Neonatal Physical Examination

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Definition and timing

Skin

Initial assessment

Head, Face, and neck

Detailed assessment

Chest, Abdomen, and Genitalia

Extremities and Spinal Cord

Definition:

Assessment of recently born infant at various points within the time frame of first 6-8 weeks after birth including head to toe examination to look for any pathology.

•Timing:

- Initial exam immediately after birth and any resuscitation
- Full and detailed assessment within 48hours and always prior to discharge
- Follow up 5-7 days and 6weeks.

Never D/C a newborn before you examine him; some abnormalities may appear 24-48 hours after birth like CHD, murmurs, jaundice

Why is it necessary?

Detect congenital abnormalities 1-3%

Detect some acquired abnormalities

Reassure parents when normal findings are detected

Initial assessment

rapid scoring system based on physiologic responses to the birth process, is a good method for assessing the need to resuscitate a newborn.

The 1-minute score **determines how well the baby tolerated the birthing process**. The 5-minute score tells the health care provider how well the baby is doing outside the mother's womb

APGAR
Test Scoring

	Score 0	Score 1	Score 2
Appearance	 Blue all over	 Blue only at extremities	 No blue coloration
Pulse	No pulse	<100 beats/min.	>100 beats/min.
Grimace	 No response to stimulation	 Grimace or feeble cry when stimulated	 Sneezing, coughing, or pulling away when stimulated
Activity	 No movement	 Some movement	 Active movement
Respiration	No breathing	Weak, slow, or irregular breathing	Strong cry

Causes of a low APGAR score?

- Asphyxia
- Maternal drugs
- CNS disease
- Congenital muscular disease
- Prematurity
- Sepsis

- **8-10** = normal cardiopulmonary adaptation
- **4-7** = warrant close attention to determine whether the infant's status will improve
- **0-3** = cardiopulmonary arrest or a condition caused by severe bradycardia, hypoventilation, or central nervous system depression → ABCD approach.

DETAILED ASSESSMENT

1) Gestational age, Based on:

- Menstrual periods
- Date of conception
- Fetal U/S
- Physical parameters after birth (Ballard score)

Pre-term (<37 weeks)
Full term (37-42 weeks)
Post-term (>42 weeks)

3) Growth parameters :

- Head circumference
- Body length
- weight

2)VITALS

- Temperature
- Heart rate (120-160)
- Respiratory rate (30-60)
- Blood pressure
- SpO_2
- Capillary refill

Targeted Preductal SpO_2 After Birth	
1 min	60–65%
2 min	65–70%
3 min	70–75%
4 min	75–80%
5 min	80–85%
10 min	85–95%

CLASSIFICATION OF NEWBORN

1) Classification by Gestational Age

Pre-term (<37 weeks)
Full term (37-42 weeks)
Post-term (>42 weeks)

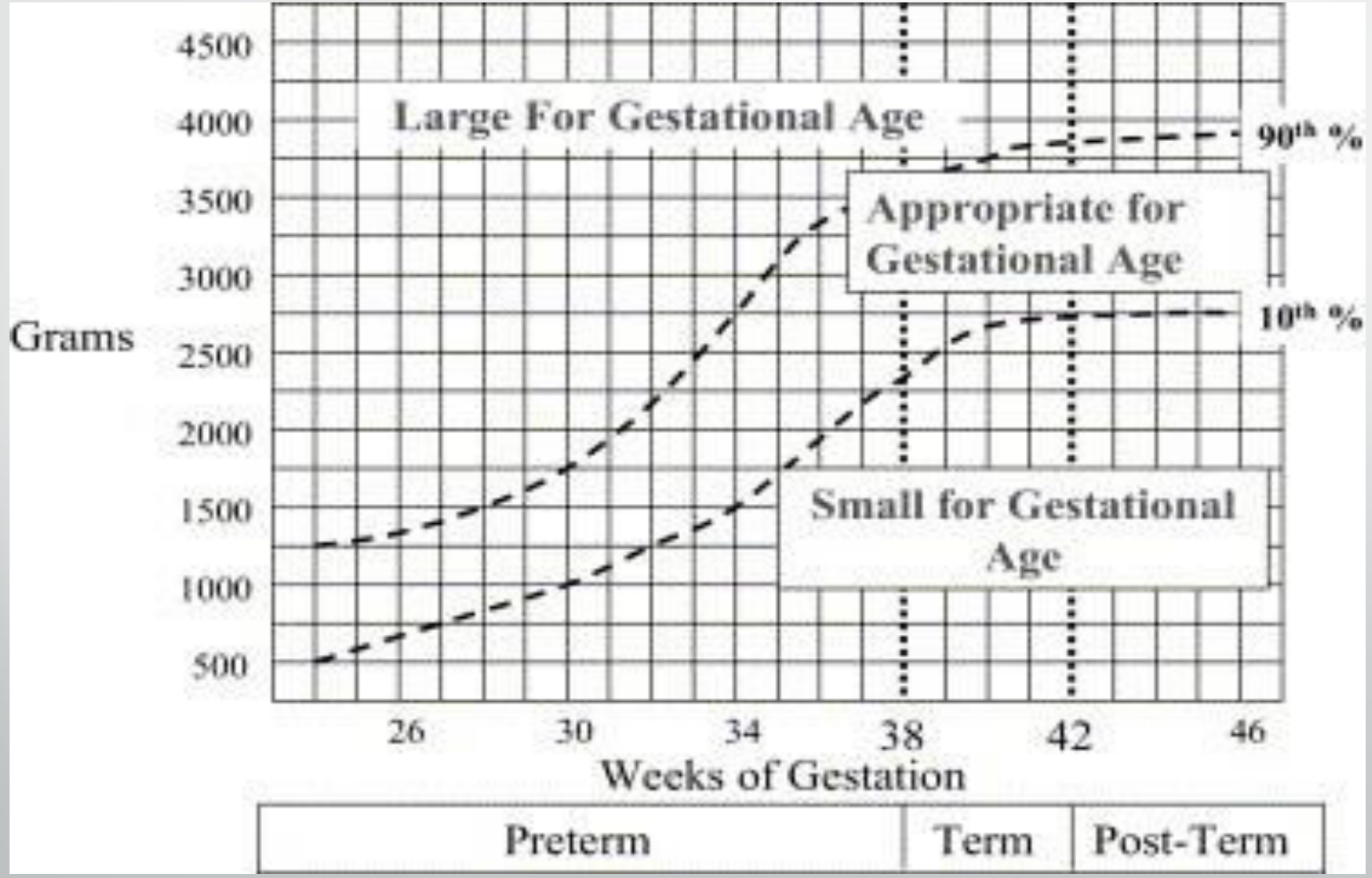
2) Classification by Birth Weight

Low birth weight (<2500 gram)
Very low birth weight ((<1500 gram)
Extreme low birth weight (<1000 gram)

3) Classification by Weight Percentiles

AGA (10^{th} – 90^{th} Percentile for GA)
SGA (< 10^{th} Percentile for GA)
LGA (> 90^{th} Percentile for GA)

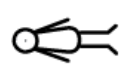
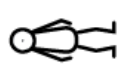
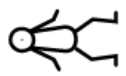
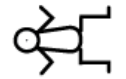
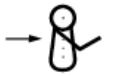
Birth weight to Gestational Age



Ballard score

- The Ballard score is commonly used to determine gestational age.
- Scores are given for 6 physical and 6 nerve and muscle development (neuromuscular) signs of maturity.
- The scores for each may range from -1 to 5.
- The scores are added together to determine the baby's gestational age.
- The total score may range from -10 to 50.
- Premature babies have low scores. Babies born late have high scores.

Neuromuscular Maturity

Score	−1	0	1	2	3	4	5
Posture							
Square window (wrist)	 >90°	 90°	 60°	 45°	 30°	 0°	
Arm recoil		 180°	 140–180°	 110–140°	 90–110°	 <90°	
Popliteal angle	 180°	 160°	 140°	 120°	 100°	 90°	 <90°
Scarf sign							
Heel to ear							

Physical Maturity

Skin	Sticky, friable, transparent	Gelatinous, red, translucent	Smooth, pink; visible veins	Superficial peeling and/or rash; few veins	Cracking, pale areas; rare veins	Parchment, deep cracking; no vessels	Leathery, cracked, wrinkled
Lanugo	None	Sparse	Abundant	Thinning	Bald areas	Mostly bald	
Plantar surface	Heel-toe 40–50 mm: −1 <40 mm: −2	>50 mm, no crease	Faint red marks	Anterior transverse crease only	Creases anterior 2/3	Creases over entire sole	
Breast	Imperceptible	Barely perceptible	Flat areola, no bud	Stippled areola, 1–2 mm bud	Raised areola, 3–4 mm bud	Full areola, 5–10 mm bud	
Eye/Ear	Lids fused loosely: −1 tightly: −2	Lids open; pinna flat; stays folded	Slightly curved pinna; soft; slow recoil	Well curved pinna; soft but ready recoil	Formed and firm, instant recoil	Thick cartilage, ear stiff	
Genitals (male)	Scrotum flat, smooth	Scrotum empty, faint rugae	Testes in upper canal, rare rugae	Testes descending, few rugae	Testes down, good rugae	Testes pendulous, deep rugae	
Genitals (female)	Clitoris prominent, labia flat	Clitoris prominent, small labia minora	Clitoris prominent, enlarging minora	Majora and minora equally prominent	Majora large, minora small	Majora cover clitoris and minora	

Maturity Rating

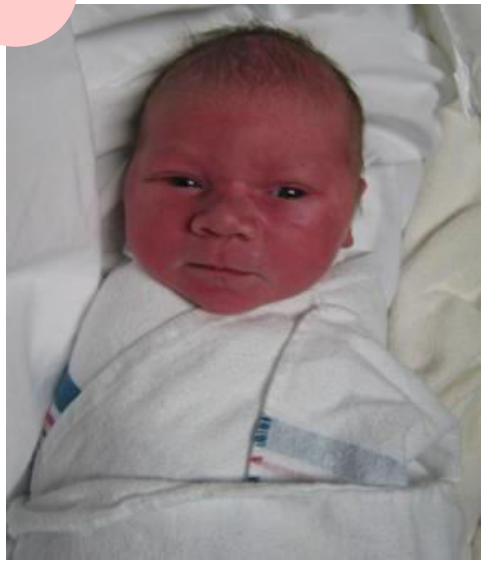
Score	Weeks
−10	20
−5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

Detailed assessment/Appearance

color

pallor

(anemia, poor perfusion, shock, asphyxia, PDA)

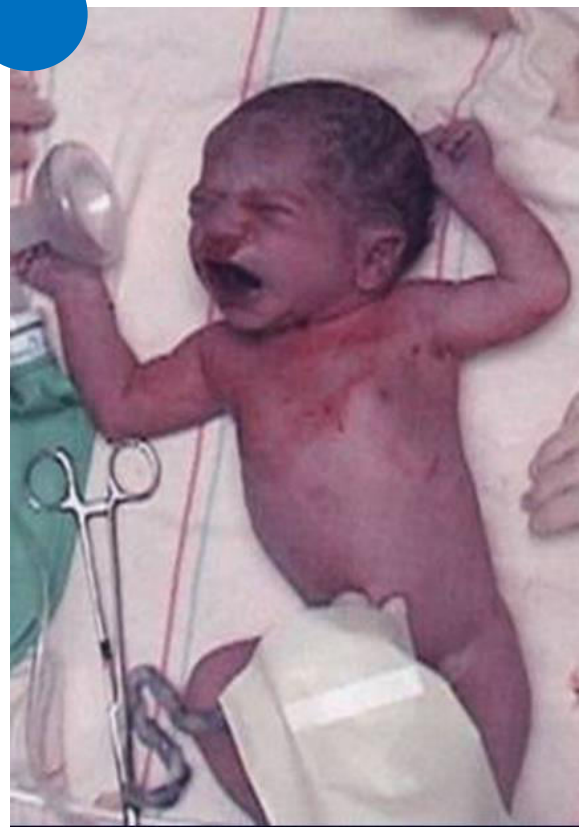


plethora

(polycythemia: large placental twin to twin transfusions, hypoxia, IUGR, perinatal asphyxia)

jaundice

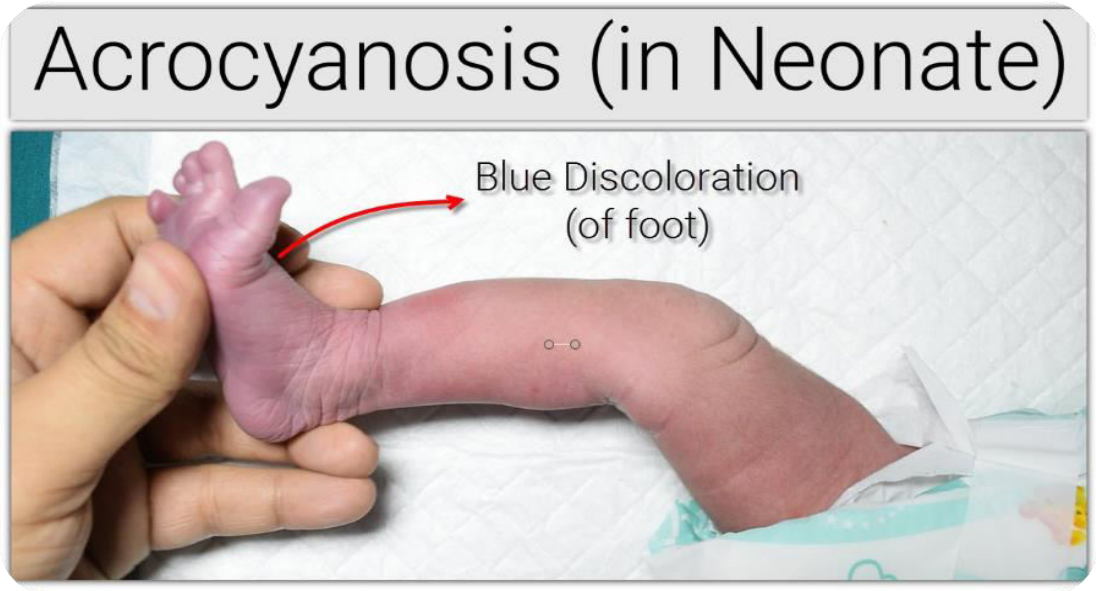
TORCH INFECTION, hemolytic disorders (g6pd, spherocytosis) Occult hematoma



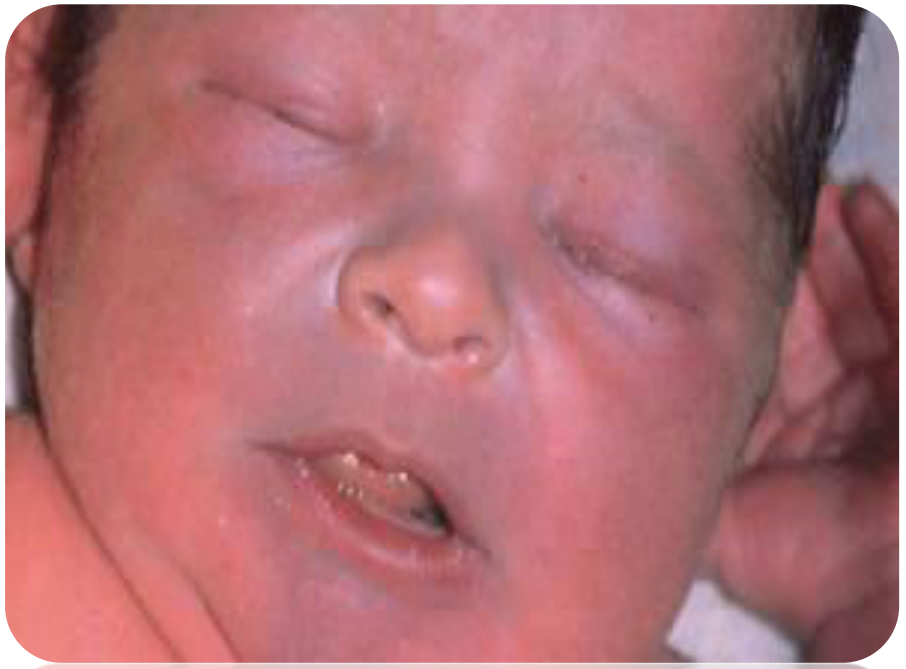
Generalized cyanosis

Methaemaglobinaemia, or significant hypoxemia.

Vasomotor instability with cutis marmorata, telangiectasia, phlebectasia (intermittent mottling with venous prominence), and acrocyanosis (feet and hands) is normal in a premature infant.



Acrocyanosis

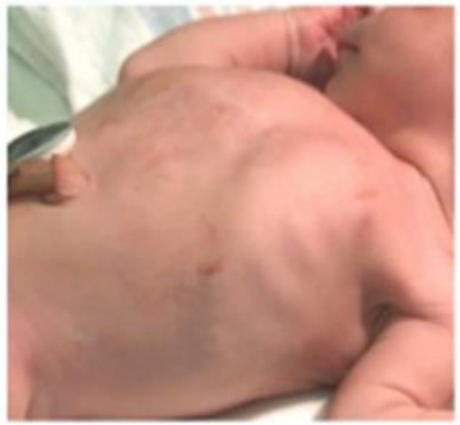


Central cyanosis

Acrocyanosis is a bluish-purple discoloration of the hands and feet and, when the newborn is centrally pink, is a normal finding.

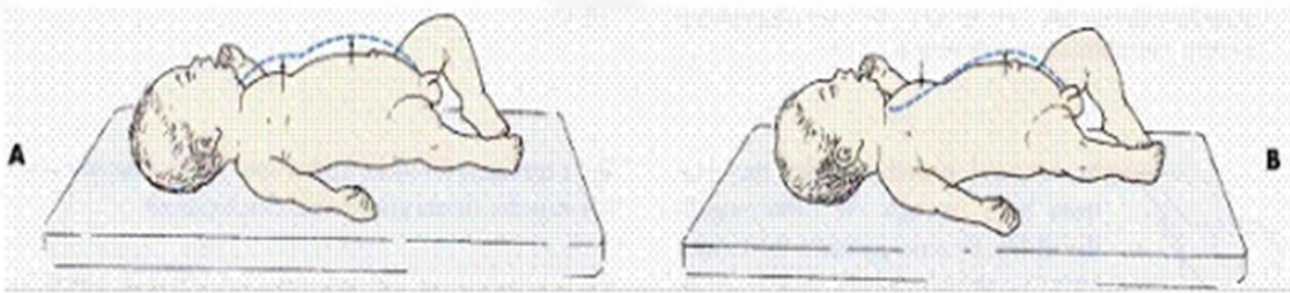
Cyanotic Heart Diseases
Respiratory RDS, Choanal atresia, Diaphragmatic hernia
CNS Respiratory center depression
Blood Methemoglobinemia
Metabolic hypothermia

Physical Examination - Respiratory



In this photo, taken during inspiration, the shadows between the ribs can be clearly seen.

Retractions may or may not occur in combination with other signs of distress: nasal flaring, grunting, and tachypnea.



Comparison: Common in newborn with **Tachypnea.**
A. Normal respiration. Chest and abdomen rise with inspiration.
B. Seesaw respiration. Chest wall retracts and abdomen rises with inspiration.

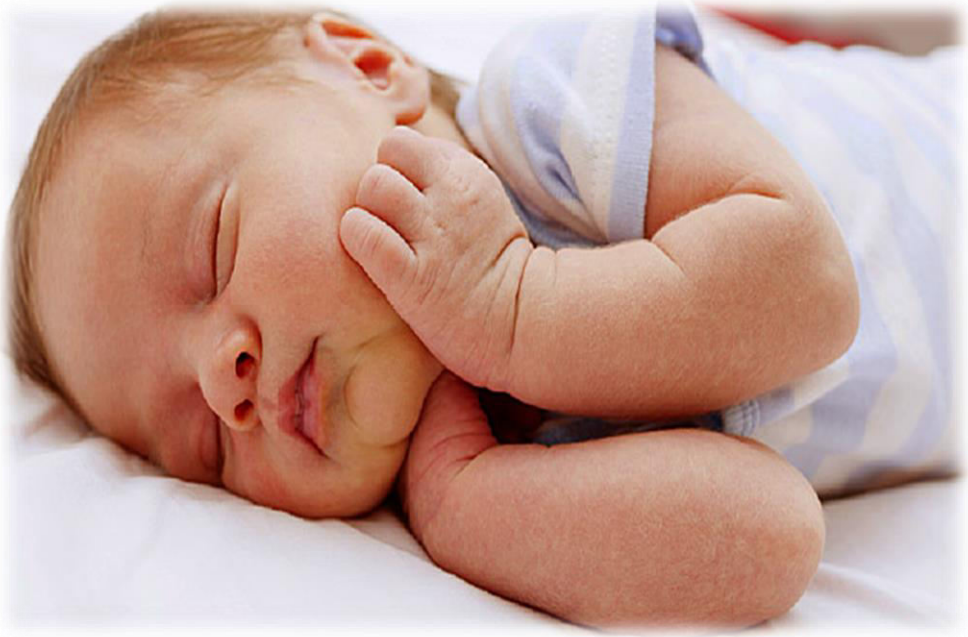
Respiratory distress signs:

- Tachypnea
- Nasal flaring
- Accessory muscle use
- subcostal, intercostal, supraclavicular, and suprasternal retractions
- Grunting

- Neonatal skin vs adult's skin

1. **Thinner**
2. **Less hairy**
3. **More proliferation >> more desquamation**
4. **Less glands secretions**

- *This makes the neonatal skin more susceptible for infections, irritants.*

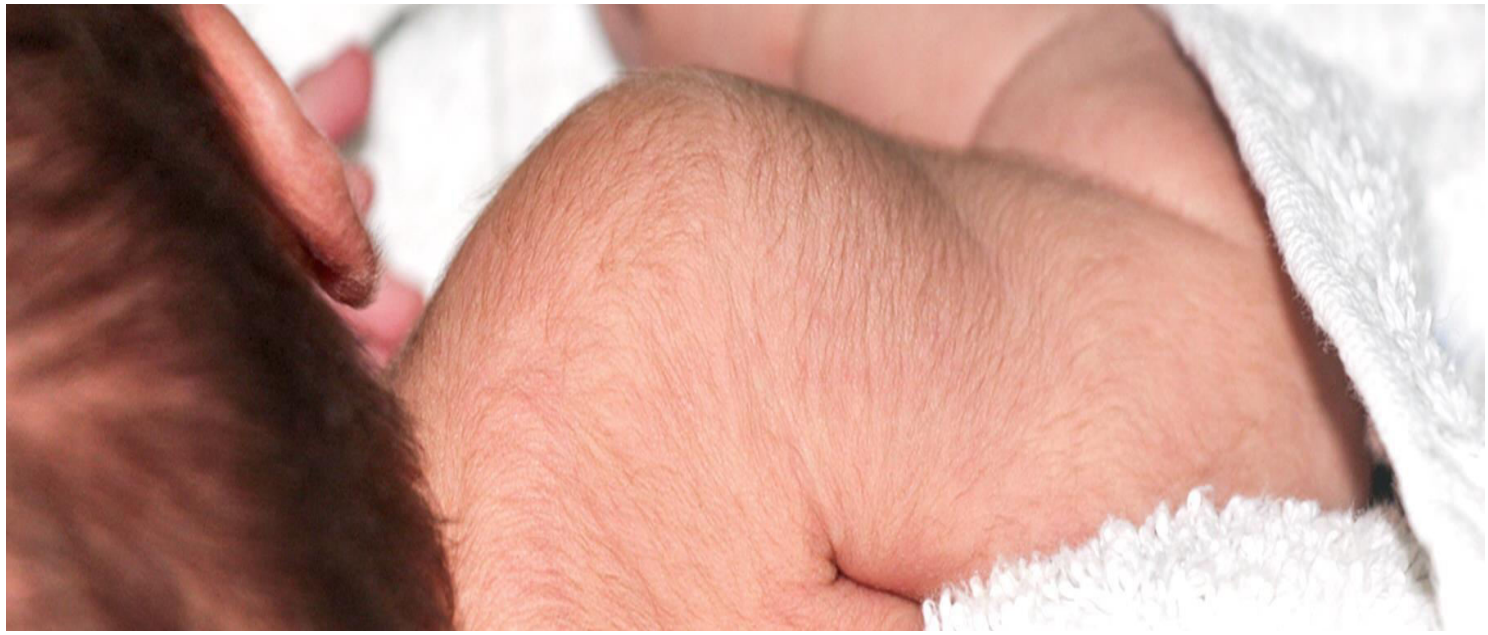


•Transient skin conditions:

