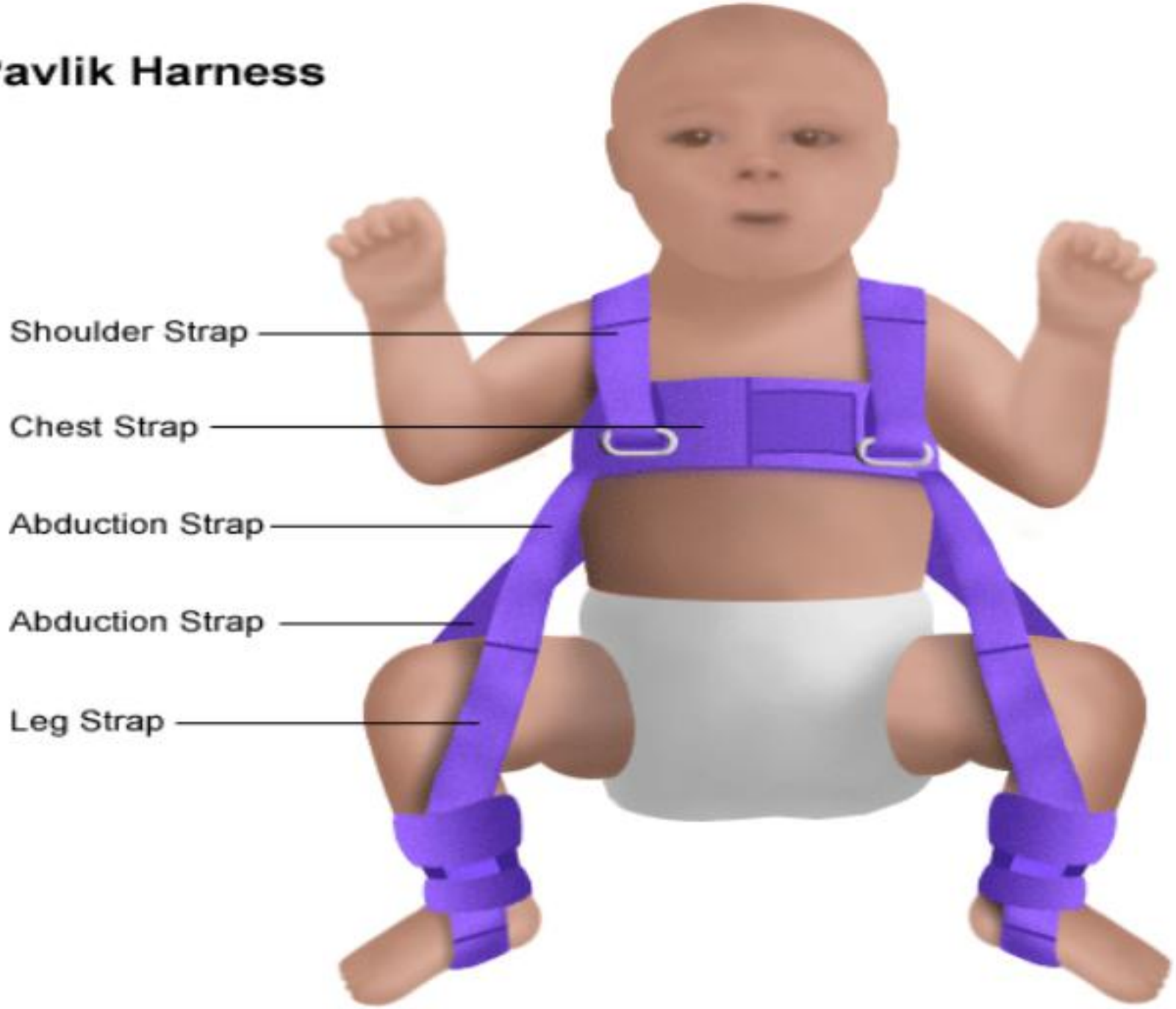


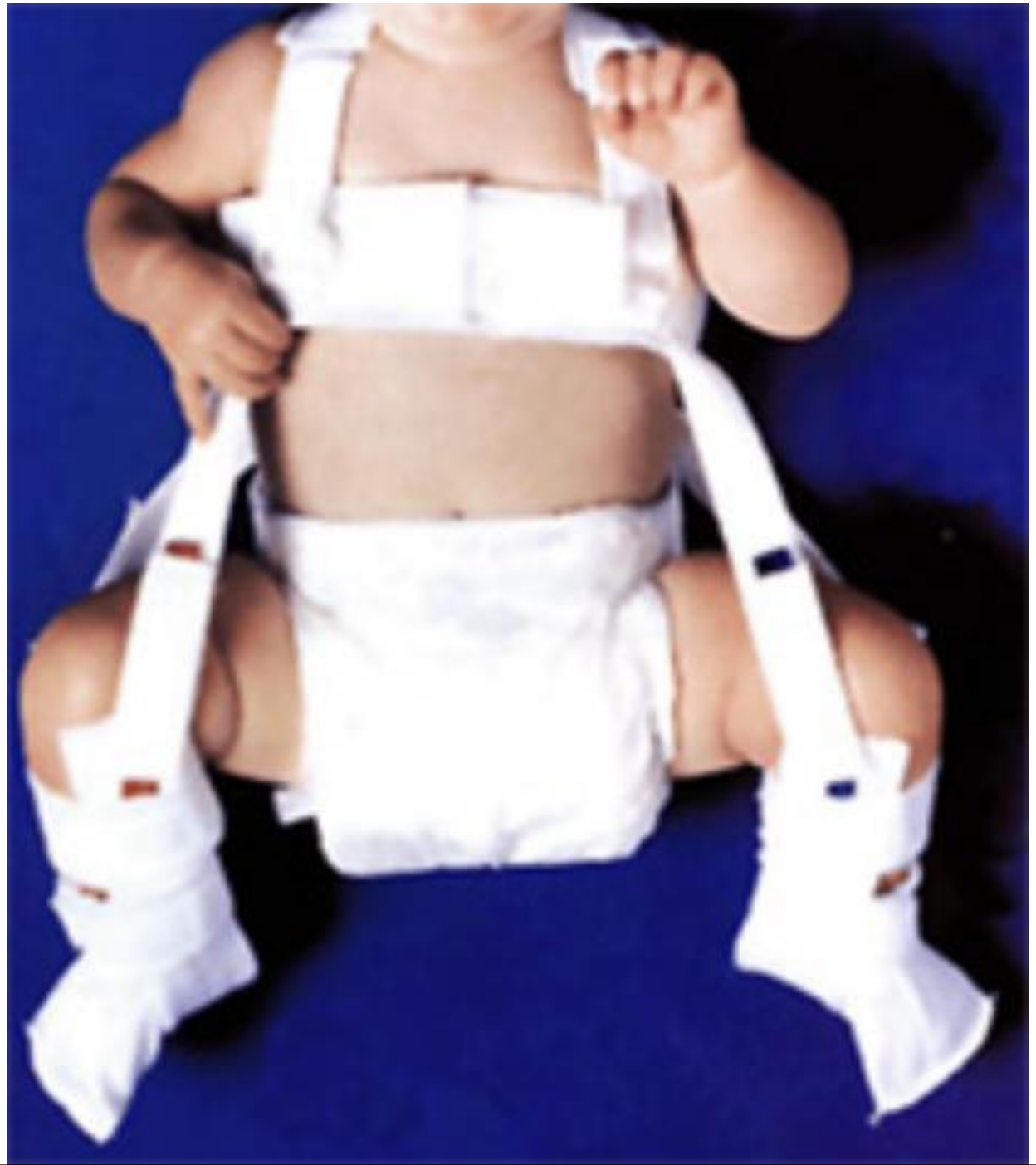


Pavlik harness



Pavlik Harness





6 -18 months

