DDH and pediatric hip

DONE BY: ASAL ALSAYYED
OBJECTIVES:

- DEFINE the pediatric hip
- describe the pathology of DDH
- Identify the risk factors of DDH
- Outline the algorithm for screening of DDH
- Explain the clinical picture of DDH in different age groups
- Analyze the findings of ultrasound and X-RAY in cases of DDH
- Assess the different treatment options for DDH
- The hip is a deep seated joint and it’s the largest ball and socket joint formed by the acetabulum and femur head.
- The acetabulum is the cup-shaped socket on the lateral aspect of the pelvis and it is formed by the ilium, ischium and pubis.
- The margin of the acetabulum is deficient inferiorly. An additional fibrocartilaginous margin of the acetabulum is referred to as the acetabular labrum. The labrum functions to deepen the acetabulum, thus holding the femoral head more securely.
- At birth the femoral head is less than 50% covered by the acetabulum, and the acetabulum is at its most shallowness and most laxity in order to maximize the hip ROM (range of motion).
- After several weeks, the acetabular cartilage starts to develop faster than the femoral head, which allows for more coverage in a normal hip, the ball of the femur fits firmly into the socket.
- Hip develops after 12 wks of gestation.
DEVELOPMENTAL DYSPLASIA OF THE HIP (DDH)
DDH

- It’s a spectrum of abnormalities affecting the growing hip.
- It results in **dysplasia** and possible **subluxation** or **dislocation** of the hip secondary to capsular laxity and mechanical factors.
- Subluxation is an incomplete or partial dislocation of a joint. In the case of the hip joint, it means the ball started to come out of the socket, but did not come fully out or **dislocate**.
- DDH occurs after the 1st trimester and although DDH is most often present at birth, it may also develop during a child's first year of life.
- Previous name for DDH is CDH “congenital dysplasia of the Hip” as they thought that it occurs in the 1st trimester (not after 1st trimester) and anything that happens in the 1st trimester is called congenital.
- Most cases are dysplasia, if neglected it will become subluxation or dislocation at walking age.
- All children must be screened for DDH at 3 month of age.
Pathology:
- The acetabulum is shallow (shaped like a saucer instead of a cup).
- The femoral head gets dislocated.
- The capsule is stretched and the ligamentum teres becomes elongated and hypertrophied.

Classification:
- Dysplasia
- Subluxation – Incomplete contact between the articular surfaces of the femoral head and acetabulum.
- Dislocation – Complete loss of contact.
- Instability – Ability to subluxate or dislocate the hip with passive manipulation
  - In other words:
    - Type 1 → acetabular dysplasia
    - Type 2 → acetabular dysplasia + Subluxation
    - Type 3 → frank dislocation
DEVELOPMENTAL DYSPLASIA OF THE HIP (DDH)

Incidence: 1 or 2 per 100 infants (1 in 1000 for dislocation)

Left hip is more often affected, due to the baby’s intrauterine position of the left hip against the mother’s sacrum, which forces it into an adducted position

girls:boys = 7:1

May be associated with other congenital abnormalities that occur with tighter intrauterine space (e.g., metatarsus adductus)

20% bilaterally

Rare in prematures; because the hormone "relaxin" which wouldn't have reached its highest levels in these babies when they are born
● ETIOLOGY IS MULTIFACTORIAL.
○ GENETIC FACTORS: TWO HERITABLE FEATURES PREDISPOSE TO DDH: GENERALIZED JOINT LAXITY AND SHALLOW ACETABULUM.
○ INTRAUTERINE ENVIRONMENTAL FACTORS:
  ■ 1. HORMONAL CHANGES IN LATE PREGNANCY MAY AGGRAVATE LIGAMENTOUS LAXITY IN THE INFANT. → THE HORMONE "RELAXIN"
AT THE END OF GESTATION, THERE WILL BE PRODUCTION OF RELAXIN HORMONE TO RELAX THE JOINTS OF HIP IN MOTHER, THIS RELAXIN WILL AFFECT THE HIPS IN THE INFANT ALSO, WHICH WILL INCREASE THE RISK OF DDH, BUT IN PREMATURE THIS HORMONE "RELAXIN" WILL NOT BE SECRETED.
  ■ 2. INTRAUTERINE MALPOSITION, ESPECIALLY A BREECH POSITION WITH EXTENDED LEGS, WOULD FAVOR DISLOCATION.
● BREECH BIRTH OCCURS WHEN A BABY IS BORN BOTTOM FIRST INSTEAD OF HEAD FIRST
○ POSTNATAL FACTORS INCLUDE PRACTICES THAT ARE ASSOCIATED WITH DDH CARRYING BABIES IN CONFINED CLOTHES THAT CAUSES HIP EXTENSION, HIP AND KNEES ADDUCTION. THIS INCREASES THE PSOAS MUSCLE-TENDON TENSION AND PREDISPOSE TO DISPLACEMENT
RISK FACTORS: 7FS

Females are more commonly affected: receptors in females are 7 times more sensitive to maternal hormones, leading to ligamentous laxity.

First born → not well dilated uterus ▶

Firstborn breech, mostly delivered by c-section. And that’s why it’s said that DDH is more common in babies born by caesarean section because most breech babies are delivered by c-section.

Family history ▶

Fluid abnormalities (oligohydramnios): condition in pregnancy characterized by a deficiency of amniotic fluid. It is the opposite of polyhydramnios.