1. Lanugo hair
2. Vernix caseosa
3. Stork bite marks
4. Cutis marmorata (livedo reticularis)
5. Sucking Blisters
6. Milia (milk spots)
7. Erythema toxicum neonatorum Toxic erythema
8. Transient neonatal pustular melanosis
9. Acne neonatorum
10. Neonatal lupus

• *Lanugo hair*

- Thin, soft, usually unpigmented hair.
- It increases by Gestational age 20W and usually fades before term , and replaced by villus hair
- More in preterm
- Less in post term
- Most at shoulders , upper arms, back , forehead



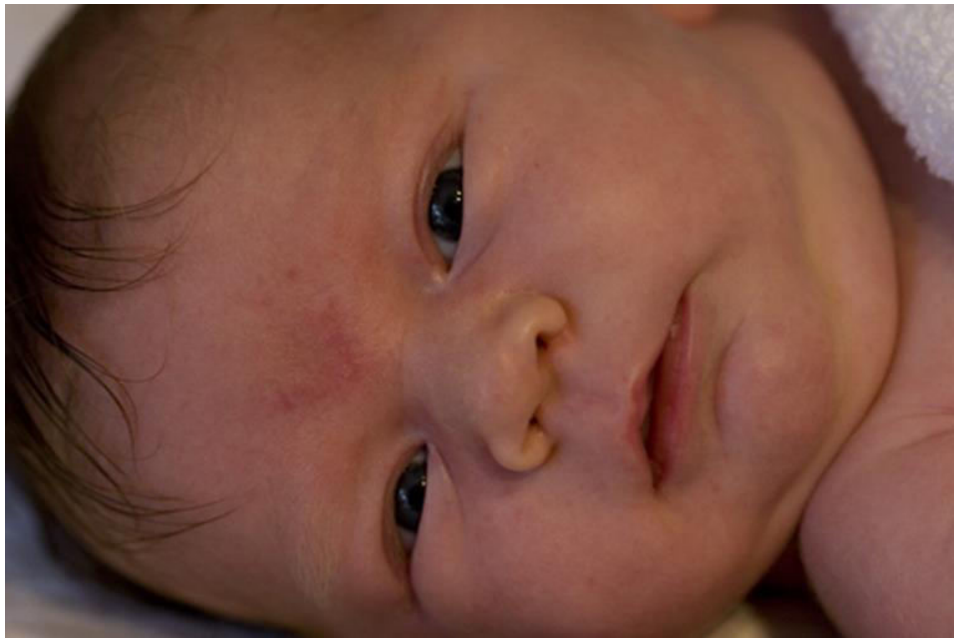
- Normal findings The skin may look normal, dry, wrinkled or vernix covered in healthy babies. There may be meconium staining of the skin and nails

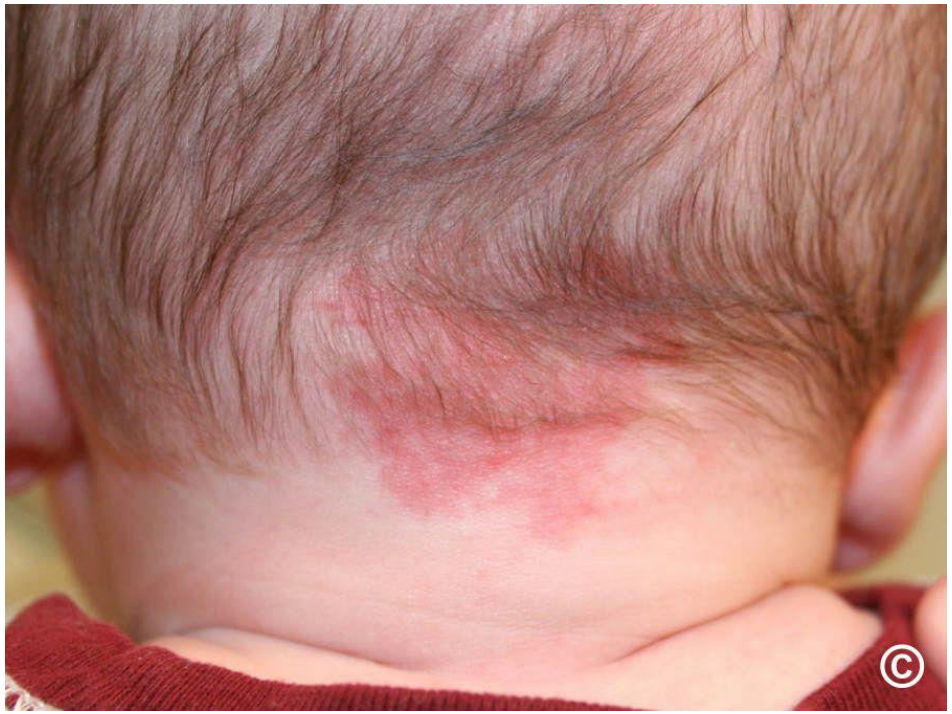
- ***Vernix caseosa***

  - Cheesy white skin covering
  - Composed of sebum and shed skin and lanugo
  - Vernix is theorized to serve several purposes, including moisturizing the infant's skin and facilitating passage through the birth canal.

Stork bite marks

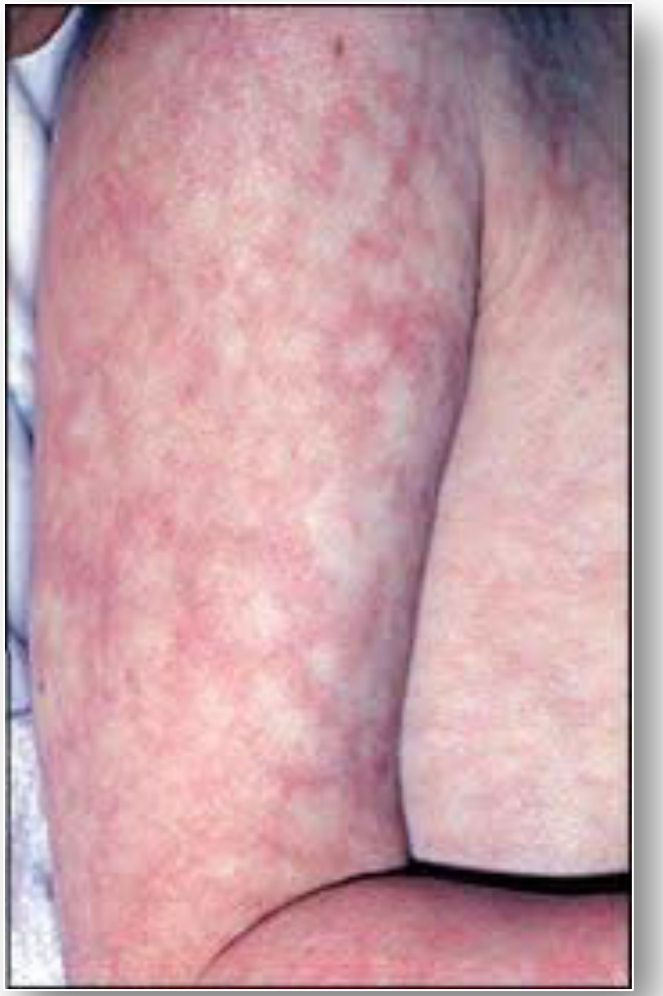
- Prominent capillaries commonly cause pink areas called ‘stork’s beak marks’ at the nape of the neck, the eyelids and the glabella.
- The facial one's fade without treatment over subsequent months. Marks on the neck often persist.





Cutis marmorata

- Cutis marmorata is a reddish-purple mottled skin or marbled appearance or pattern common in newborns
- It appears in response to cold temperatures
- It's usually temporary and benign
- It can also occur in children, adolescent girls and adults
- In infants, cutis marmorata is usually on the trunk and limbs

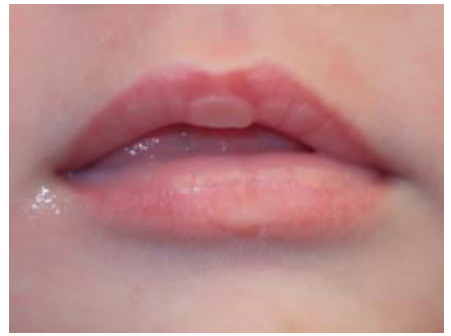


- Cutis marmorata is very common in newborns. It's more commonly seen in premature babies

- It's estimated that most newborn and up to 50% of children have cutis marmorata

- It should disappear as the skin becomes warmer

DDX: **Sepsis**, Klippel-Trenaunay-Weber syndrome, neonatal lupus erythematosus, nevus anemicus, livido reticularis associated with collagen vascular disorder, nevus flammus, and diffuse phlebectasia.



SUCKING BLISTER

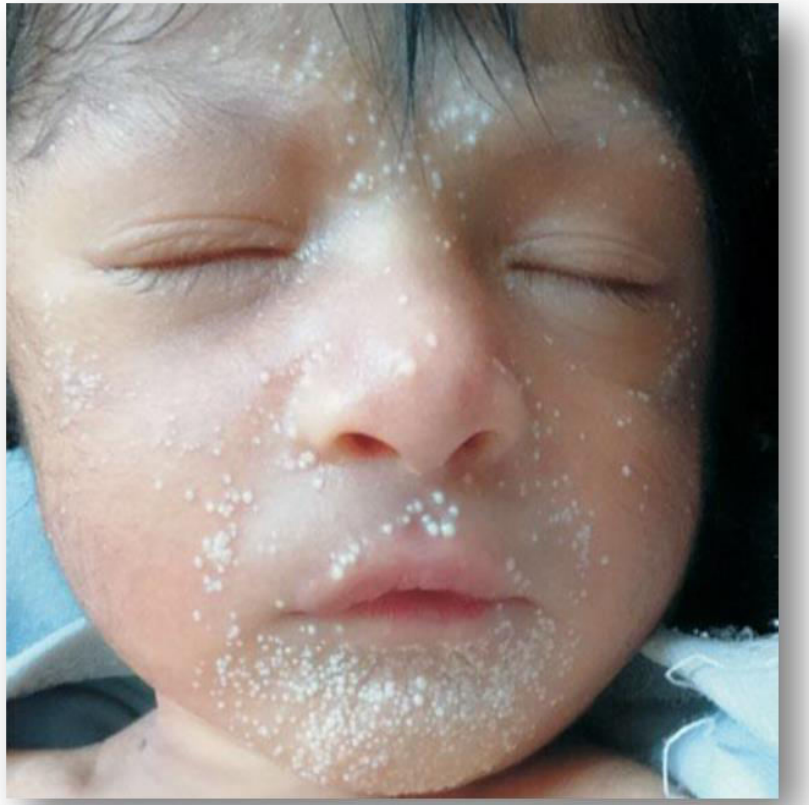
- A blister or denuded area seen in neonates, usually seen on the forearm, wrist and fingers
- Due to vigorous sucking in utero
- 0.5% of newborn
- One or two solitary clear bullous lesion with no surrounding erythema. Can also present as an erosion or a crusted lesion

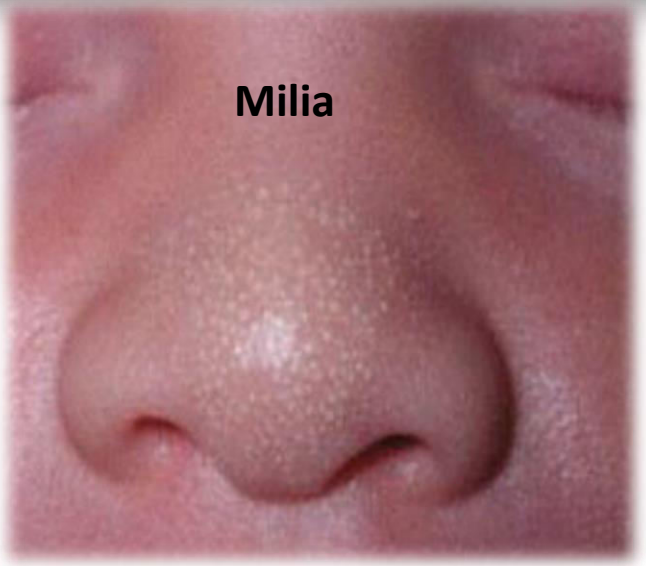
Treatment:

- None, heal rapidly without sequelae
- Topical antibiotic/Dressing as needed if eroded

Milia - Milk spots

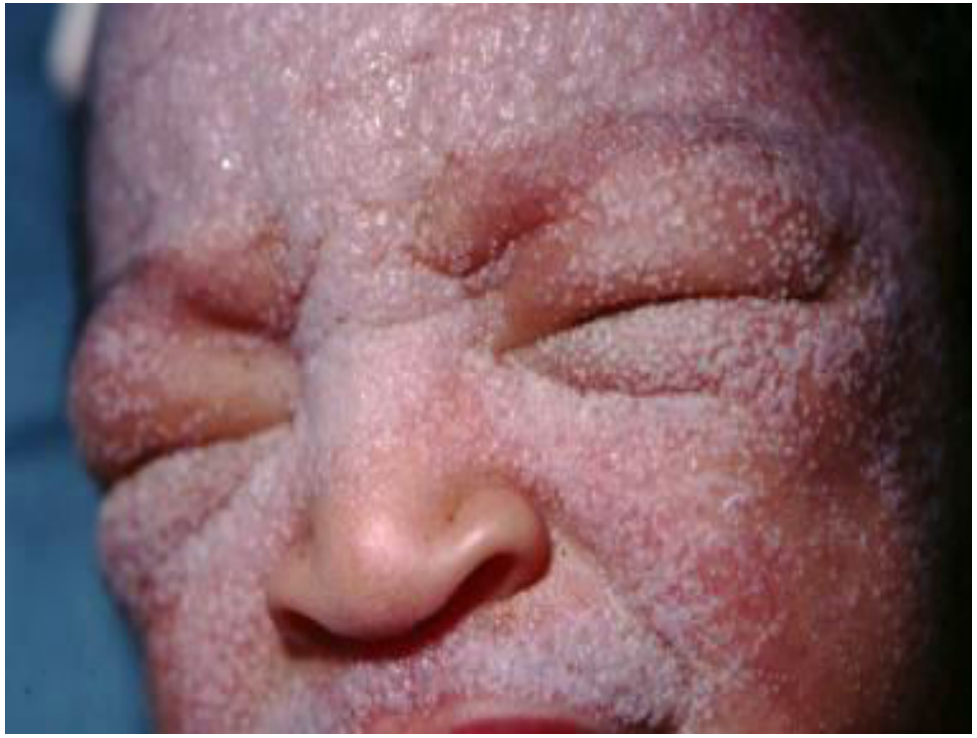
Yellow-white epidermal cysts of the pilosebaceous follicles that are noted on the nose) small firm white papules, 1-2mm in size.
Disappear spontaneously during first 3-4 weeks

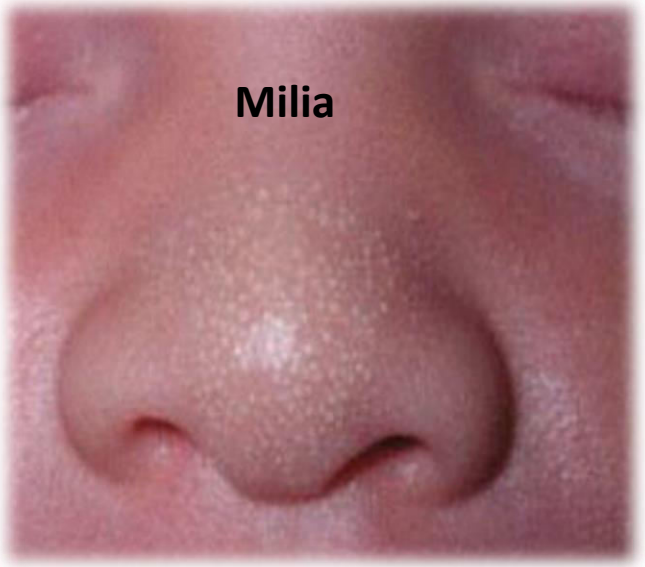




Miliaria (Prickly heat)

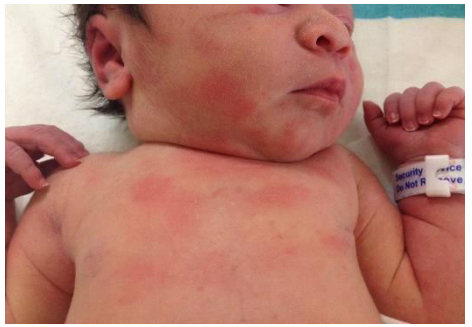
Affects newborn babies in warm climates and is due to <u>blockage (occlusion) of the sweat duct.</u>

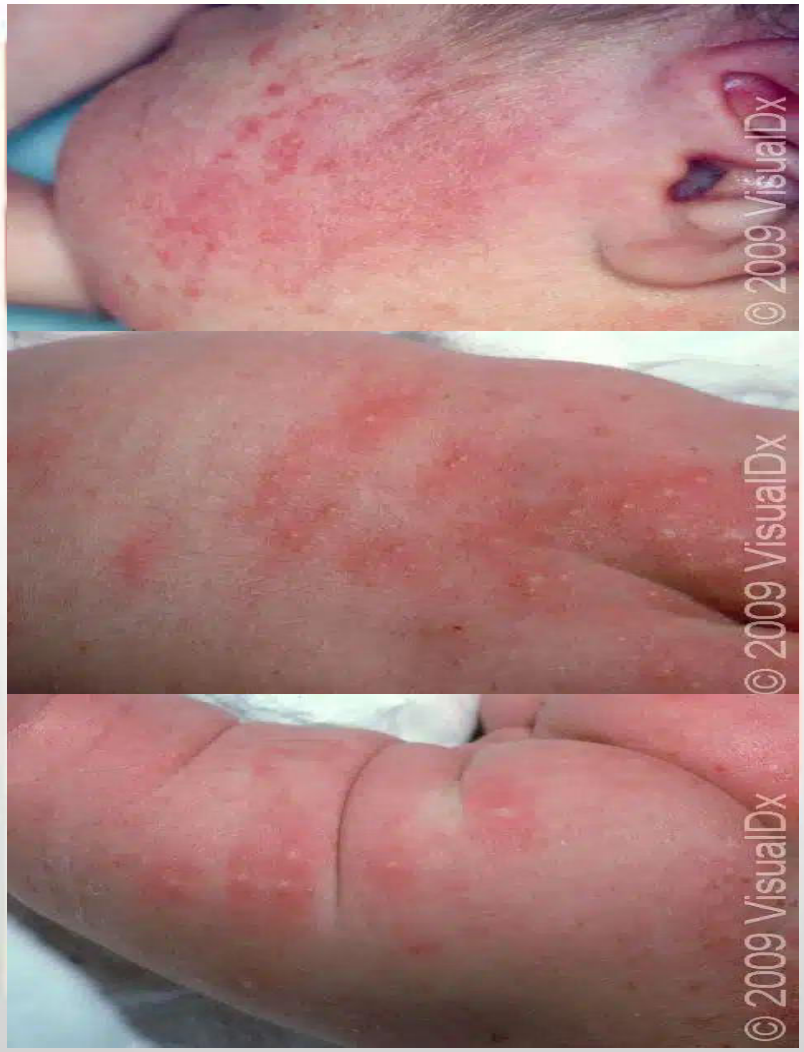




Milia

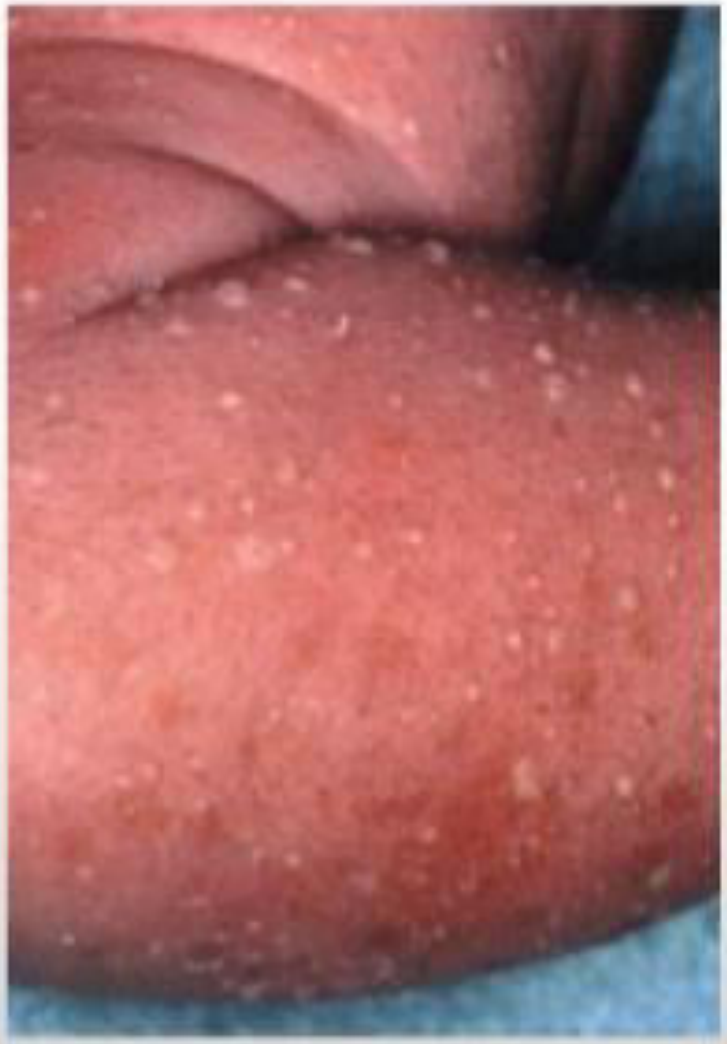
TOXIC ERYTHEMA OF NEWBORN (ERYTHEMA TOXICUM NEONATORUM)





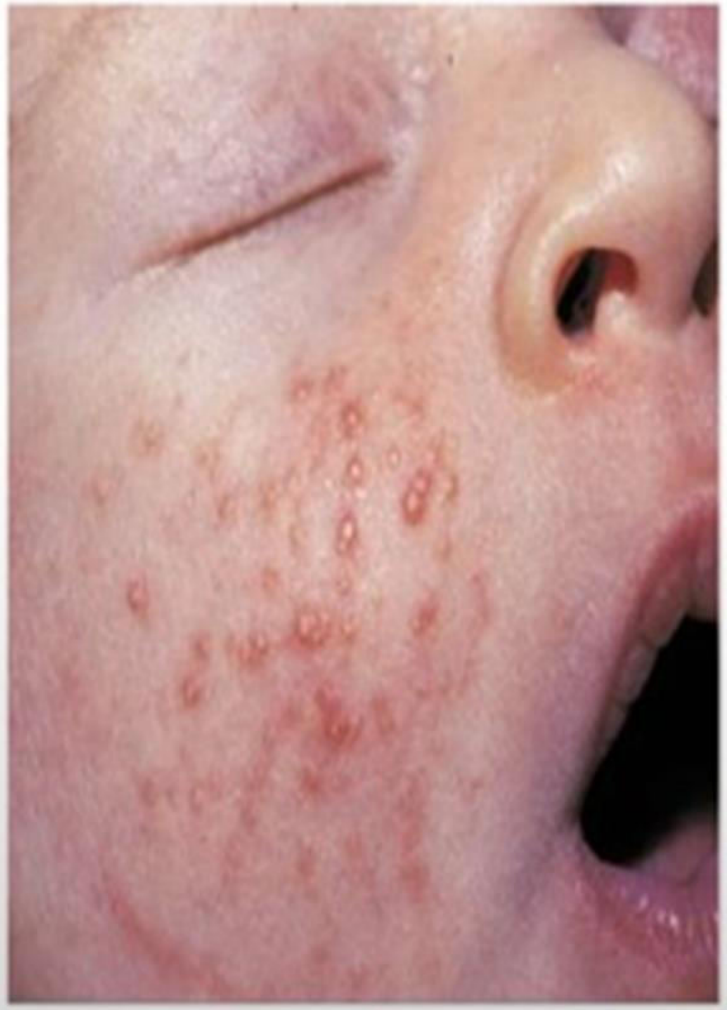
- Benign, self-limiting disorder of unknown etiology
- Most commonly, the eruption initially takes the form of a blotchy, macular erythema
- Most commonly on the trunk, face and proximal parts of the limbs (palms and soles not involved)
- In more severe cases, urticarial papules arise within the erythematous areas, may be surmounted by small pustules
- **2nd day >>> 1 week**
- **Sterile culture [only eosinophils]**