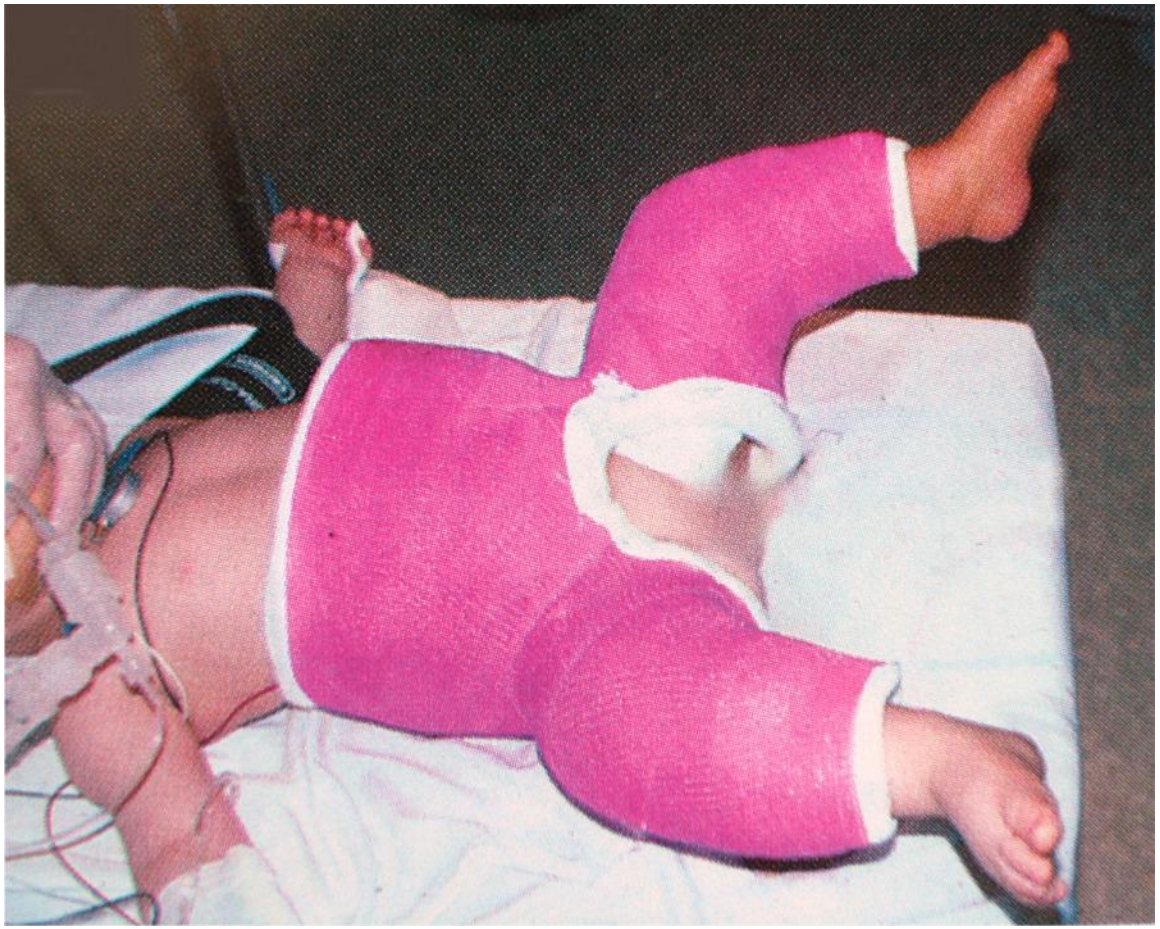
- Most of the children would have started crawling by now, so splints and harnesses ideally cannot be used