Facial abnormalities ▶

Feet abnormalities ▶
Presentation:

- Acetabular dysplasia → only appears on x-ray
- Frank dislocation
  - Legs of different lengths.
  - Uneven skin folds on the thigh.
  - Less mobility or flexibility on one side.
  - Limping, toe walking, or a waddling, duck-like gait later in life.
- DDH itself is not painful and it doesn’t cause delayed walking
1. **Barlow test**: a maneuver that is performed by adducting the hip while applying light pressure on the knee, directing the force posteriorly. If the hip dislocates (pops out of socket with a ‘clunk’ is felt), the test is considered positive. The test is harmful and shouldn’t be done.

2. **Ortolani test**: relocates the dislocation of the hip joint that has just been elicited by the Barlow maneuver by abducting the hip joint. Barlow and Ortolani tests are inapplicable after 3 months of age because of certain changes that happen in the hip joint and make it fixed and no more reducible by that age. Specifically, this tests for posterior dislocation of the hip. Affected leg will have less abduction ROM.

3. **Galeazzi test “Allis sign”**: It is performed by flexing the knees while lying down so that the feet touch the surface and the ankles touch the buttocks. If the knees are not level (apparent limb length discrepancy) then the test is positive. Shorter leg is the affected leg.
HOW TO ASSES HIP STABILITY IN INFANTS:
Ortonali’s test:

To assess if the hip is dislocated
CLUNK: POSITIVE RESULT
To assess if the hip is sublaxable (can be easily dislocated from the acetabulum)

BARLOW’S TEST:
DDH
Coronal flexion view
The **triradiate cartilage** is the 'Y'-shaped epiphyseal plate between the ilium, ischium and pubis to form the acetabulum of the hip bone.
RECOMMENDATION OF THE AMERICAN ACADEMY OF PEDIATRICIANS (AAP) FOR HIP ASSESSMENT FOR DDH

All newborns should be screened by physical exam

Routine ultrasound for all newborns is NOT needed

If there is positive Ortonali or Barlow sign (clunk):
1. Orthopedic referral
2. No need for ultrasound or radiograph

3. Use of triple diapers is not recommended (will delay more appropriate treatment).

If there is "equivocal" (soft clunk or asymmetry), repeat the exam after 2 weeks.

Follow up after two weeks:
1. If the results are the same (soft clunk, asymmetry), orthopedic referral or ultrasound
2. If the results became negative: no need for further action
3. If the results became positive Ortonali or Barlow (clunk): orthopedic referral
RECOMMENDATION OF THE AMERICAN ACADEMY OF PEDIATRICIANS (AAP) FOR HIP ASSESSMENT FOR DDH

Risk factors

If the results of the newborn examination are negative (or equivocally positive), risk factors may be considered:

- Female:
  - Hips should be reevaluated at 2 weeks of age

Infants with a positive family history of DDH or breech presentation:

- For boys, hips reevaluated at 2 weeks of age
- For females, ultrasound at the age of 6 weeks or radiographs at the age of 4 months should be performed

- Consider radiographs for all breech (boys and girls) at the age of 4 months for detection of acetabular development
RECOMMENDATION OF THE AMERICAN ACADEMY OF PEDIATRICIANS (AAP) FOR HIP ASSESSMENT FOR DDH

Periodicity ▶

1. The hips must be examined at every well-baby visit.

2. If DDH is suspected (by abnormal exam or prenatal complain for difficult change of diaper) in any visit, one of the following has to be done:

   - Focus exam of the hip with the child relaxed
   - Orthopedic referral
   - Imaging study (ultrasound for children less than 4 months or radiographs for children older than 4 months)
HOW TO ASSES HIP STABILITY IN TODDLERS AND CHILDREN

Shortening of the femur (Galeazzi sign)
Unequal gluteal fold
Limited abduction
Limping (for unilateral cases) and waddling gait (for bilateral cases)
Pain is NEVER a symptom of UNTREATED DDH until the development of hip arthritis (usually by the 4th decade of life)
Management
1. If the age of presentation is < 6 months or the weight is < 9 kg: Pavlik harness for at least 6 weeks and no more than 3 months.
   - The ideal position for pavlik harness is 35-60° abduction (it should be abducted with distance btw the 2 knees cannot be less than 3-4 fingers (controlled by posterior straps). and 90-100° flexion. (control by anterior strap)

   - Pavlik harness is designed to hold the hip in the proper position while allowing free movement of the legs and easy diaper care, by keeping the hip flexed and abducted.
   - Pavlik harness prevents extension and adduction, not force flexion and abduction.
   - It helps to tighten the ligaments around the hip joint and promotes normal hip socket formation.
   - If abduction is > 60° there's a risk for AVN, because maximum abduction might compress the ascending branches of lateral epiphyseal vessels.
   - If flexion is > 100° there is a risk of inferior dislocation and injury to the neurovascular bundle (femoral nerve palsy).
   - After fitting the Pavlik harness → follow up after 1 week
   - Worn 23 hours a day for the duration of “age of application + 2 months” (eg: if the palvik harness was applied at the age of one month, it should be left for 3 months)
2. If the age is between 6-12 months or failure of pavlik harness: arthrogram, closed reduction and spica casting 
and then we bring the child to OR and inject the dye again and do another exam, make sure it is 
spica cast usually applied for 6 weeks-stable and apply a spica for another 6 weeks

3. If age of presentation is 1-2 years or failure of closed reduction: open reduction and femoral 
osteotomy (to make reduction more stable, and to reduce stress on the femoral head to avoid 
development of avascular necrosis) + spica casting. 
Do CT to the patient after the surgery to ensure there's no posterior dislocation

4. If >2 years → open surgery + pelvic and femoral osteotomy

5. If age of presentation > 3 years: palliative surgery because acetabular remodeling ends by the 
age of 3. 
any form of treatment can affect blood supply, even the pavlik harness and it is more than in - 
open reduction than closed reduction.
THANK YOU