TRANSIENT NEONATAL PUSTULAR MELANOSIS



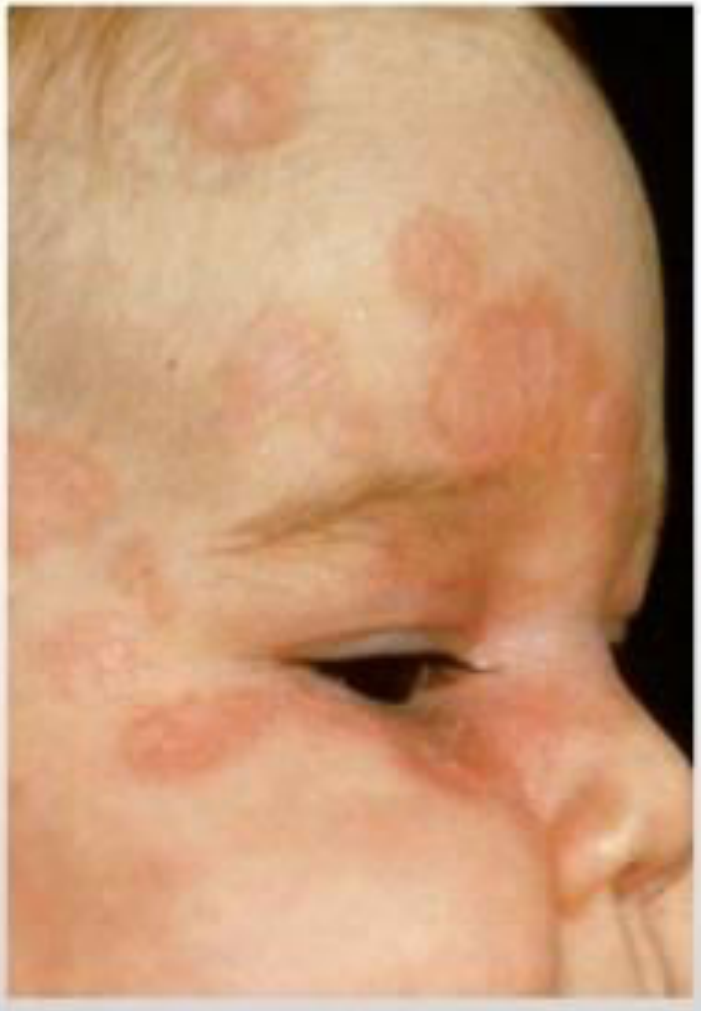
- Idiopathic pustular eruption that heals with brown pigmented macules
- Usually present at birth, more common in black neonates
- Characterized by 1–3 mm, flaccid, superficial, fragile pustules with no surrounding erythema
- Site – Any site, but predominantly in the chin, forehead, axilla and nape of the neck.
- Eventually the pustules rupture and form brown crust and finally a small collarette of scales
  - Birth >> 2 days
  - Sterile culture [**neutrophils**, slight eosinophils]

NEONATAL ACNE



- Prepubertal acne can be divided into five subgroups: neonatal, infantile, midchildhood, preadolescent and adolescent
- Thought to be due to androgens (maternal & infant)
- May affect up to 20% of neonates, more common in boys
- Presents at or shortly after birth with erythematous papulopustular lesions, *and comedones*
- Site - commonly on cheeks, chin and forehead

NEONATAL LUPUS ERYTHEMATOSUS



- Occurs in about 1-2% of babies born to mothers with clinical or subclinical autoimmune connective tissue disease (primarily SLE and Sjögren's syndrome)
- Transplacental passage of maternal autoantibodies ssA-Ro and ssB-La is thought to play role in pathogenesis
- Babies from subsequent pregnancies have a 20–25% risk of skin or cardiac disease
- Present with either skin lesions (90%) or cardiac lesions (1%)
- Well-defined areas of macular or slightly elevated erythema, frequently annular

- Site - face, particularly the forehead, temples and upper cheeks
- 'Spectacle-like' distribution of lesions around the eyes is especially characteristic
- Congenital heart block (typically begins during the 2nd or 3rd trimester)
- Associated - hepatosplenomegaly, anemia, leukopenia, thrombocytopenia, and/or lymphadenopathy

Investigation- skin biopsy, circulating autoantibodies in both the mother and the child, ultrasound or electrocardiography

Treatment-

- Sunprotection
- Except for cardiac involvement, usually resolves in 6-12 months
- 50% with cardiac involvement will require a pacemaker

Birth marks

Vascular

Salmon patch
(Nevus simplex)

port wine stain
(nevus flammeus)

Hemangioma

Melanocytic

Mongolian spots

Congenital
melanocytic nevi

Nevus of Ota

Others

Aplasia cutis
congenita

Blueberry muffin
Baby

SKIN\VASCULAR

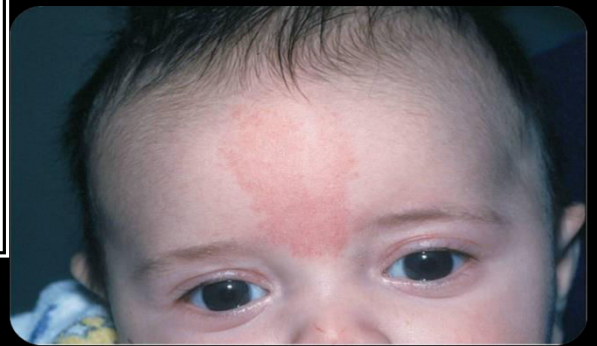
Vascular lesions

Salmon patch “nevus simplex”

capillary malformation

Glabella , middle of the forehead, upper eyelids

Since birth
Usually disappears
Weeks to months

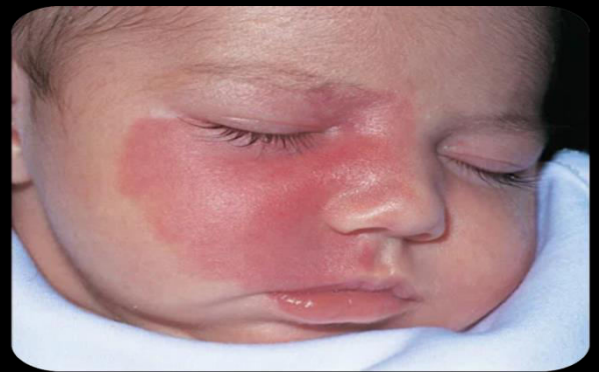


Port wine stain “nevus flammeus”

capillary malformation

Mostly face , but maybe anywhere

Since birth
Usually persists and becomes more darker purple



Hemangioma

benign vascular tumor

face, scalp , but maybe anywhere

Since birth or after birth (grow fast 1 st year)
Usually disappears after 5-9 years

SKIN\VASCULAR

Port wine stain

- Mature dilated dermal capillaries.
- The lesions are

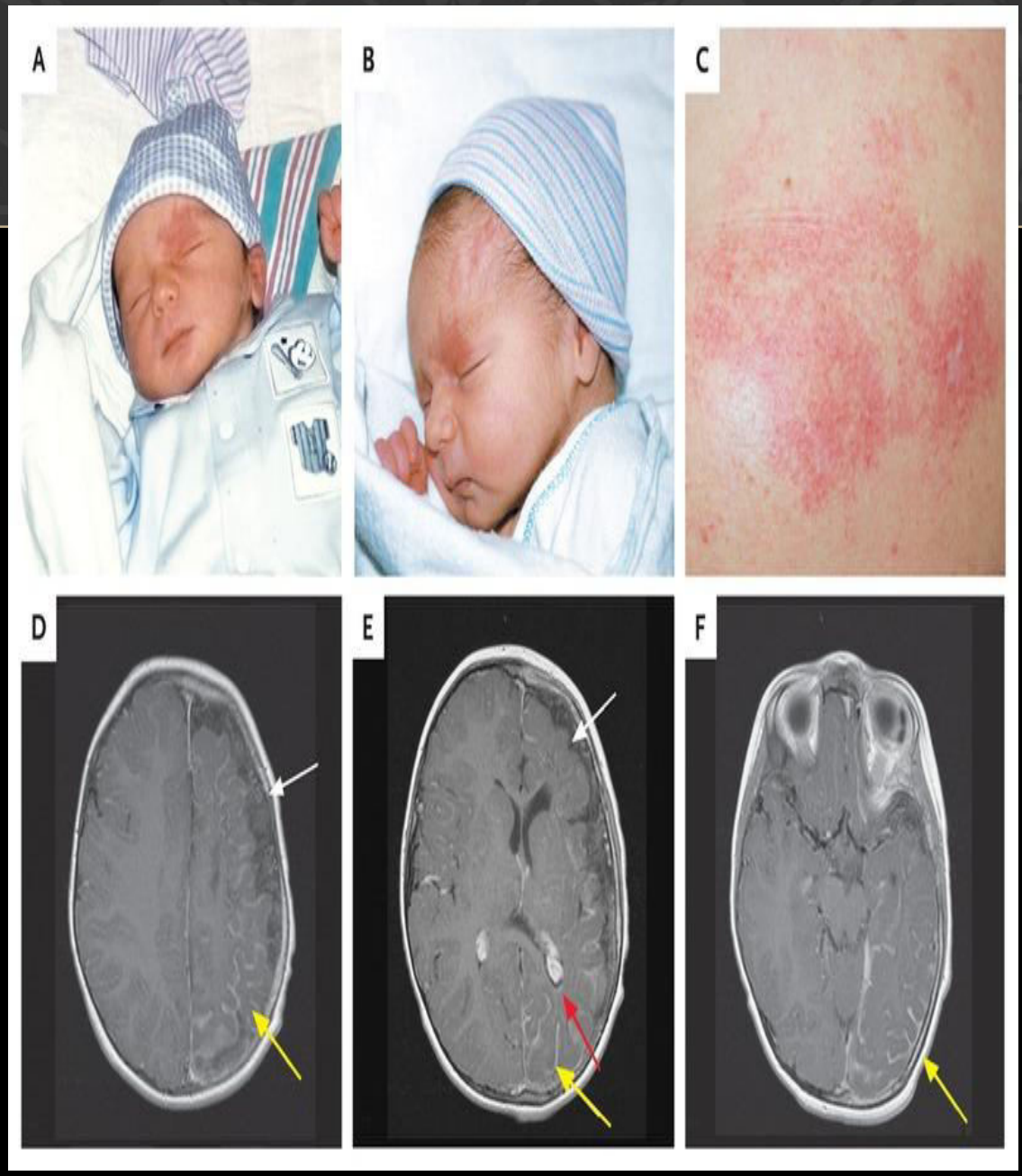
macular, sharply circumscribed, pink to purple

May develop elevated areas that bleed spontaneously

- head and neck region is the most common site
- most lesions are unilateral

When a port wine stain is lateral and localized to the forehead and upper eyelid, the diagnosis of

Sturge-Weber syndrome glaucoma, leptomeningeal venous angioma, seizures, hemiparesis contralateral to the facial lesion, intracranial(tram-line) calcification)



Hemangioma

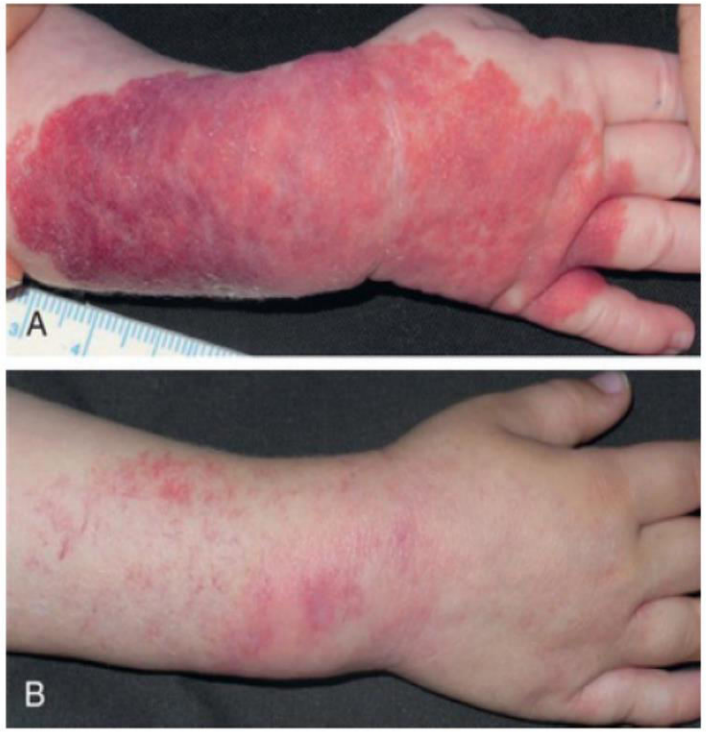


FIG. 669.9 Spontaneous regression of infantile hemangioma. A, Hemangioma on right lower arm, age 14 wk. B, Residual telangiectasia at age 23 mo. (From Léaute-Labréze C, Harper JI, Hieger PH: Infantile haemangioma. *Lancet* 390:85–94, 2017, Fig. 5, p. 88.)

proliferative, benign vascular tumors of vascular endothelium that may

be present at birth or, more commonly, may become apparent in the 1st or 2nd week of life, predictably enlarge, and then spontaneously involute.

IHs are the most common tumor of infancy, occurring in 5% of newborns

classified as superficial, deep, or mixed

Most IHs are mixed

Risk factors include

prematurity, low birthweight, female sex, and white race

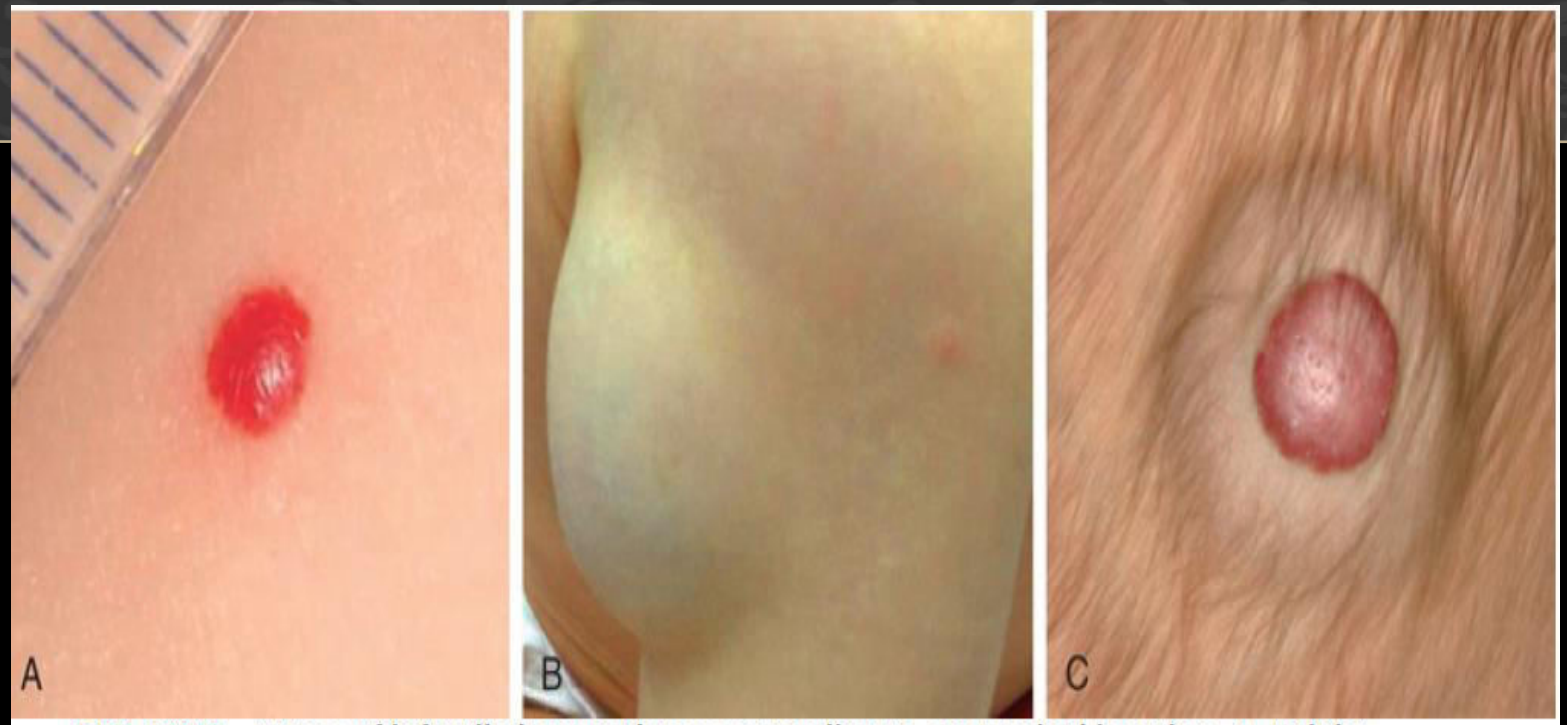
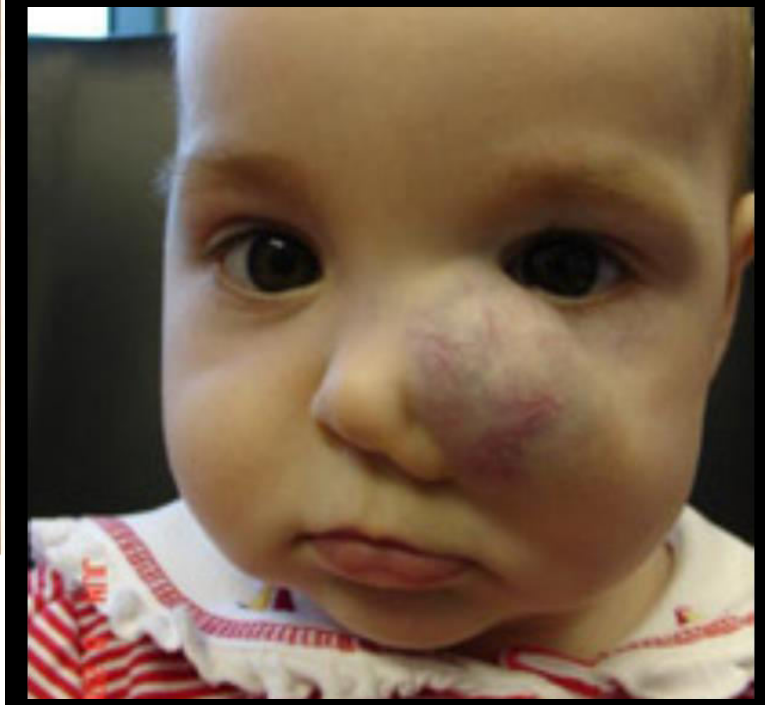


FIG. 669.6 Types of infantile hemangiomas according to anatomical location. A, *Bright red* , intracutaneous hemangioma. B, *Bluish* , deep hemangioma. C, Mixed type. (From Léaute-Labréze C, Harper JI, Hieger PH: Infantile haemangioma. *Lancet* 390:85–94, 2017, Fig. 4, p. 88.)



Cavernous hemangioma (cavernous angioma)

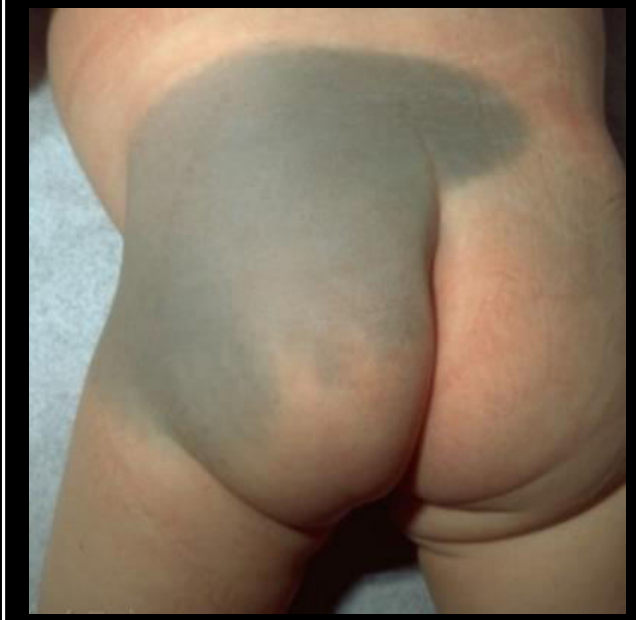
Most IHs are mixed
phase of rapid expansion, followed by a stationary period and finally
by spontaneous involution

SKIN\MELANOCYTES

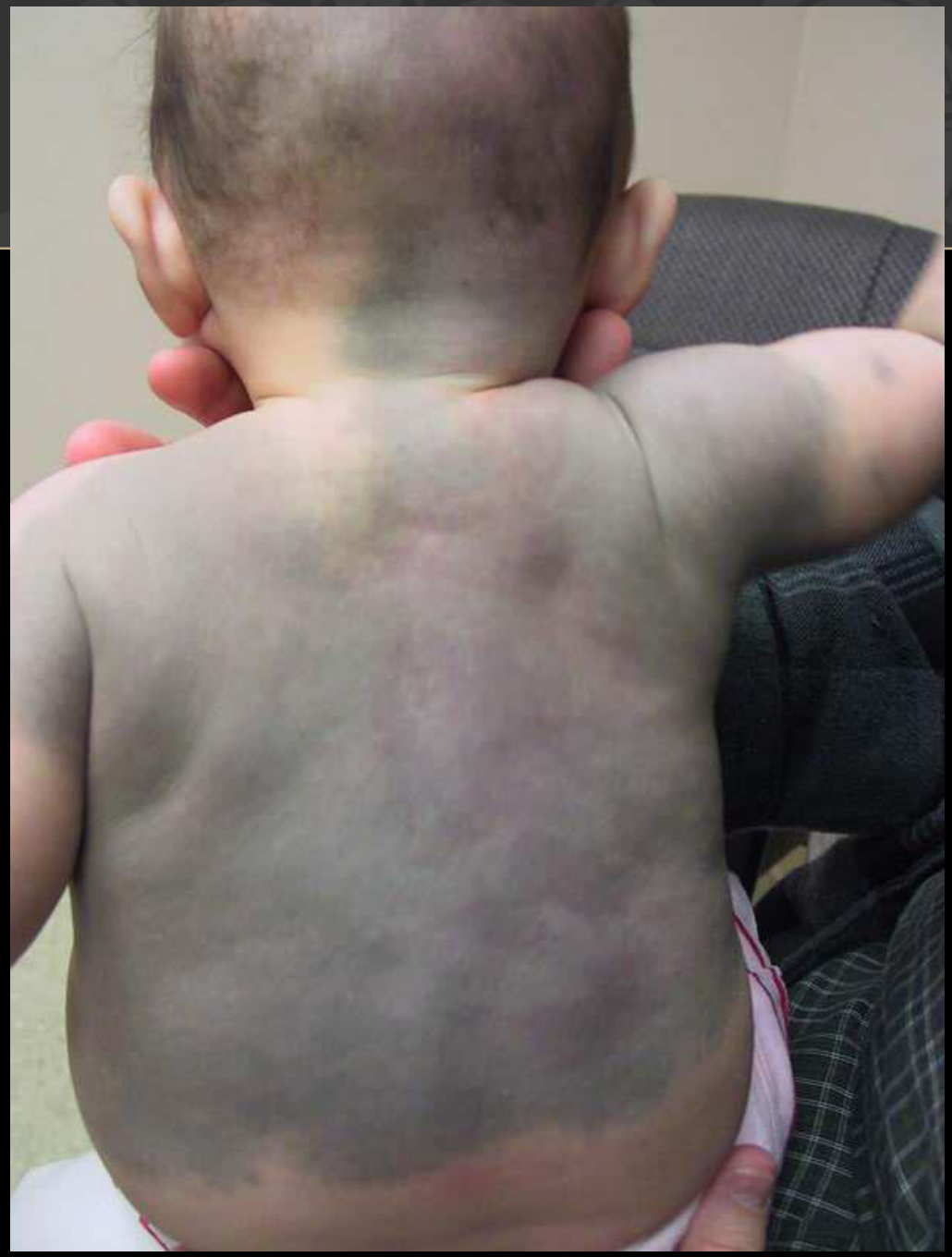
Melanocytes

Mongolian spots	Nevus of ota	Congenital melanocytic nevi
"Congenital dermal melanocytosis" entrapment of melanocytes in the lower two thirds of the Dermis Usually lumbrosacral distribution **Usually disappears before puberty** No complications	*"Oculo dermal melanocytosis"* Entrapment of melanocytes in the upper third of the dermis ophthalmic and maxillary Distribution Scleral involvement **Persist** and may become worse **Slight Risk for glaucoma**	Abnormal number and distribution of melanocytes **+- Hypertrichosis** Face , neck , trunk , back Persists **Risk of malignancy 1-2%**