6 -18 months

- In most cases, closed reduction of the hip can still be done under anaesthesia and can be immobilised in a double hip spica

6 -18 months

- In case the hip cannot be reduced by gentle manipulation, excessive force should not be used for fear of compromising the vascularity of the capital femoral epiphysis



Avoid extremes of abduction and flexion

CONTINUE FOLLOW UP TILL THE HIP HAS DEVELOPED NORMALLY

- If the hip remains dislocated and cannot be reduced with gentle manipulation, a period of traction in abduction can be employed to stretch the soft tissues and to bring the head to the level of the acetabulum , so that a closed reduction can then be done followed by application of a hip spica

- Immobilisation in a spica has to be continued for 3-4 months, with possible change of spica under anaesthesia at 6 - 8 weeks. Reduction has to be confirmed by X-ray or CT scan and child is to be followed up till the hip has developed normally

18 - 36 months

- Acetabular dysplasia continues, head may remain subluxed or dislocated and adaptive shortening of muscles has occurred
- Closed reduction without undue force is very often not successful.

18 - 36 months

- Undue force or tight reduction resulting from the shortened soft tissues will result in AVN of femoral head
- Incidence of avascular necrosis is very high (10 %), compared to less than 1% in children below age of 1 yr

Management 18 - 36 months

- The aim is to achieve reduction of the hip and thus facilitate the normal development of the hip, at the same time to avoid the chances of avascular necrosis of the femoral head

Management 18 - 36 months

- Open reduction of the hip is often required with some femoral shortening to reduce the pressure on the femoral head

Management 18 - 36 months

- In addition, to improve the containment of the head in the acetabulum and to improve the development of the socket, an osteotomy of the innominate bone is required, to change the direction and inclination of the acetabulum

SALTER's INNOMINATE OSTEOTOMY

Above the age of 3 years

Poor results due to

- Persistent pelvi femoral instability
- Secondary changes in the femur and acetabulum due superior migration of the femur and persistent acetabular dysplasia
- Adaptive shortening of the pelvi femoral muscles

These cases diagnosed late will need

- Open reduction with additional procedures on the femoral side like derotation osteotomy to correct increased anteversion of the neck with femoral shortening

These cases diagnosed late will need

- Some form of re- directional osteotomy of the acetabulum to improve the reduction and to help in the development of a near normal acetabulum

Cases diagnosed very late in childhood

- Better left alone, especially in bilateral cases
- Reconstructive surgery, like THR can be done later on, when the hip becomes painful due to arthritic changes

Treatment

- The earlier the better.
- Best time for treatment is in newborn period.
- It depends on the device and age of the patient.
- Goal is to:

1.Flex and abduct hips.

2.Reduce femoral head and maintaining it.

Treatment

- From (1-6 months) use Pavlik Harness.
- From 6 months -1 year use hip spica.
- From the age of 1 year to 3 years:
  - Traction
  - Adductor tenotomy
  - Surgical / Closed reduction
  - Salter innominate osteotomy.

To Summarize

- Cases of DDH, diagnosed at birth or soon after can expect to have uniformly good results with simple conservative management. The importance of early diagnosis has to be emphasised

To Summarize

- The incidence of complications and poor results increase progressively with increasing age, at which the diagnosis is made and has to be avoided at all cost.

EFFECTIVE NEONATAL SCREENING, INVOLVING THE OBSTETRICIAN, THE PAEDIATRICIAN AND THE ORTHOPAEDIC SURGEON CAN GO A LONG WAY IN EARLY DIAGNOSIS, THUS IMPROVING THE OUTCOME

LET THIS BE OUR GOAL


THANK YOU