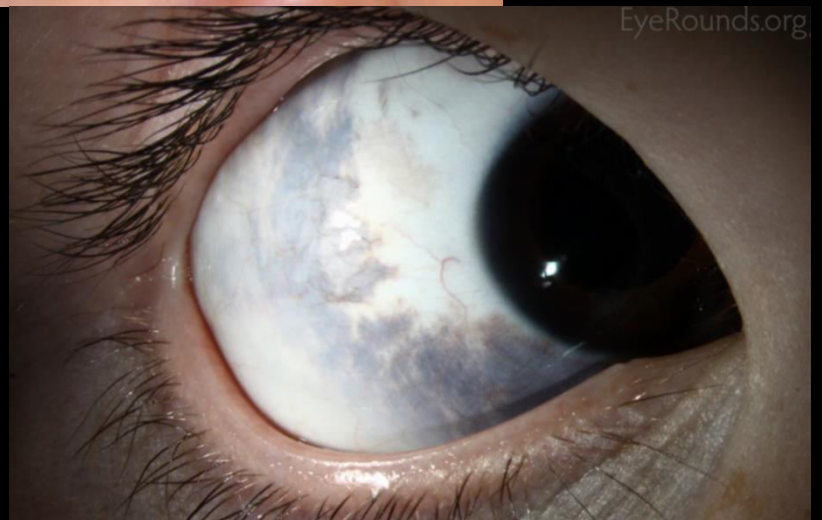
Mongolian spot



Transient, dark blue to black pigmented macules seen over the lower back and buttocks in more than 50% of African American, Indian, and Asian infants

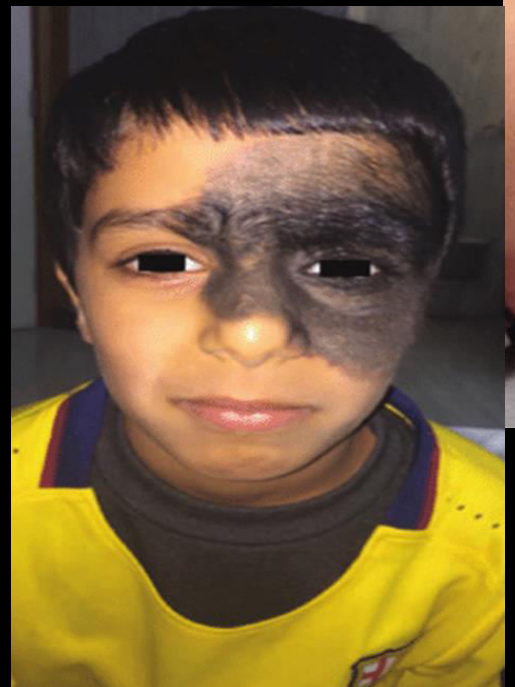


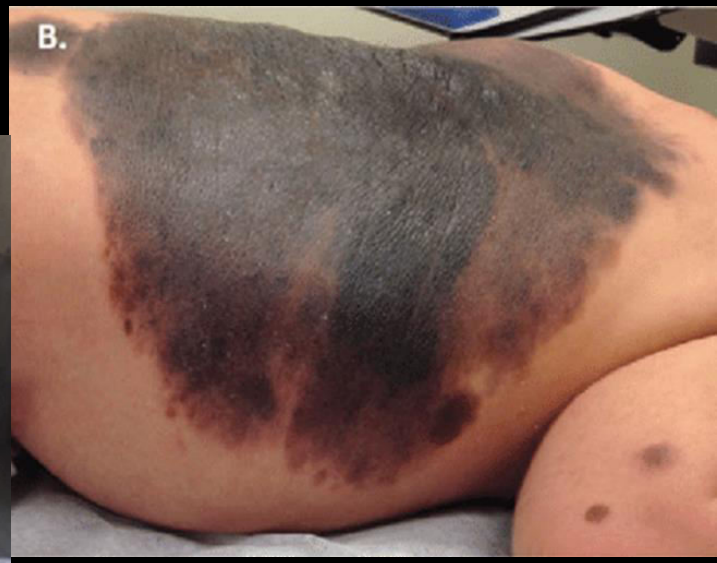
Nevus of Ota



MELANOCYTIC NAEVI

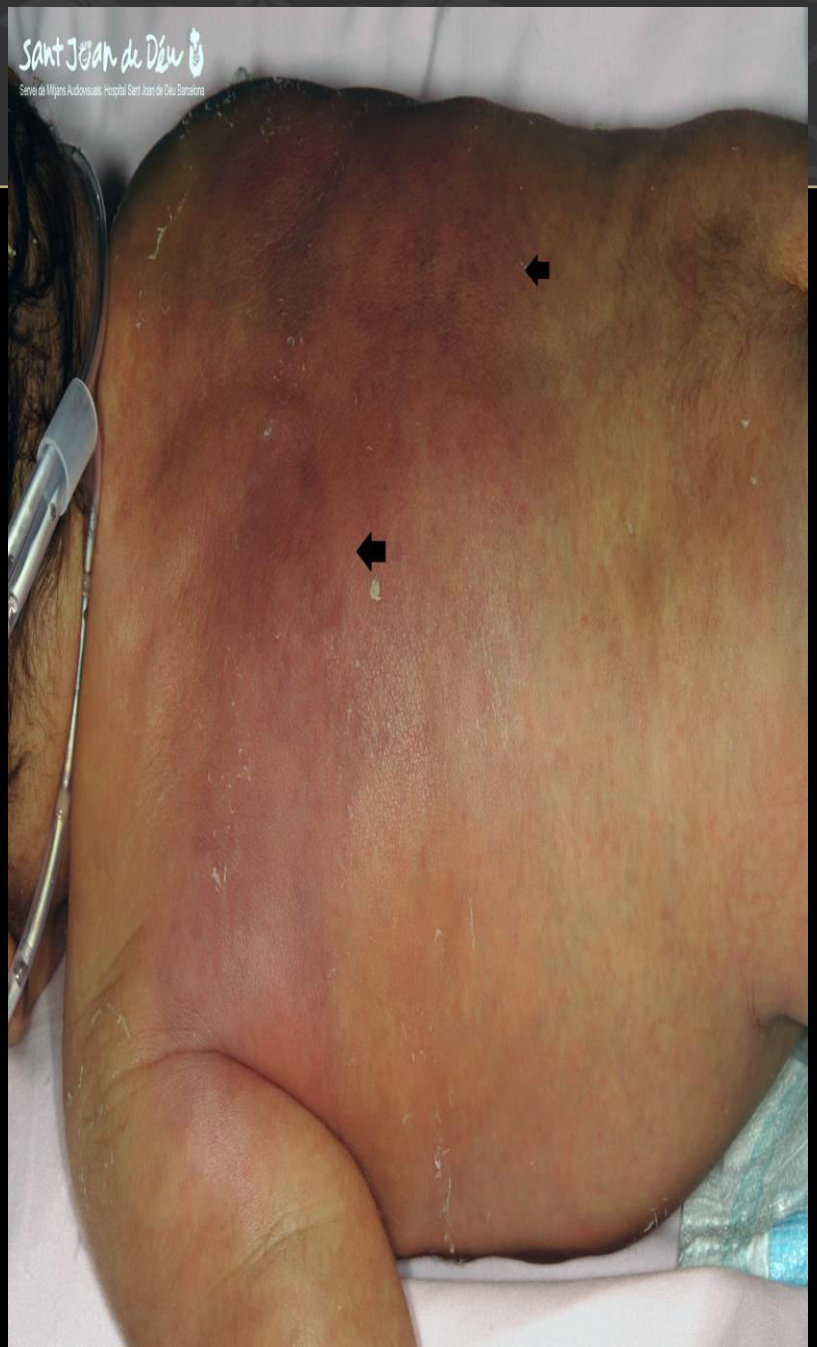
REQUIRE FOLLOW-UP AND TREATMENT BY A PLASTIC SURGEON OR DERMATOLOGIST.





SUBCUTANEOUS FAT NECROSIS

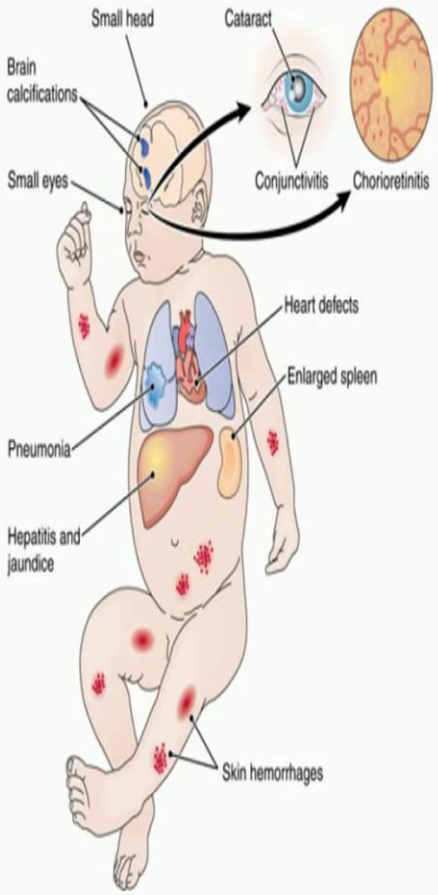
CAUSES PALPABLE FIRM PLAQUES, OFTEN WITH SOME ERYTHEMA UNDER THE SKIN, OVER THE BODY. IF EXTENSIVE, THERE CAN BE ASSOCIATED HYPERCALCAEMIA THAT MAY REQUIRE TREATMENT. BLISTERS OR BULLAE ARE USUALLY PATHOLOGICAL; CAUSES INCLUDE INFECTION AND SIGNIFICANT SKIN DISEASE



Infections

TORCH

TORCH syndrome



Infection of a developing fetus or newborn by any of a group of infectious agents.

"TORCH" is an acronym meaning:

T: Toxoplasmosis

O: Other Agents

R: Rubella (German measles)

C: Cytomegalovirus

H: Herpes Simplex

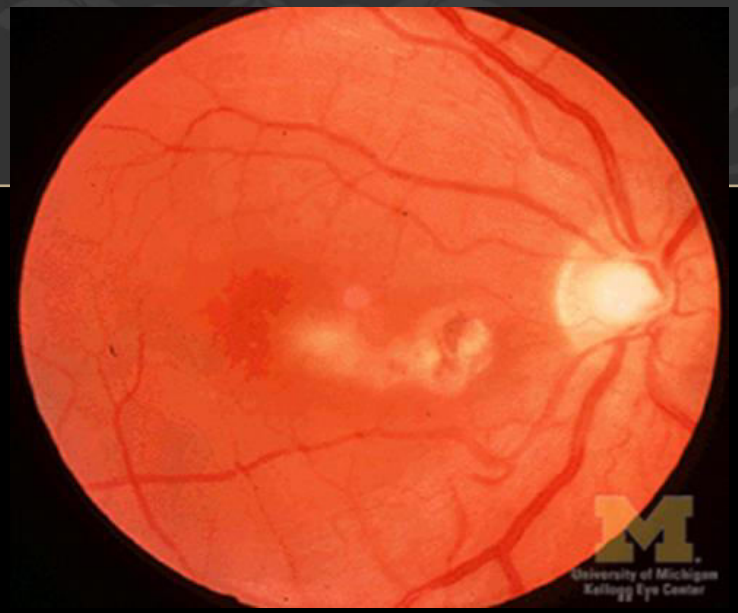
Toxoplasma gondii

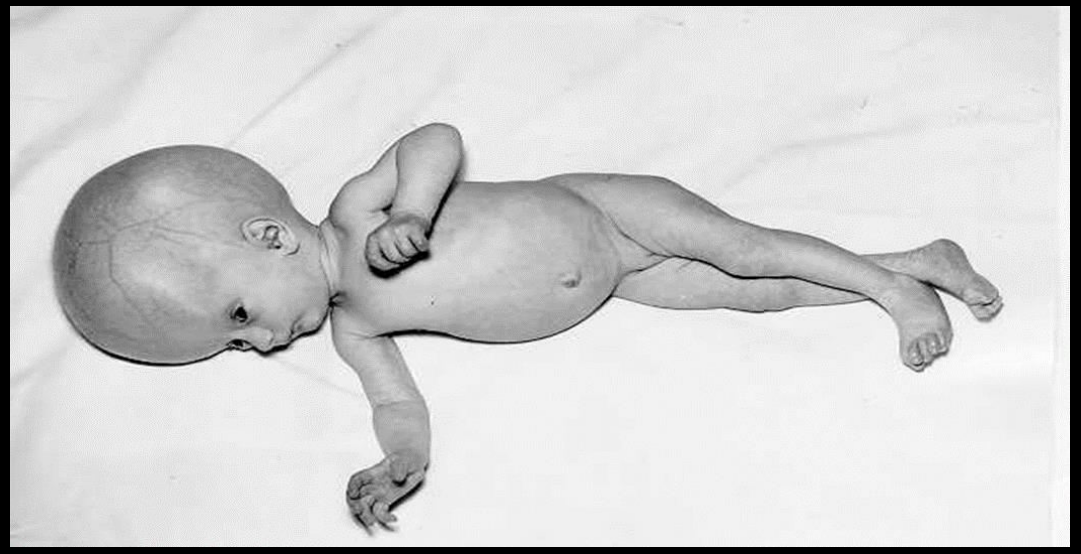
FETAL INFECTION

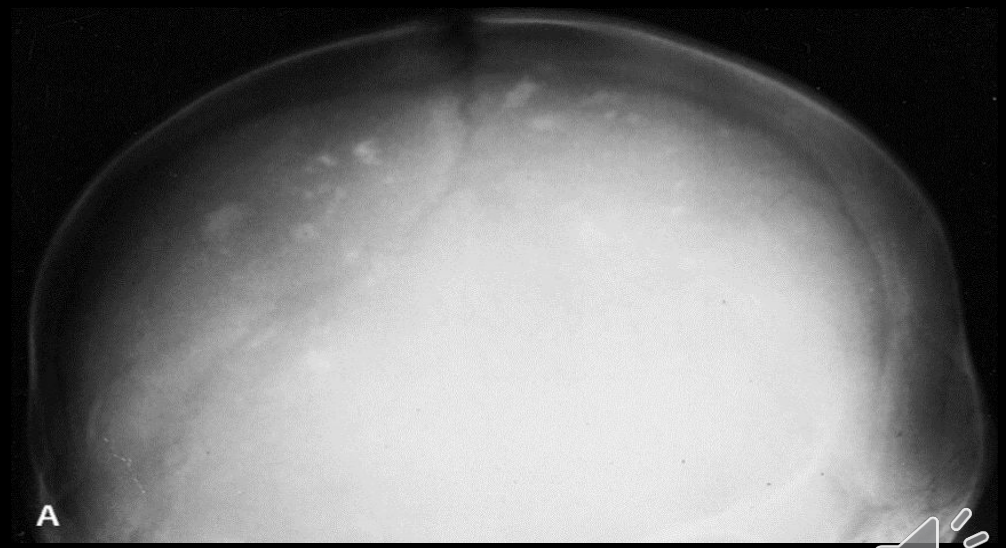
Chorioretinitis

Intracranial calcifications

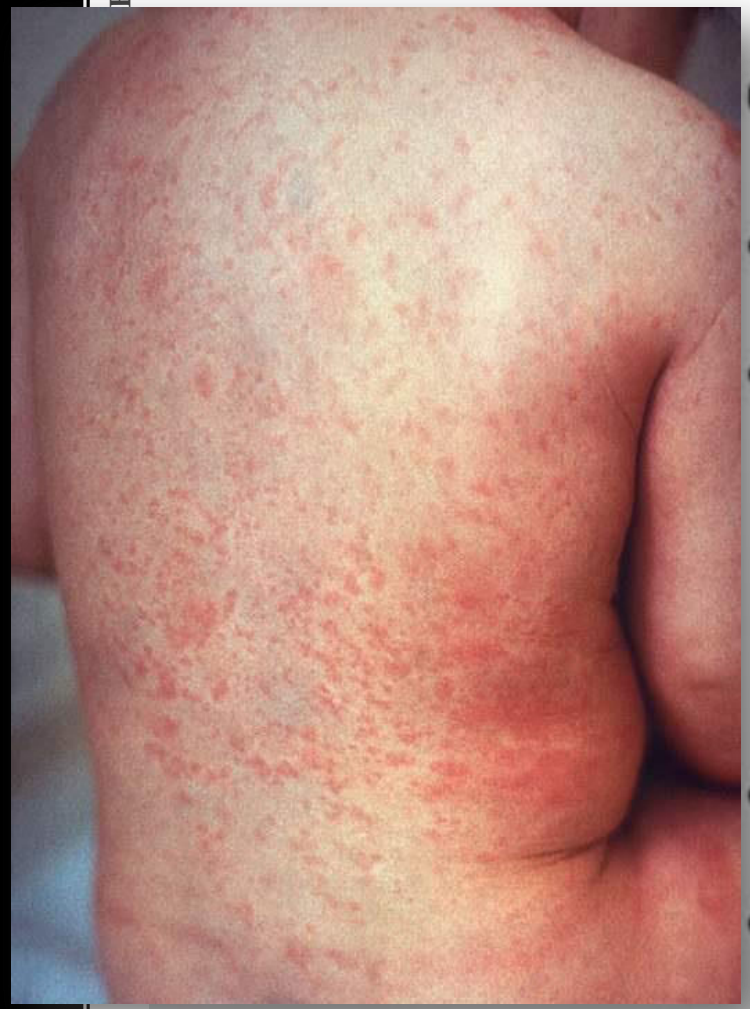
Hydrocephalus.







CONGENITAL RUBELLA



Congenital rubella typically results from maternal infection

• Preconception	minimal risk
• 0-12 weeks	100% risk of fetus being congenitally infected resulting in major congenital abnormalities. Spontaneous abortion in 20% of cases.
• 0-16 weeks	congenital rubella syndrome (85%)
• After 16 weeks	normal development, slight risk of deafness and retinopathy

CONGENITAL RUBELLA SYNDROME

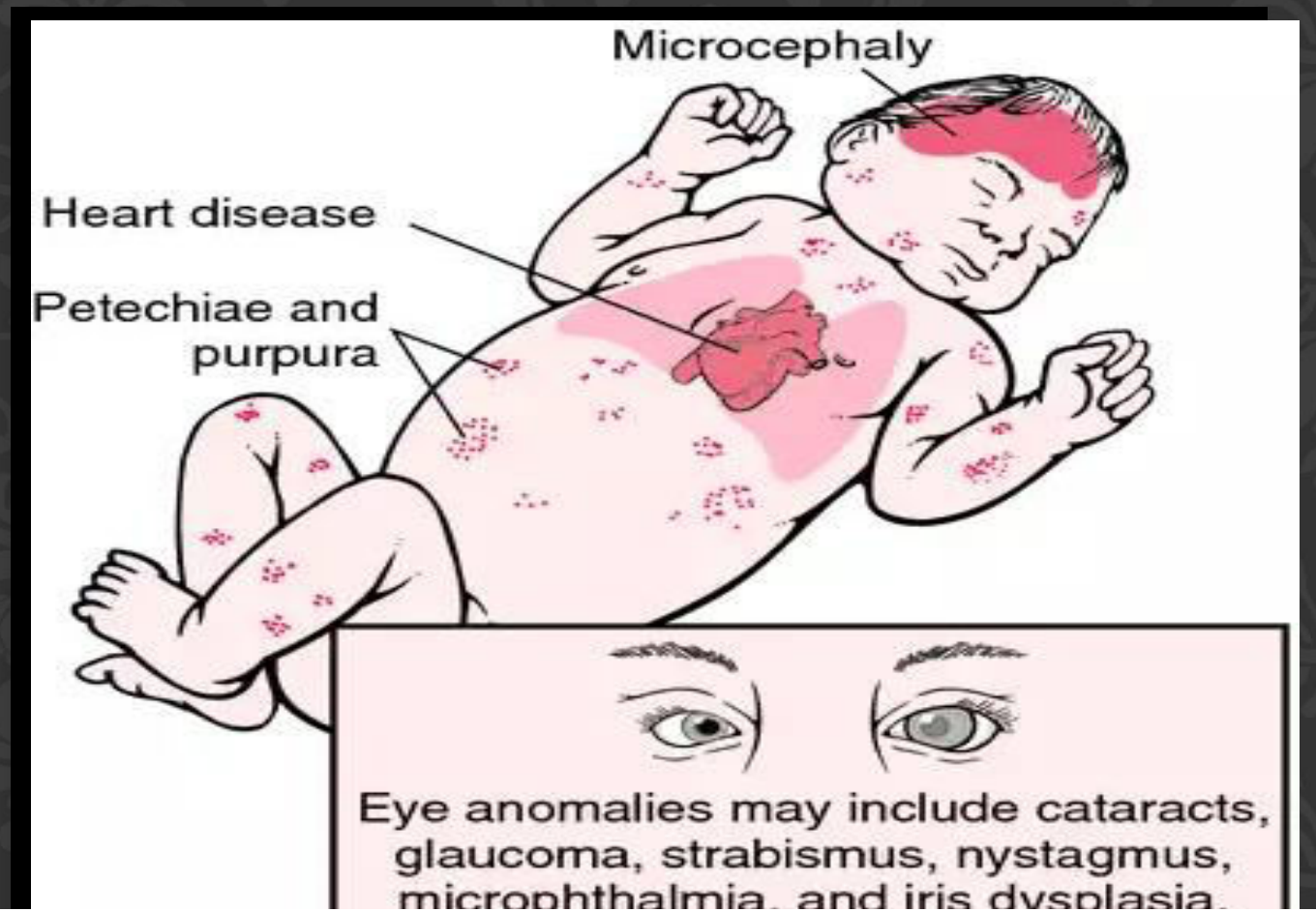
Heart defects (patent ductus arteriosis, pulmonary stenosis, pulmonary arterial hypoplasia)

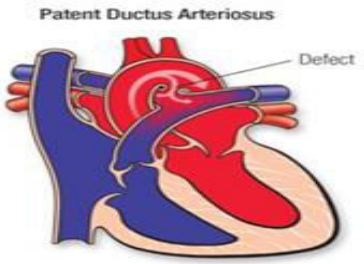
Eye defects (cataracts, microphthalmos, retinopathy)

CNS problems (mental and psychomotor delay, speech and language delay)

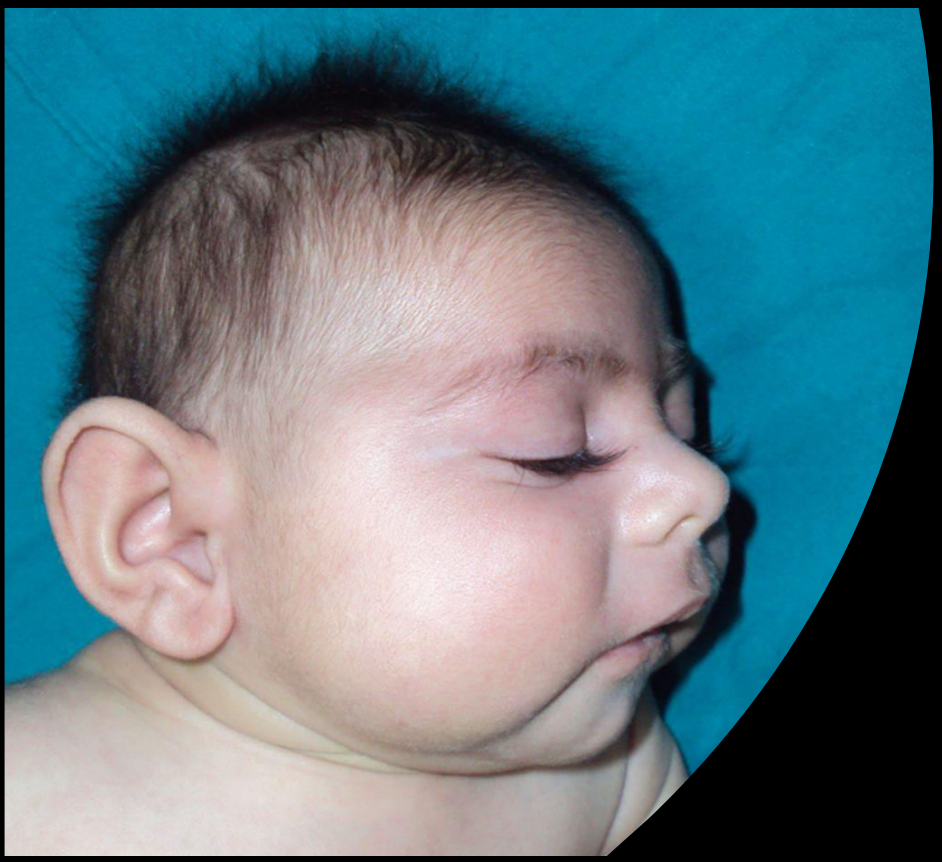
Microcephaly and sensorineural deafness

Hepatosplenomegaly; Thrombocytopenic purpura (blueberry muffin rash) and haemolytic anaemia.



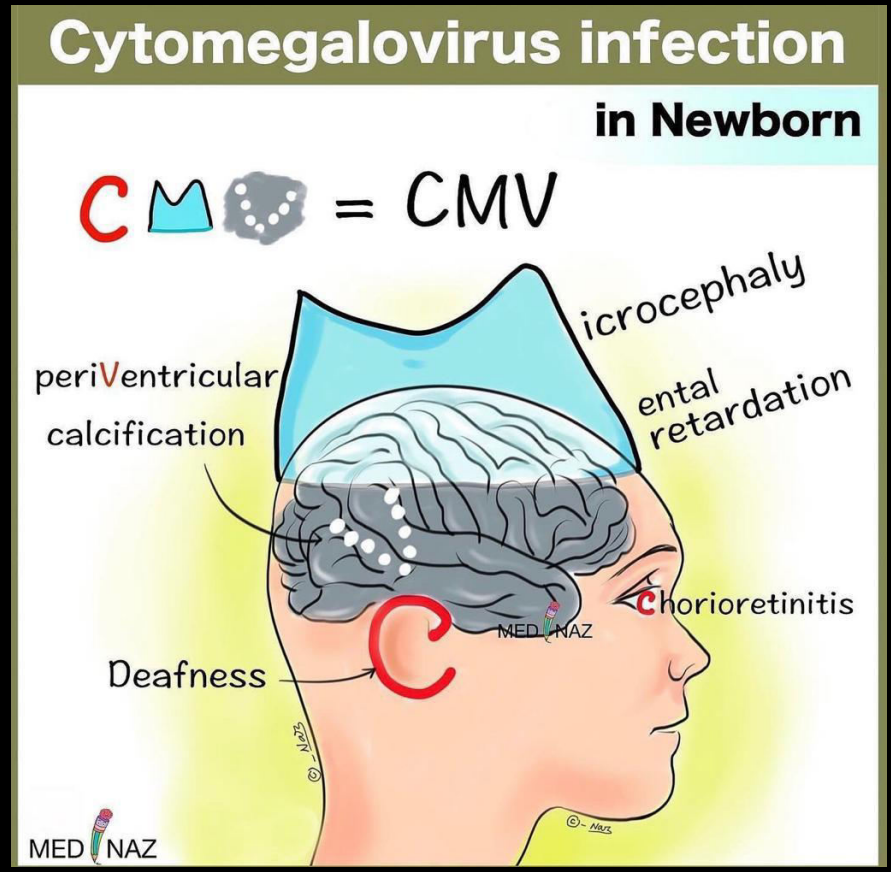


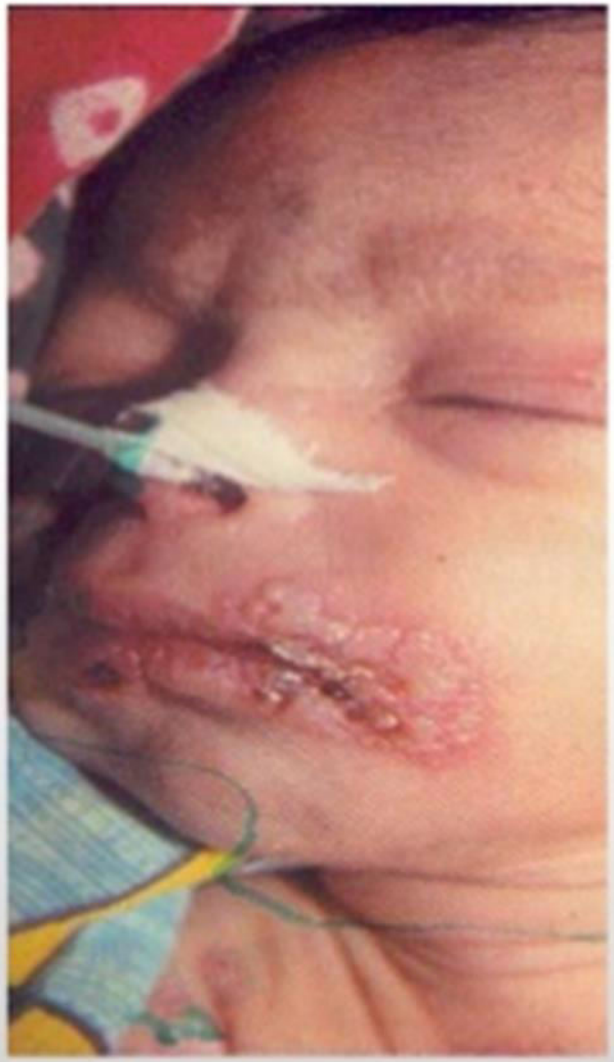
CYTOMEGALOVIRUS (CMV)



Fetal infection

- IUGR
- Microcephaly
- Sensorineural hearing loss
- Cerebral atrophy
- Ventriculomegaly
- Periventricular calcification
- Fetal hydrops





Herpes simplex type 2 or 1 virus

Intrauterine infection: chorioretinitis, skin lesions, microcephaly, Hydrops Fetalis,In-utero fetal demise

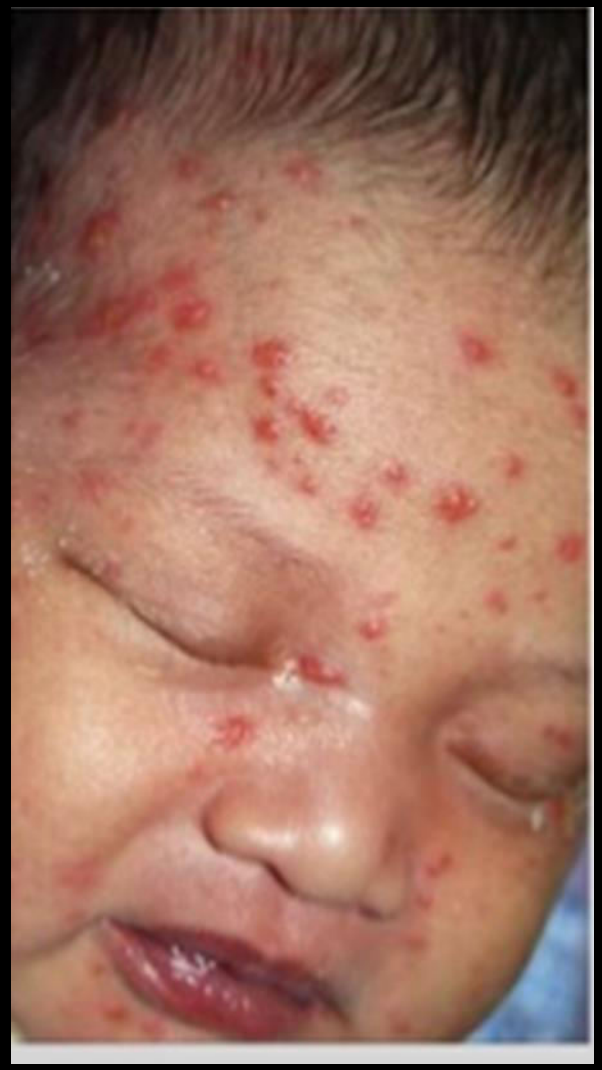
Postnatal: encephalitis, localized or disseminated disease, skin vesicles, keratoconjunctivitis

Neonatal herpes

• Clinical manifestation can arise any time during the first six weeks of life, but usually occurs within the first month of life.

• It is classified into three subgroups in the infant depending on the site of infection:

1. Disease localized to skin, eye and or mouth
2. Local central nervous system (CNS) disease (encephalitis alone)
3. Disseminated infection with multiple organ involvement, 30% mortality rate

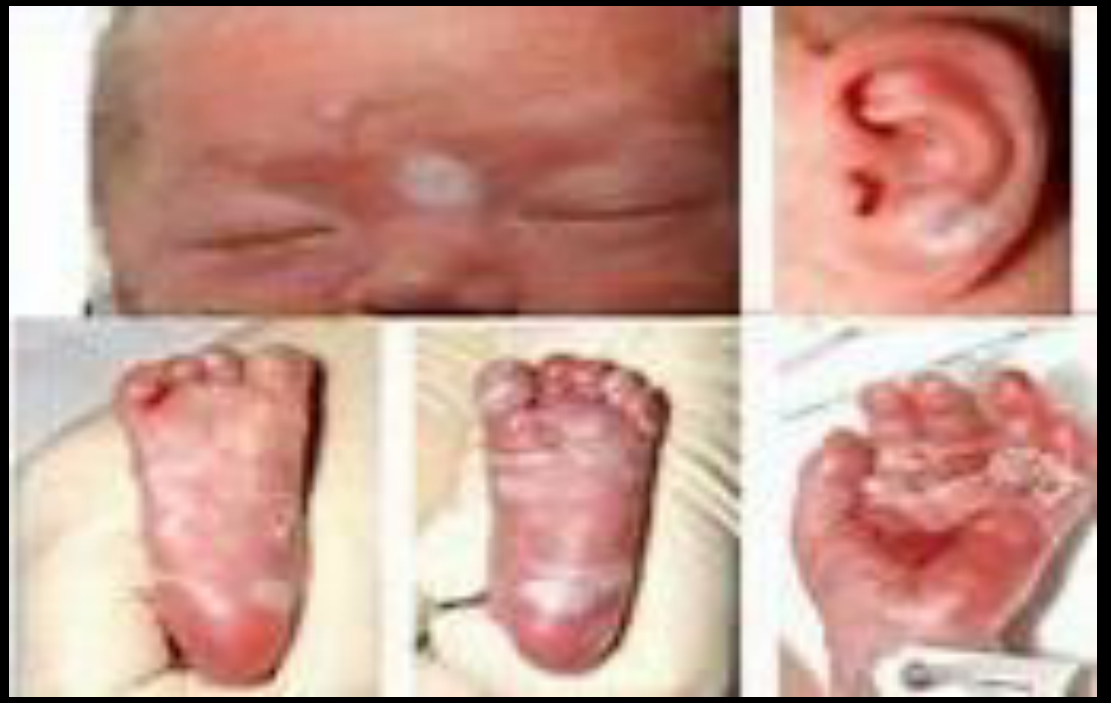


Varicella-zoster virus

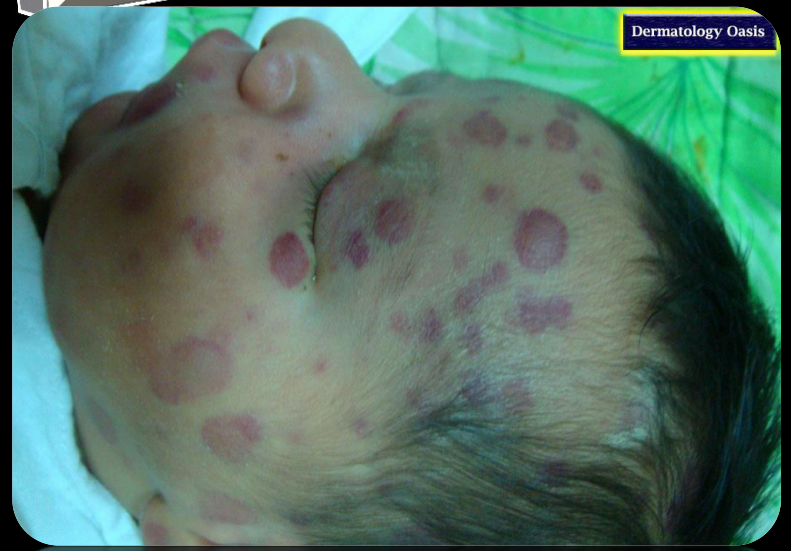
Microphthalmia, cataracts, chorioretinitis, cutaneous and bony aplasia/hypoplasia/atrophy, cutaneous scars Zoster as in older child.

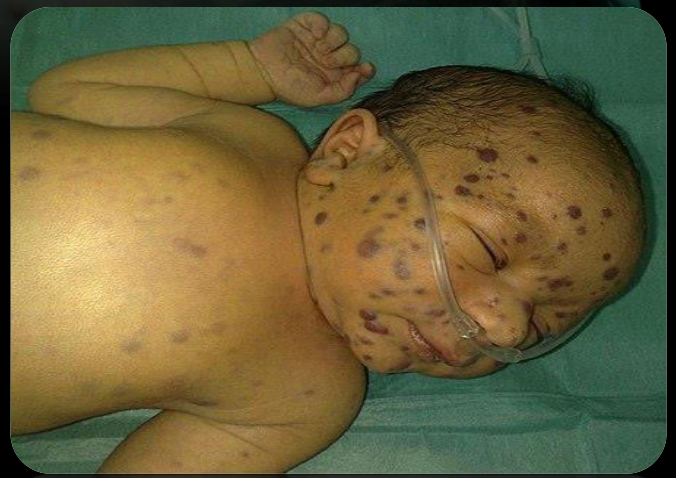
Treponema pallidum (syphilis)

Presentation at birth as nonimmune hydrops, prematurity, anemia, neutropenia, thrombocytopenia, pneumonia, hepatosplenomegaly Late neonatal as snuffles (rhinitis), rash, hepatosplenomegaly, condylomata lata, metaphysitis, cerebrospinal fluid pleocytosis, keratitis, periosteal new bone, lymphocytosis, hepatitis



Blueberry muffin Baby





Congenital infections	TORCH complex
Severe haemolysis	(i) ABO or Rhesus incompatibility (ii) Hereditary spherocytosis (iii) Twin-twin transfusion
Congenital vascular lesions	(i) Multiple hemangiomas of infancy (ii) Multifocal lymphangioendotheliomatosis (iii) Blue rubber bleb nevus syndrome (iv) Multiple glomangiomas
Early onset malignancies	(i) Leukemia (ii) Langerhans cell histiocytosis (iii) Disseminate neuroblastoma (iv) Rhabdoid tumor (v) Rhabdomyosarcoma (vi) Primitive neuroectodermal tumors (vii) Choriocarcinoma (viii) Myofibromatosis

HEAD, FACE AND NECK

HEAD

- Shape
- Fontanells
- Craniosynostosis
- Caput succedaneum
- Cephalohematoma
- Subgleal hemorrhage

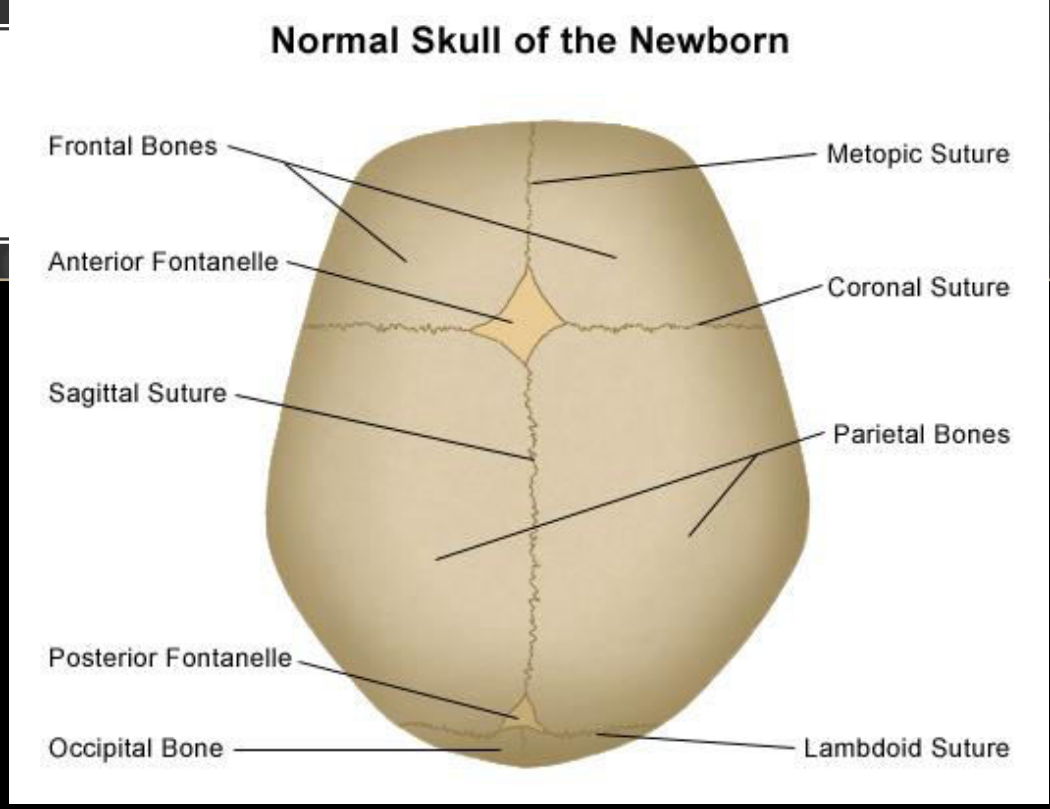
SHAPE

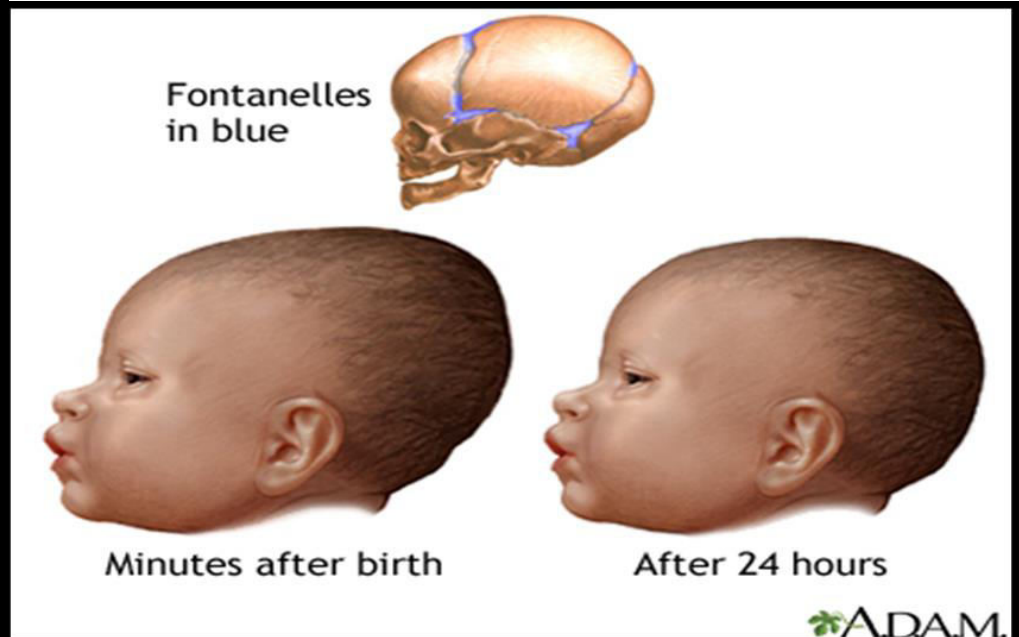
Head shape varies depending on the type of birth- vertex, breech, or C-section.

Vertical elongation of the head is common with vertex deliveries.

The head of an infant born by cesarean section or from a breech presentation is characterized by its roundness.

The skull may be molded, particularly if the infant is the first-born and if the head has been engaged in the pelvic canal for a considerable time. The parietal bones tend to override the occipital and frontal bones.

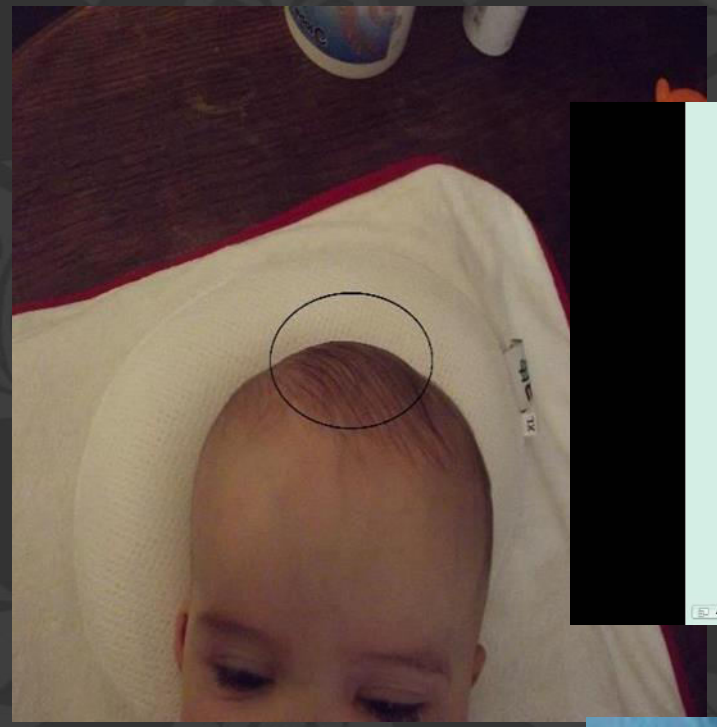


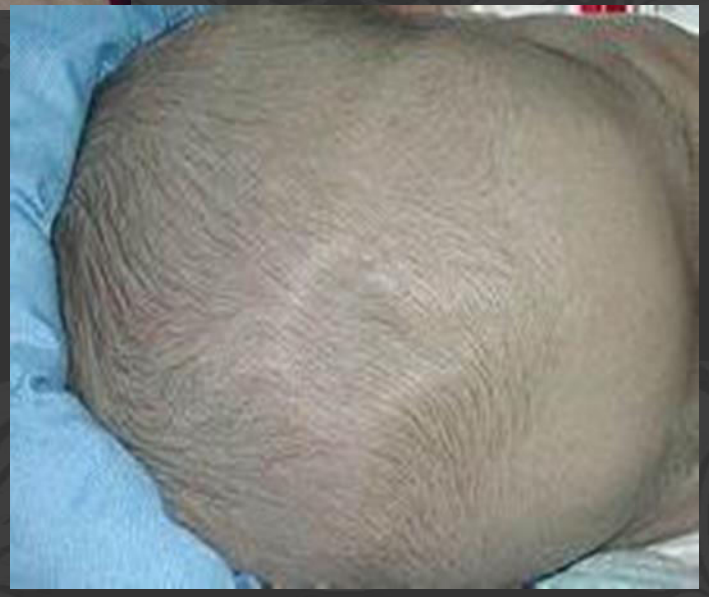


Fontanells

- The anterior fontanelle is normally open, soft, and flat at birth; it's mean diameter is < 3.5 cm. it usually closes between 9 and 18 months of age.
- The posterior fontanelle is often only a fingertip in size, or just barely open, closes by 4 months of age.
- A large fontanelle can result from hydrocephalus, hypothyroidism, or rickets.
- Persistently small fontanels suggest microcephaly, craniosynostosis, congenital hyperthyroidism, or wormian bones; presence of a third fontanel suggests trisomy 21, but is seen in preterm infants.
- Soft areas (**craniotabes**) are occasionally found in the parietal bones at the vertex near the sagittal suture; they are more common in preterm infants and in infants who have been exposed to uterine compression. Is also seen in hydrocephalus, rickets, and syphilis.

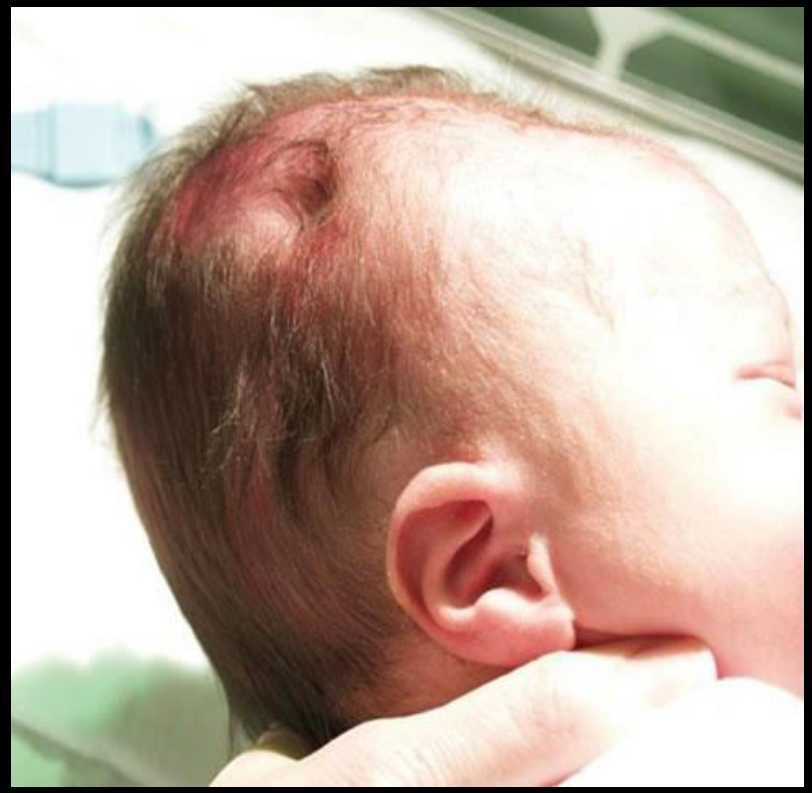
Table 94-1	Disorders Associated with a Large Anterior Fontanel
Achondroplasia	
Apert syndrome	
Athyrotic hypothyroidism	
Cleidocranial dysostosis	
Congenital rubella syndrome	
Hallermann-Streiff syndrome	
Hydrocephaly	
Hypophosphatasia	
Intrauterine growth restriction	
Kenny syndrome	
Osteogenesis imperfecta	
Prematurity	
Pyknodysostosis	
Russell-Silver syndrome	
Trisomies 13-, 18-, and 21	
Vitamin D deficiency rickets	





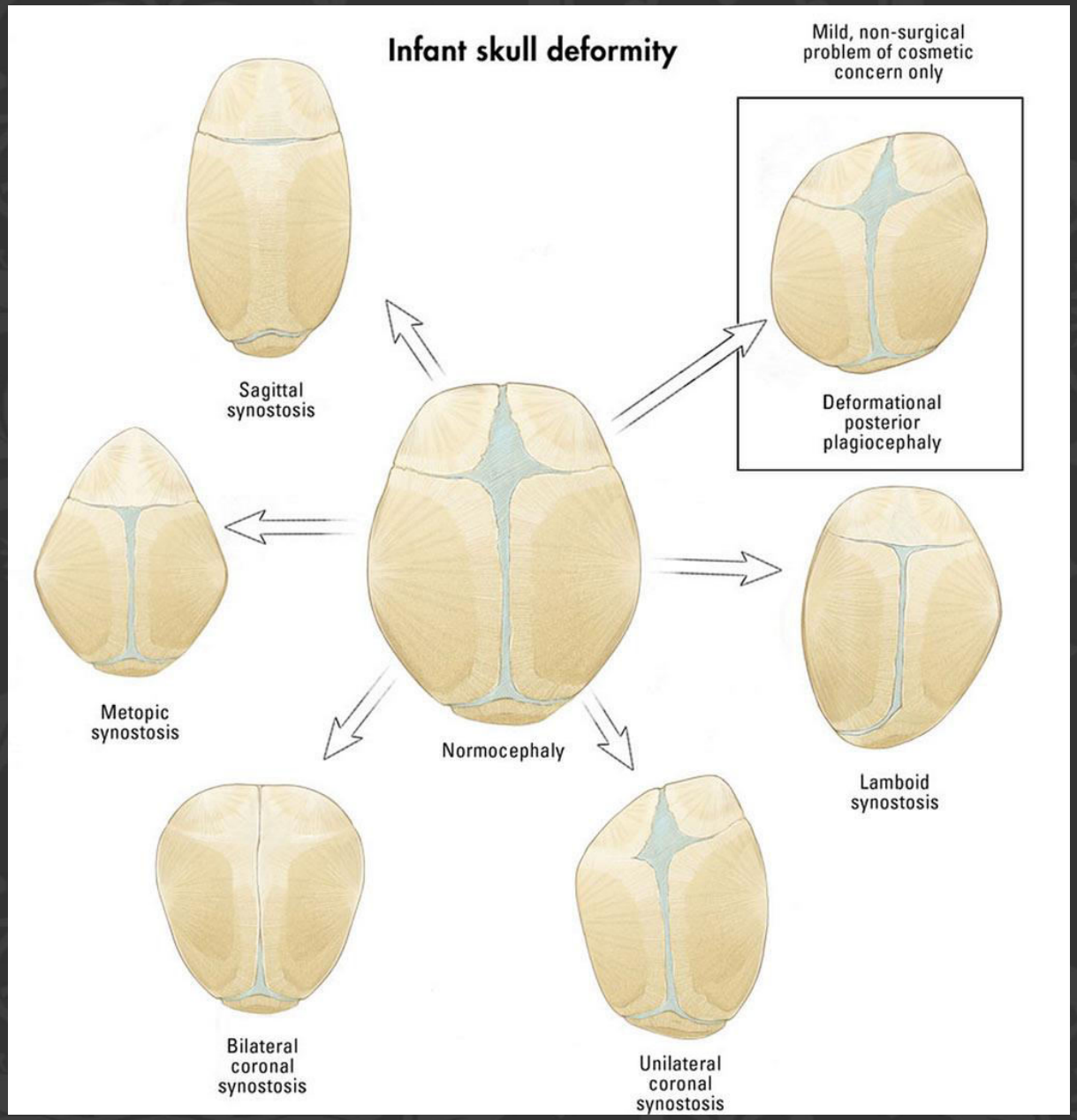
Sunken fontanelle
(dehydration, decreased ICP)

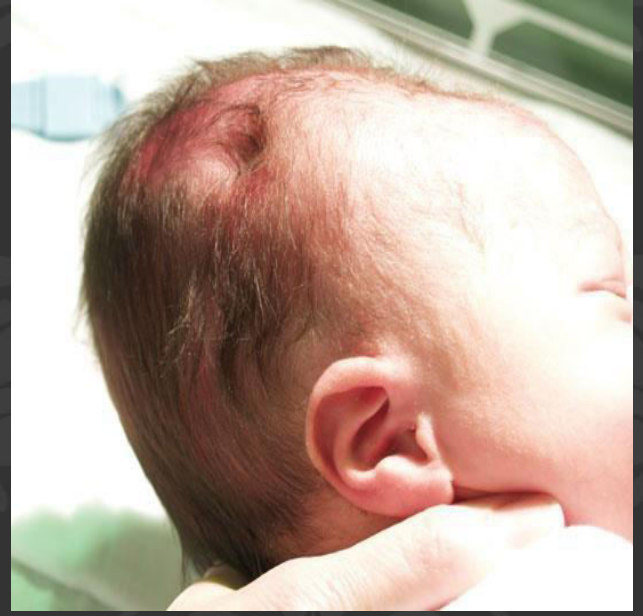
. Caput succedaneum is soft-tissue swelling over the vertex due to pressure in labour.



Craniosynostosis

- is the premature closure of >1 sutures of the skull resulting in an abnormally shaped head.
- The earliest sign is increased bone density along the suture.





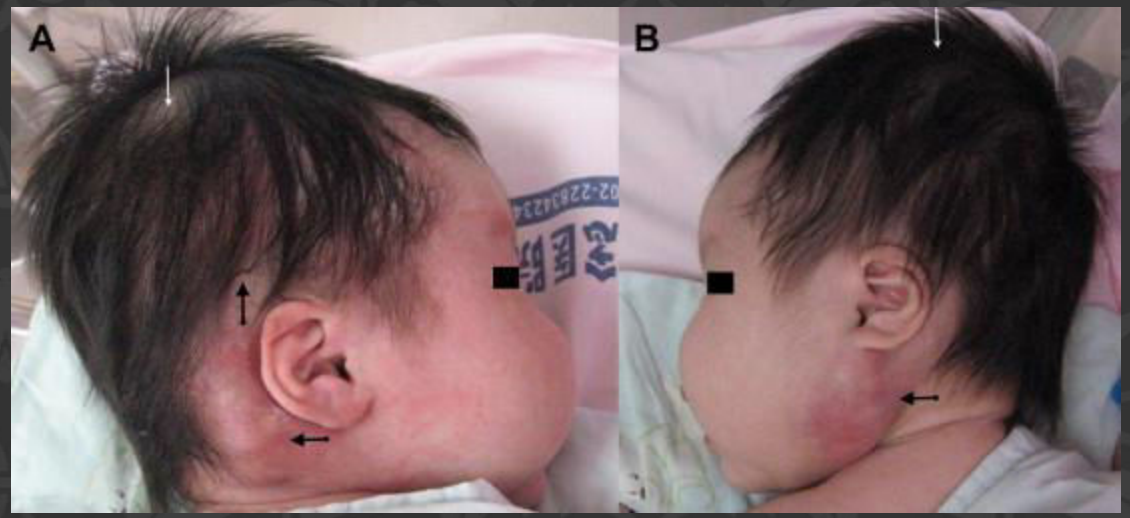
- Caput succedaneum

- Cephalohematoma

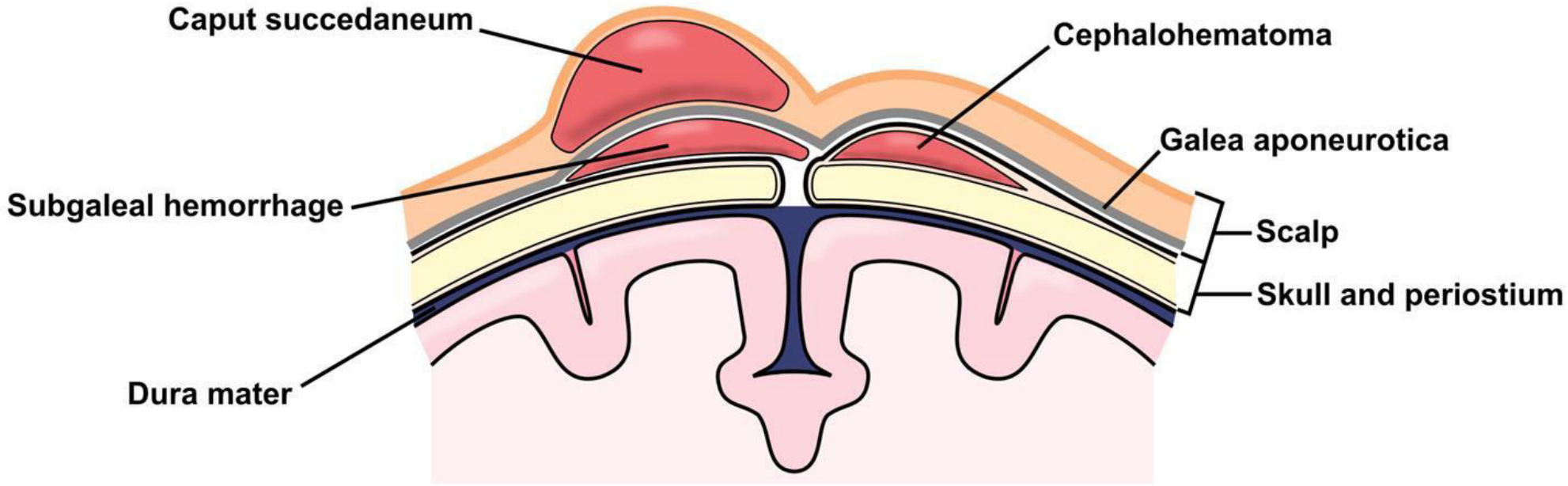
CAPUT SUCCEDANEUM	CEPHAL HAEMATOMA
1. Present at birth on normal vaginal delivery.	1. Appears within a few days after birth on normal or forceps delivery.
2. May lie on sutures, not well defined.	2. Well defined by suture, gradually developing, hard edge.
3. Soft, pits on pressure.	3. soft, elastic but does not pits on pressure.
4. Skin ecchymotic.	4. No skin change.
5. Size largest at birth , gradually subsides within a day.	5. Become largest after birth and then disappears within 6-8 weeks to few months.
6. No underlying skull bone fracture.	6. May underlying skull bone fracture.
7. No treatment required.	7. No treatment required.

Subgaleal hemorrhage

- Bleeding between the scalp aponeurotica and the periosteum of the outer surface of the skull.
- Presents as a firm, fluctuant swelling over the scalp, extending posteriorly to the neck or in front of the ears.
- Associated with repeated vaccum assisted delivery attempts or coagulopathy



Neonatal Extracranial Injuries



Moises Dominguez

Macrocephaly

- Familial with Autosomal Dominant inheritance
- Hydrocephalus
- Other conditions
  - Achondroplasia (skeletal dysplasia)
  - Sotos' Syndrome (Cerebral Gigantism)
  - Alexander's Disease
  - Canavan's Disease
  - Gangliosidoses
  - Neurofibromatosis Type I

Microcephaly

- Familial
- Trisomy 13
- Trisomy 18 (Edward Syndrome)
- Trisomy 21 (Down Syndrome)
- Teratogen Exposure
  - Fetal Alcohol Syndrome
  - Radiation exposure in utero (<15 weeks gestation)
  - Fetal Hydantoin
- TORCH Virus congenital infection
  - Cytomegalovirus
  - Rubella
  - Toxoplasmosis

Eyes

- Red reflex testing is vital for early detection of visual abnormalities such as cataracts, glaucoma, retinoblastoma, and colobomas of the iris (a defect in the iris inferiorly that gives the pupil a keyhole appearance) . They can be associated with a syndrome as **CHARGE** syndrome and other syndromes
- **Leukocoria** a white pupillary reflex can be due to **cataracts**, **chorioretinitis**, **retinopathy of prematurity**, or **retinoblastoma**.
- **Congenital ptosis** (drooping eyelids).
- **Congenital microphthalmia** occurs with congenital abnormalities and is either AD or AR.

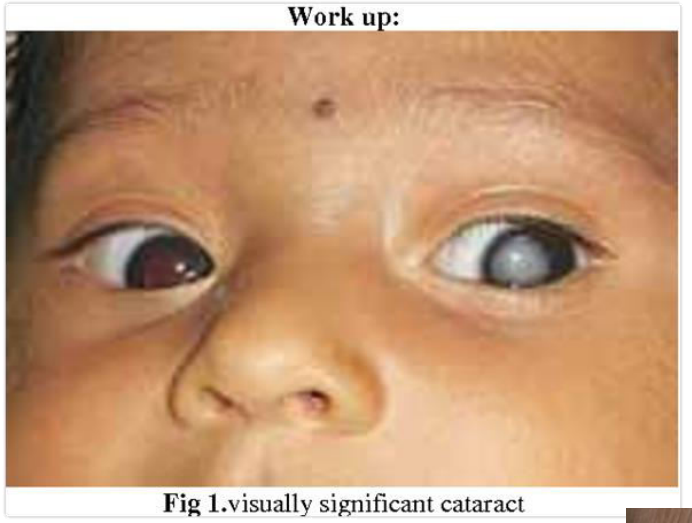
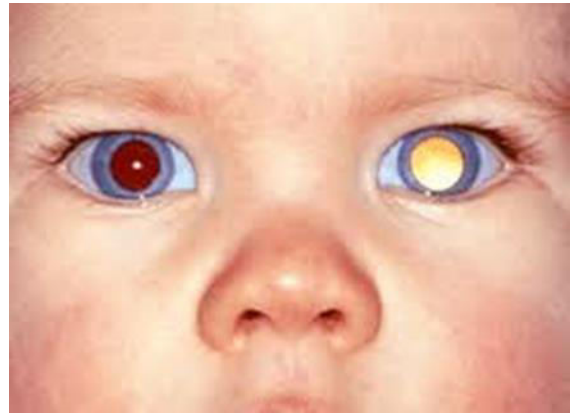
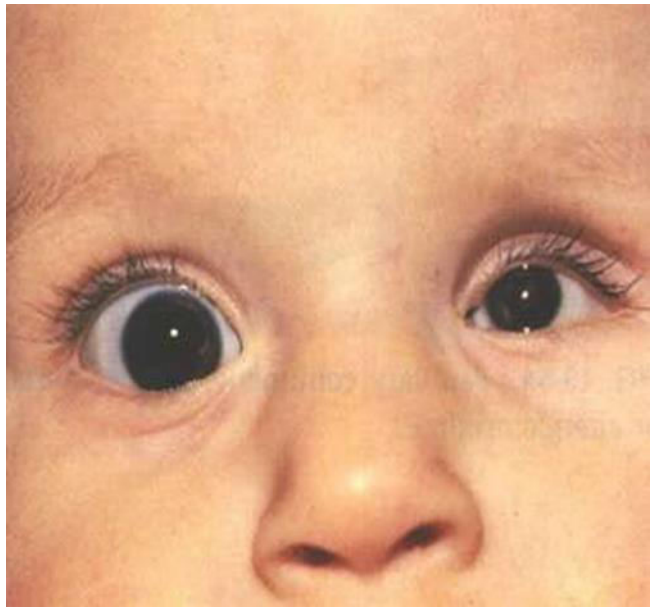
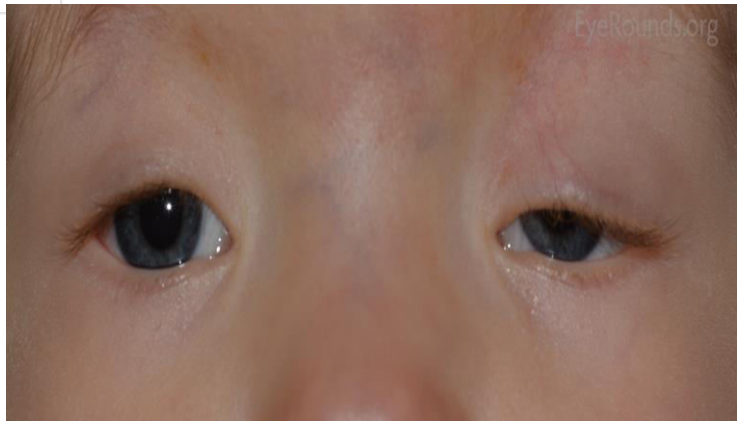


Fig 1.visually significant cataract

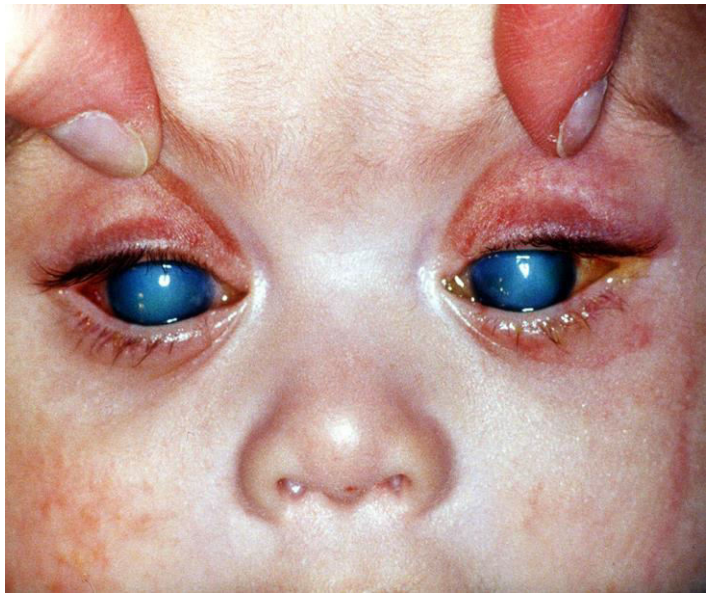


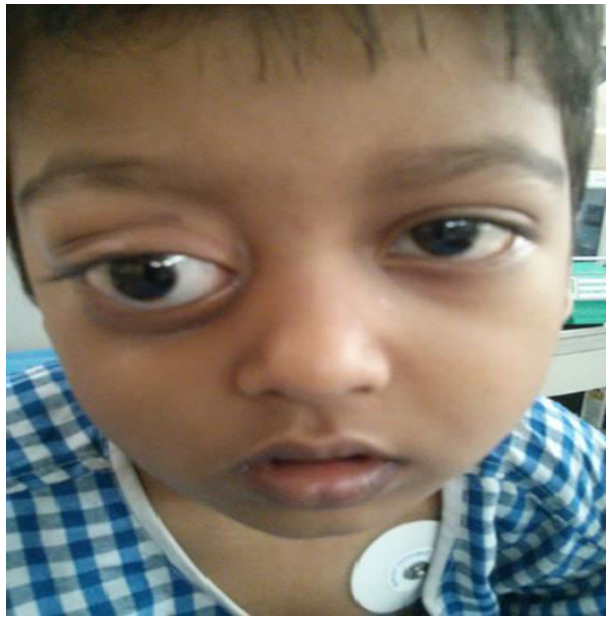


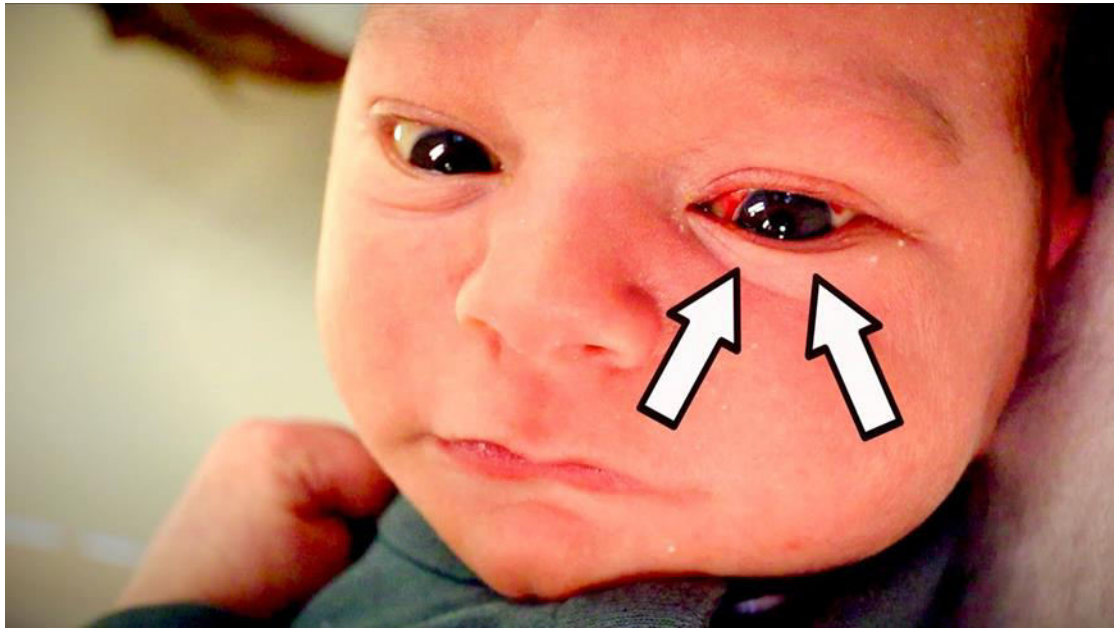


- **Proptosis** should prompt additional investigation for mass lesions or retrobulbar hemorrhage.
- **Congenital glaucoma** presents as enlarged cornea > 11mm that becomes progressively cloudy.
- hemorrhages can all be seen following birth trauma.
- **Conjunctivitis** within the first 2-5 days of life is most often caused by *Neisseria gonorrhoeae*. *Chlamydia trachomatis* is the most likely cause of conjunctivitis at 5-14 days of age.

  (its normal to find yellow crusting without inflammation after birth in infant with narrow lacrimal duct)



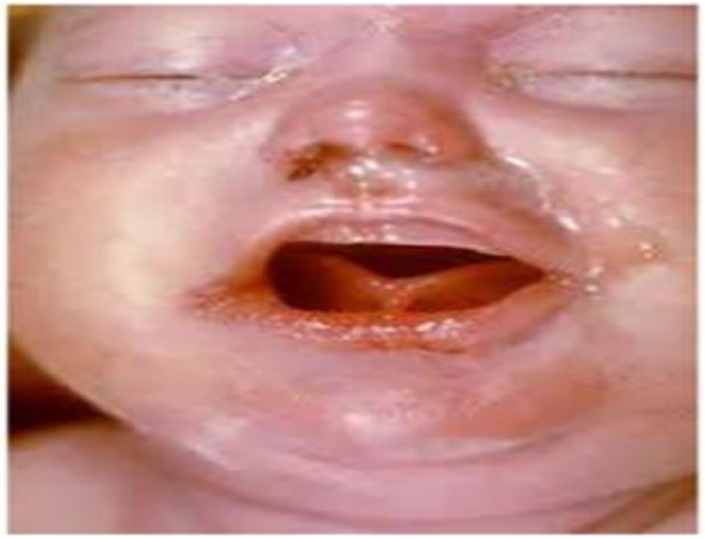


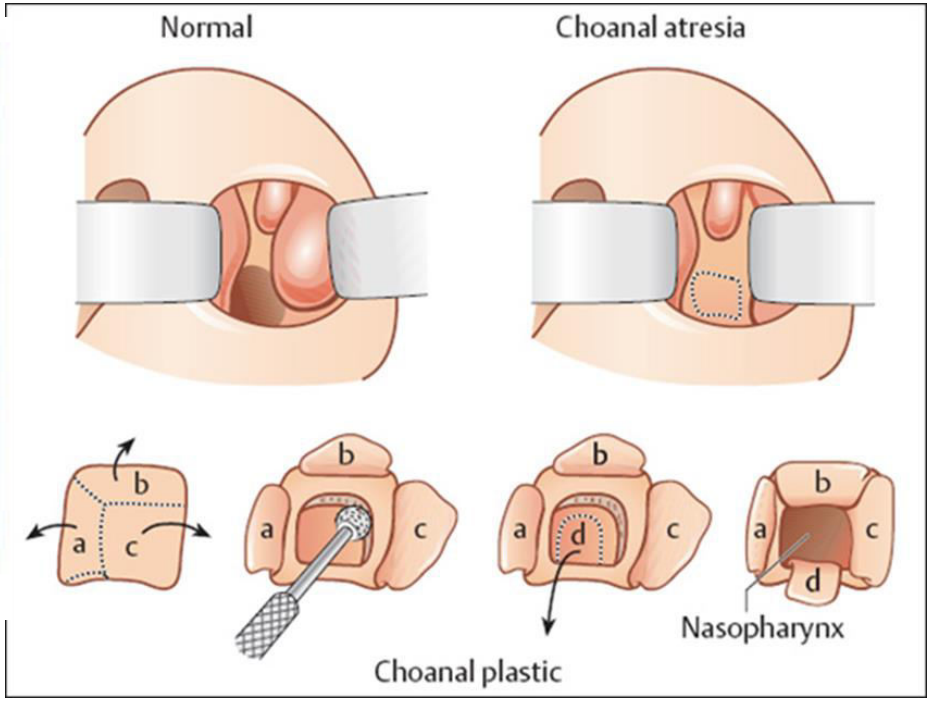


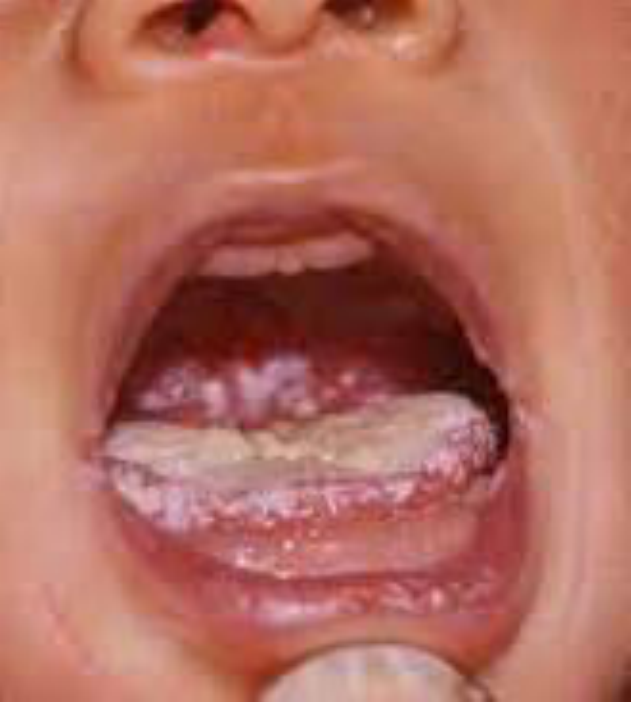
Nose:

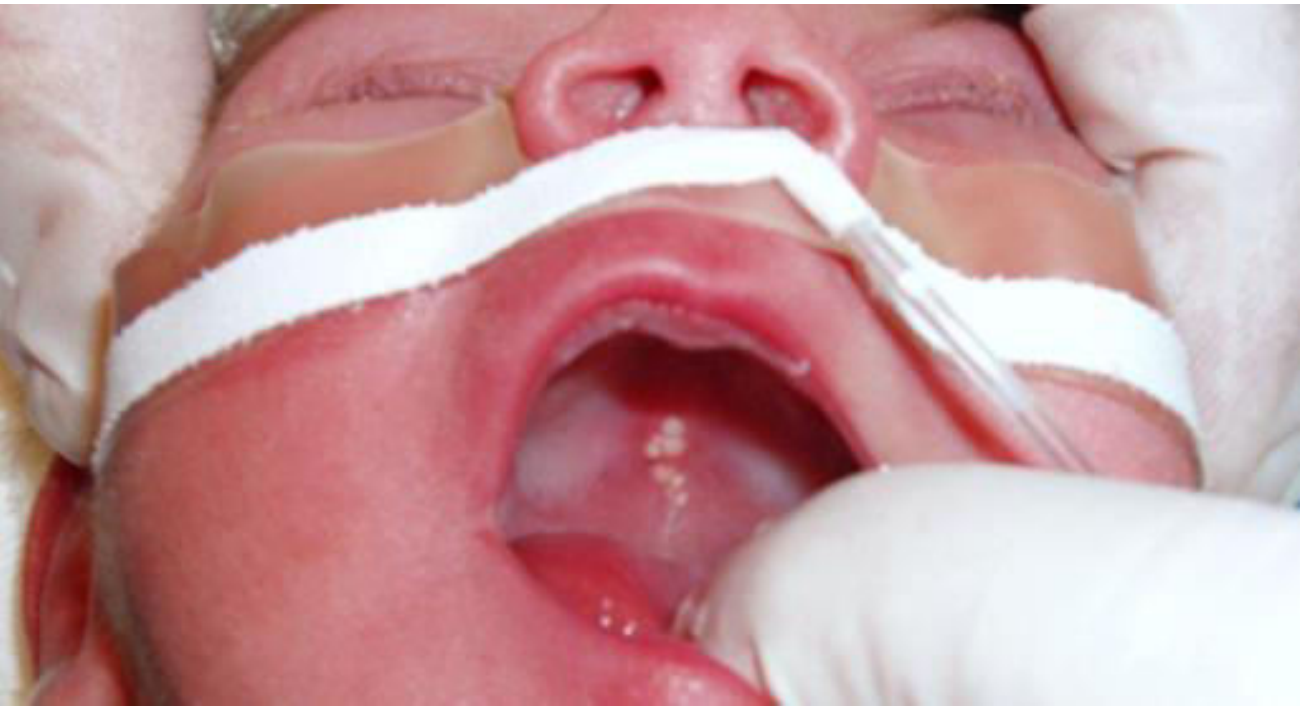
- Check that the nostrils are patent.
- Anatomic obstruction of the nasal passages secondary to unilateral or bilateral choanal atresia results in respiratory distress

❖ Hemorrhagic, thick, purulent nasal discharge (snuffles) is seen in congenital syphilis.





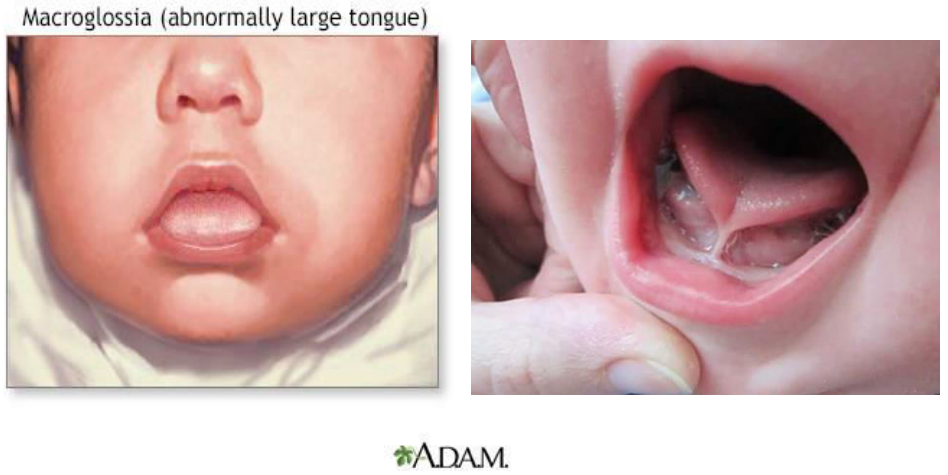




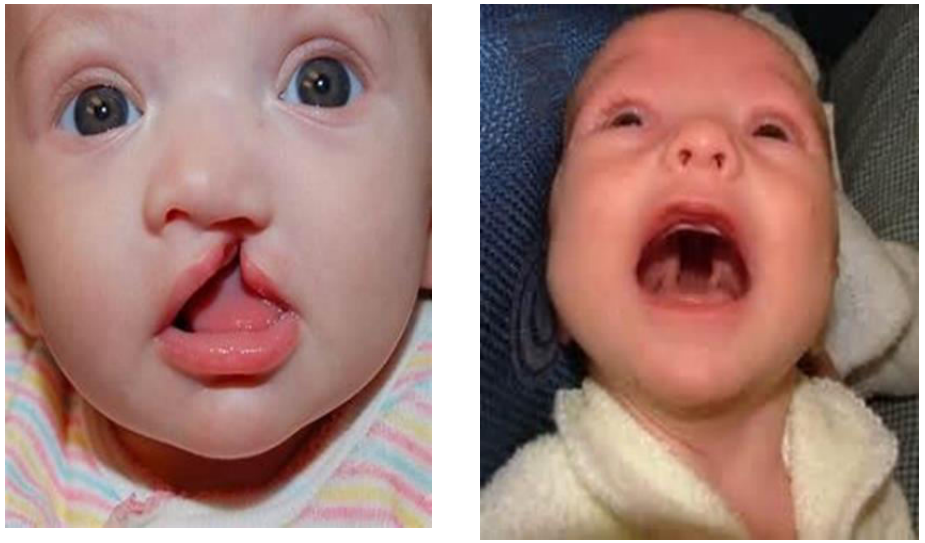
Mouth

- Normal findings Epstein’s pearls are small white mucosal cysts on the palate that disappear spontaneously.
- White coating on the tongue which is easily scraped off with a swab is due to curdled milk.
- A white coating on the tongue, not easily removed and which may bleed when scraped, is due to the fungus, Candida albicans (thrush).

- Abnormal findings Macroglossia (a large protruding tongue) occurs in Beckwith–Wiedemann syndrome , hemangioma, isolated macroglossia ,hypothyroidism.
- A normal-sized tongue protrudes through a small mouth in Down' syndrome (glossoptosis).

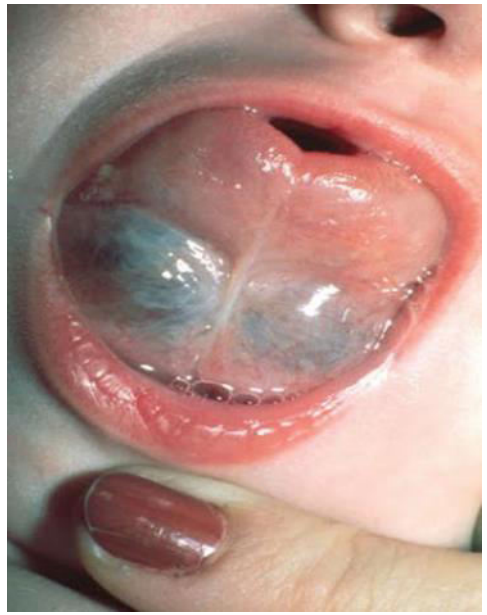


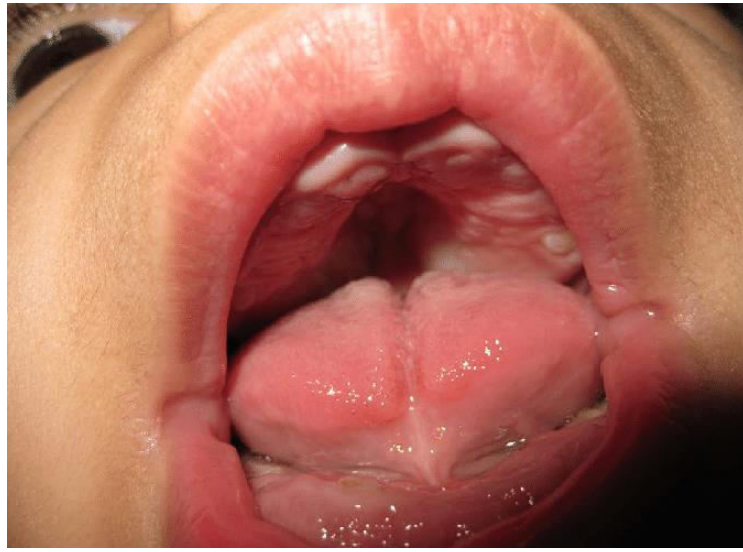
- Ankyloglossia (tongue tie) is when the lingual frenulum which joins the midline of the tongue to the floor of the mouth is abnormally short. Consequently the tongue cannot move freely, interfering with feeding.

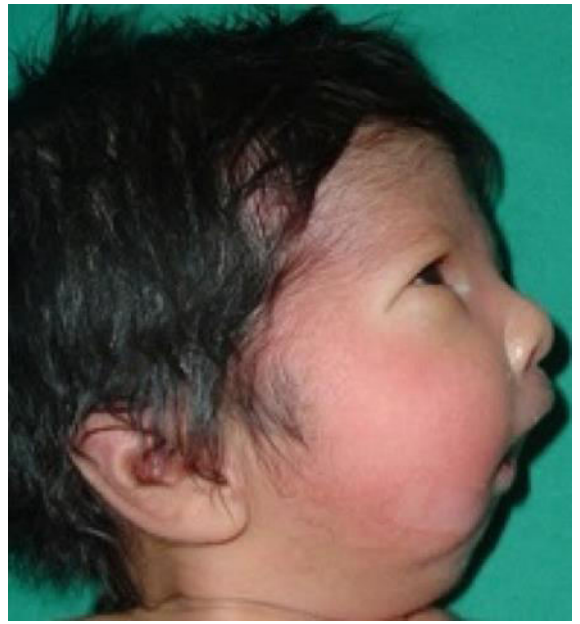


- Cleft palate may involve the soft palate or both hard and soft palates. It can be midline, unilateral or bilateral and may involve the gum (alveolus). Cleft lip can appear in isolation or in association with it. Refer affected infants early to a specialist multidisciplinary team.

- A ranula is a mucous cyst on the floor of the mouth related to the sublingual or submandibular salivary ducts .
  A translucent to bluish, Non blanching , fluctuant swelling lateral to the midline of the
  lower mouth. Congenital ranulas may resolve spontaneously but sometimes require surgery.
- Teeth usually begin to erupt at around 6 months but can be present at birth





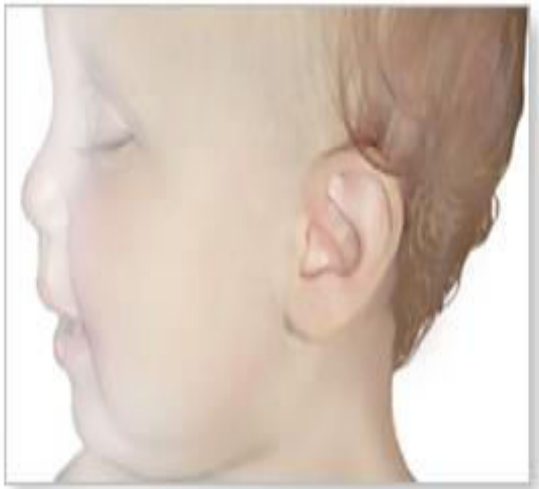


- Micrognathia (a small jaw) is sometimes associated with cleft palate in the Pierre Robin syndrome with posterior displacement of the tongue (glossoptosis) and upperairway obstruction.

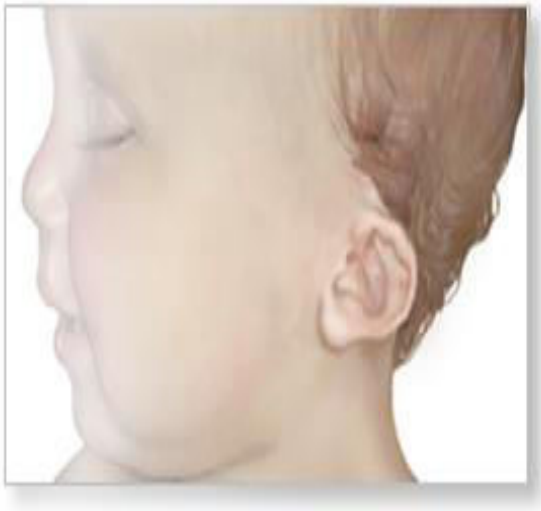
Ears:

Examination sequence ■ Note the size, shape and position. ■ Check that the external auditory meatus looks normal. ■ Otoscopic examination is not required for the newborn but is indicated in young infants to exclude otitis. A carer should hold the child to keep the head still

- Newborn Hearing Screening (performed before discharge after delivery
- Congenital Ear Anomaly
  - Low Set Ears
    - Caused by several congenital disorders (e.g. Trisomy 21, Trisomy 18)
    - Associated with hearing deficits (obtain Newborn Hearing Screening) and genitourinary anomalies (obtain renal Ultrasound)

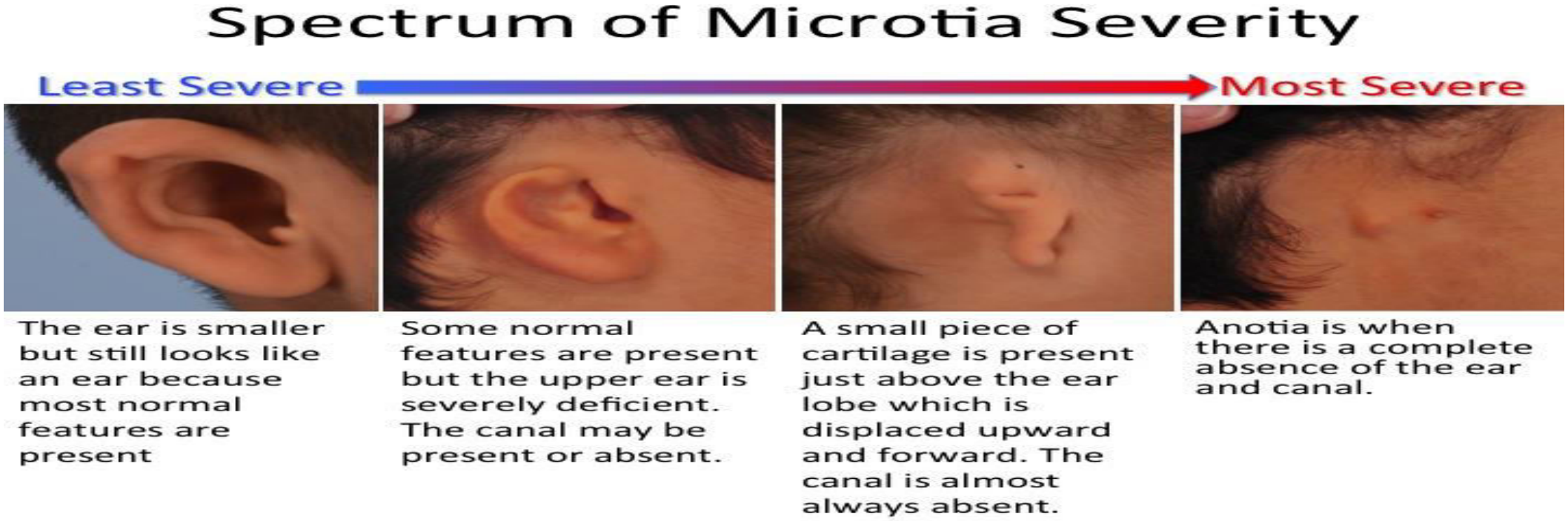


Normally developed outer ear (pinna)



Abnormal size, shape, rotation and/or location of pinna

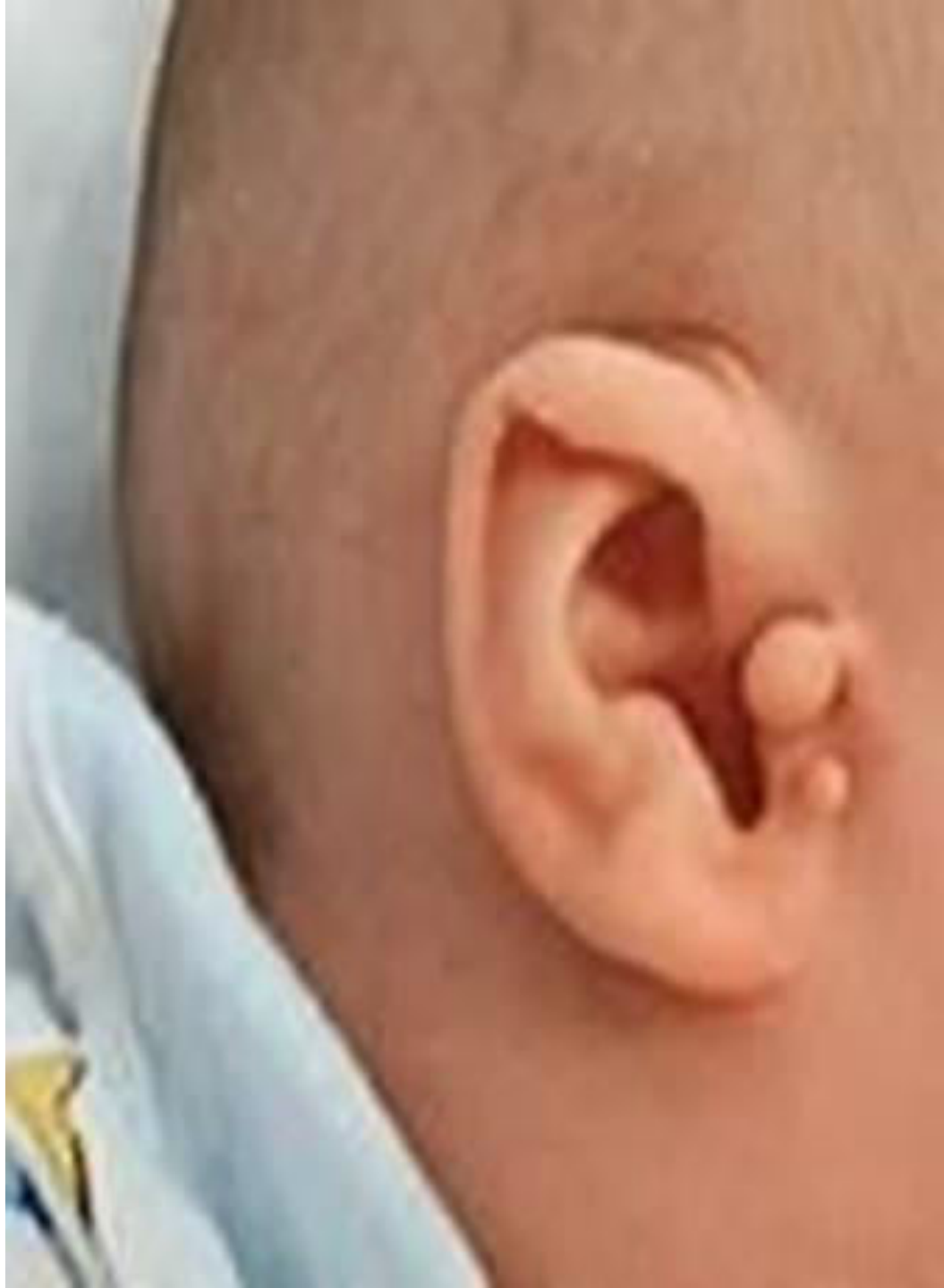
A.D.A.M.



- Microtia
  - May occur in isolation or due to underlying condition (e.g. CHARGE Syndrome, Goldenhar Syndrome, Treacher -Collins Syndrome)
  - May be associated with hearing deficit

- Pre-auricular
  Skin Tags, ear pits, fissures or sinuses
    - Associated
      with hearing deficits (obtain Newborn Hearing Screening)
    - Renal Ultrasound not
      indicated unless other dysmorphic

• features, Teratogen Exposure,
deafness Family History
or maternal diabetes

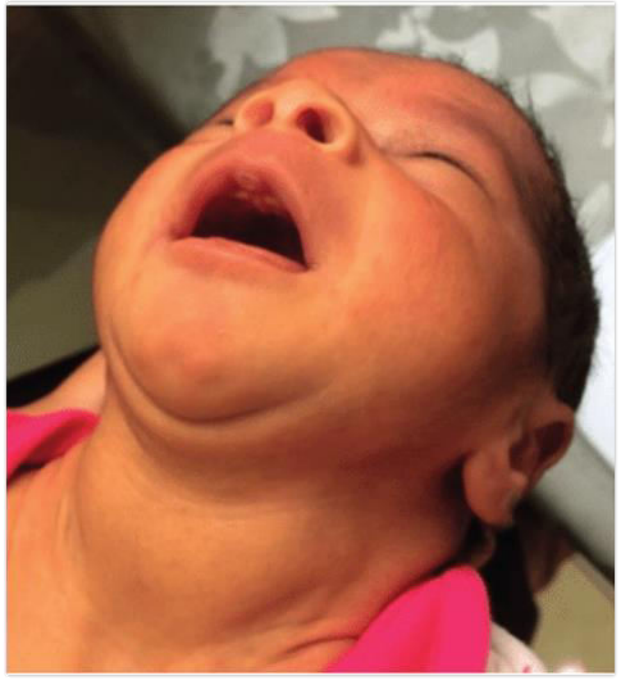


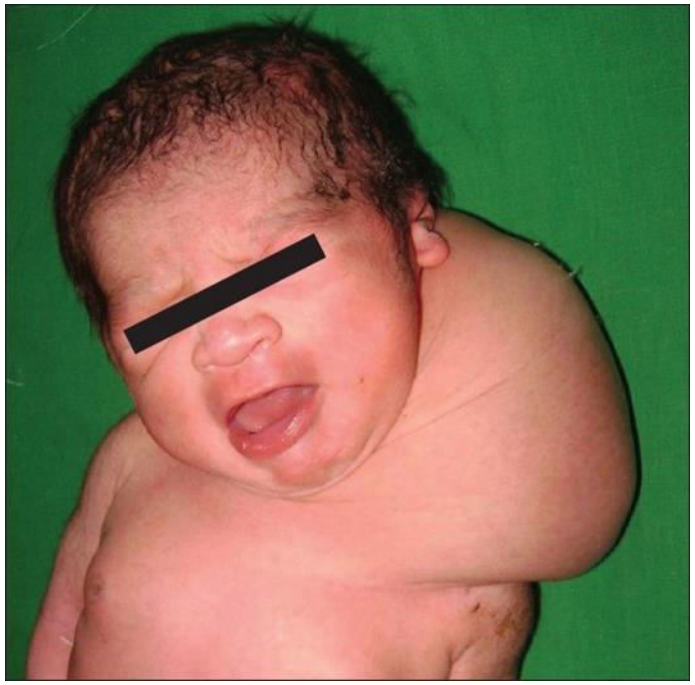
NECK

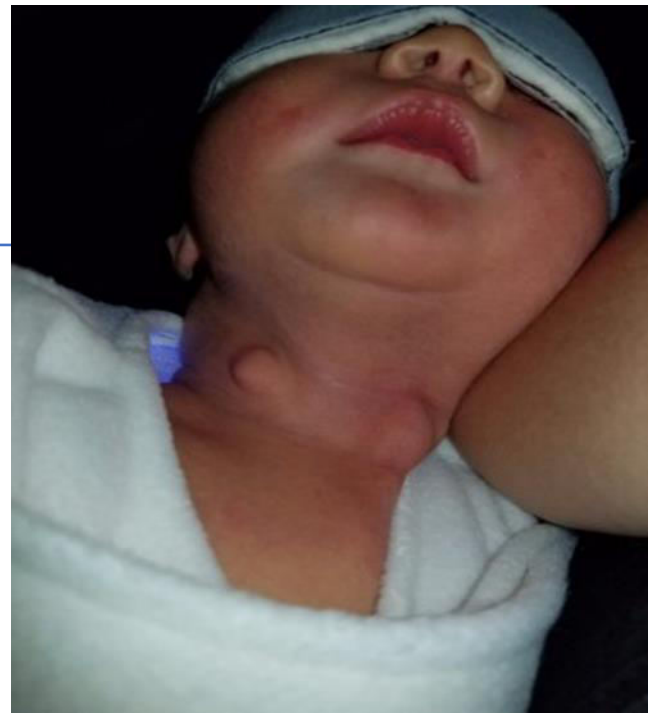
Cervical masses can be caused by a goiter, cavernous hemangioma, or cystic hygroma. Associated karyotypic abnormalities are found in up to 70% of children with cystic hygroma, including turner, klinefelter syndrome, and trisomies 13, 18, and 21.

Branchial cleft abnormalities are cysts or sinuses that occur along the anterior margin of the sternocleidomastoid muscle due to improper closure during embryonic life.

Thyroglossal duct cyst are located in the ventral midline and can extend to the base of the tongue and move vertically with swallowing and tongue protrusion.







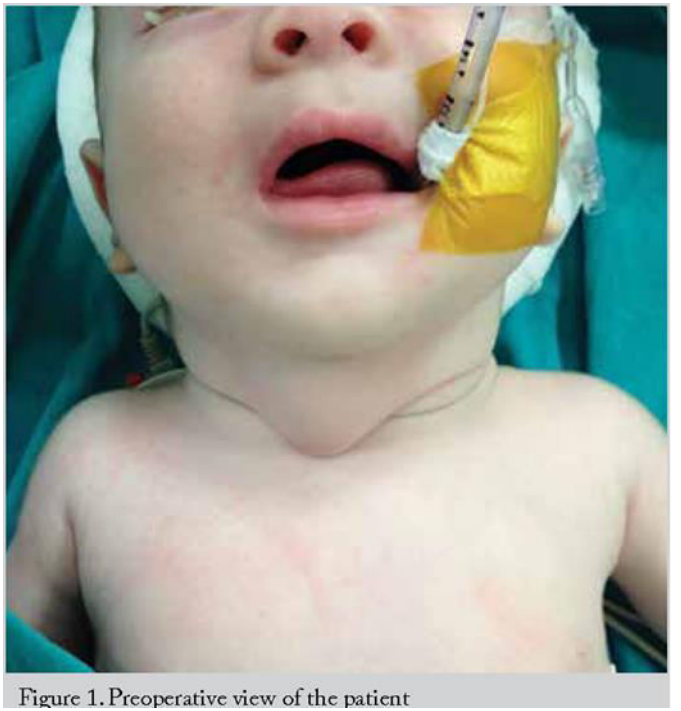
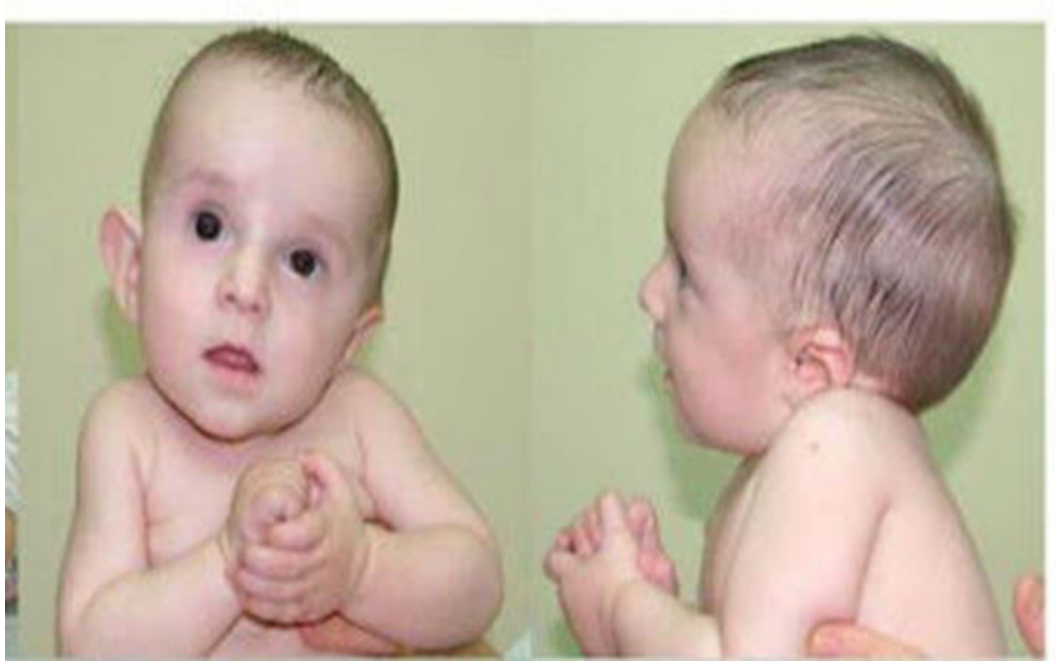
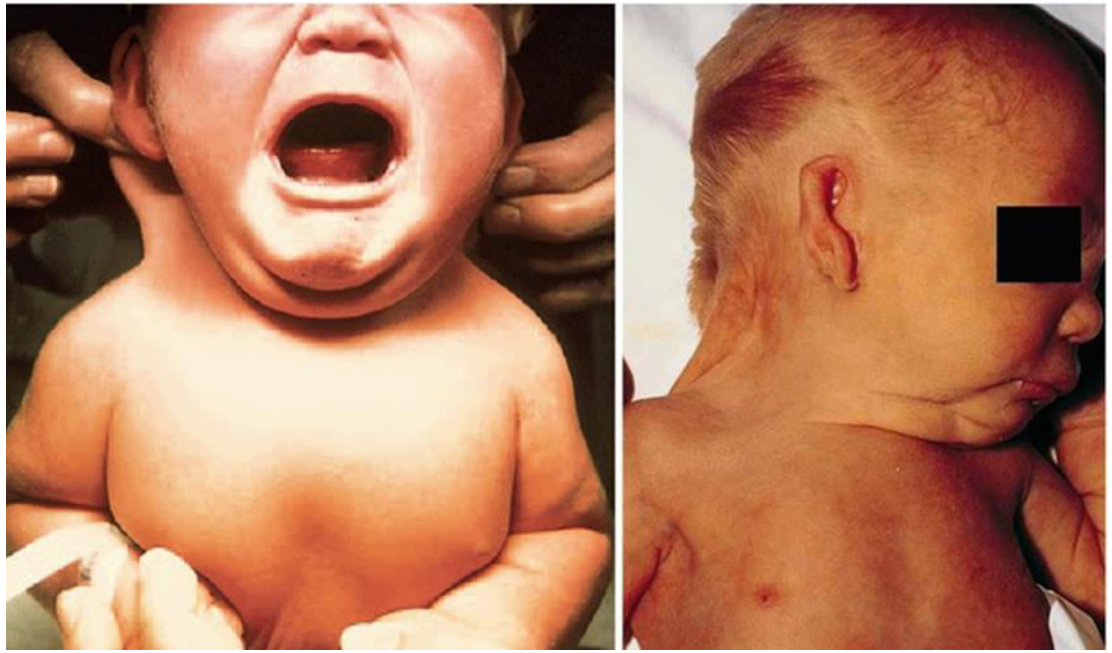


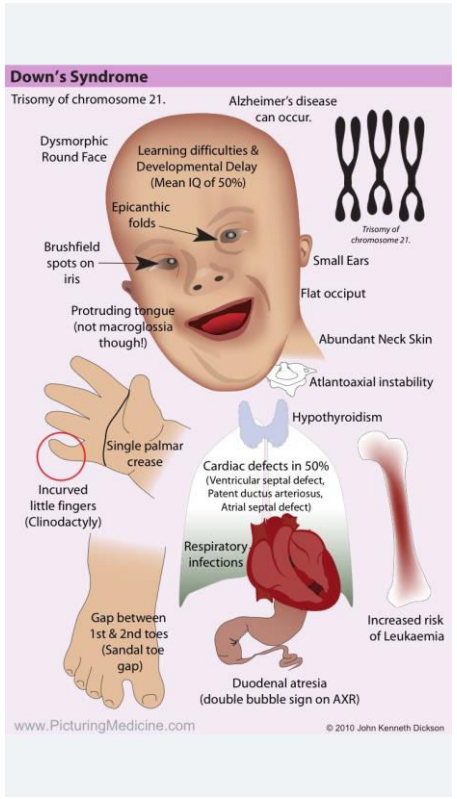
Figure 1. Preoperative view of the patient

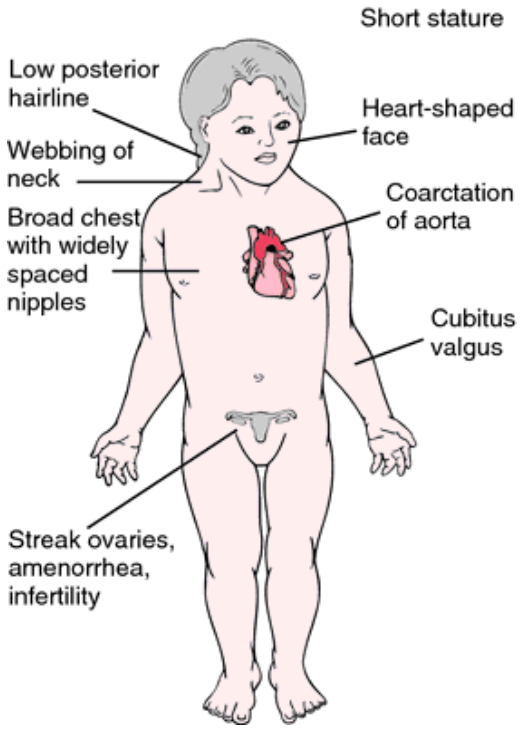
- Torticollis occurs when one of the sternocleidomastoid muscles tightens and the other is absent or atretic, resulting in head tilt.

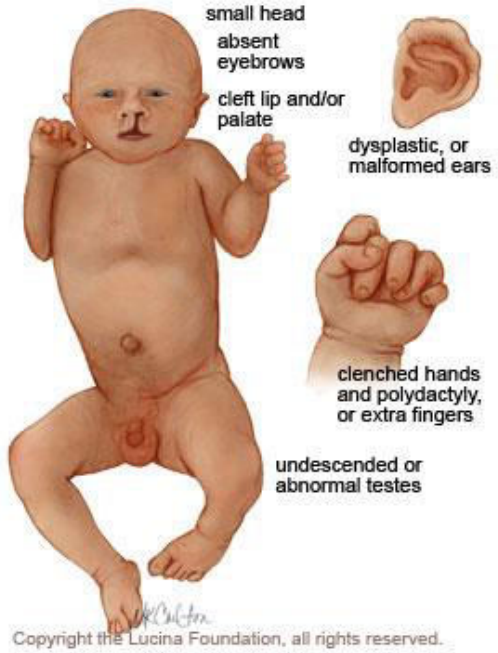


- Edema and webbing (redundant tissue) of the neck, are common findings in Turner or Noonan syndrome. Posterior nuchal thickening is characteristic of trisomy 21.



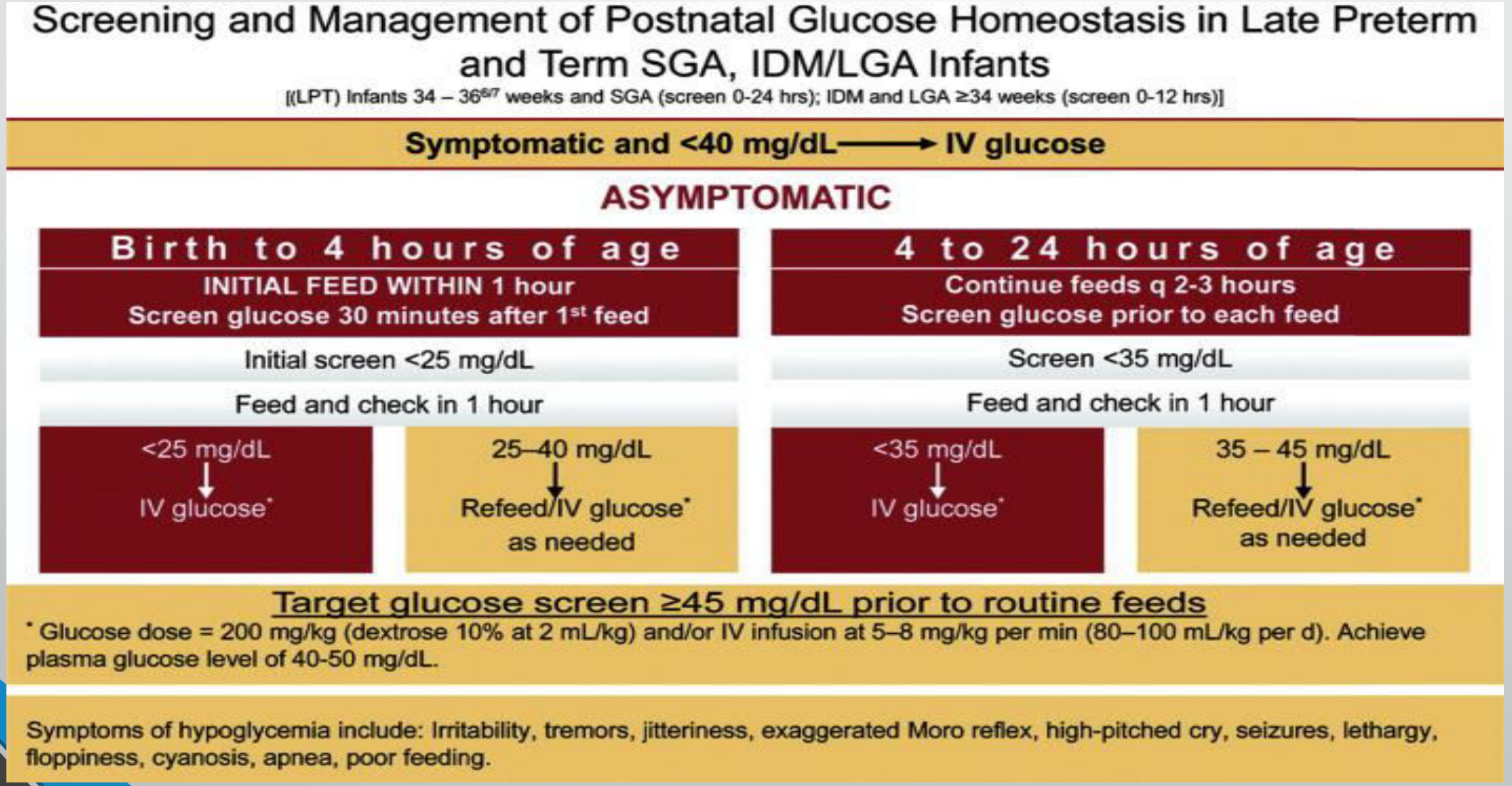






Dysmorphic features

Neonatal Hypoglycemia



INFANT OF A DIABETIC MOTHER

IN UTERO → **DELIVERY** [↑risk of prematurity] → **NEONATE**

***Poor neuro-developmental outcomes**

Maternal hyperglycemia

PLACENTA — **if vascular insufficiency → IUGR**

0-20 wks gestation

Hyperglycemia

Major congenital malformations

- Situs inversus
- Cardiac: TGA, DORV, VSD, truncus arteriosus
- CNS: Neural tube defects, caudal regression syndrome
- Renal: agenesis, hydronephrosis, duplex
- GI: atresias

Fetal pancreas functionality @ ~20 weeks

>20 wks gestation

Hyperinsulinemia + Hyperglycemia

↑ anabolism

Macrosomia
Organomegaly

↑ O2 demand (+30%)

Hypoxia

- ↑ erythropoiesis
- Iron shifts into RBCs → brain/heart affected
- Metabolic acidosis

loss of maternal Ca
maternal Mg wasting
from renal insufficiency → **Delayed neonatal PTH control***
hypocalcemia, hypomagnesemia (first 24-72h)
usually asymptomatic & self resolves

Insulin inhibits cortisol's maturational effects → **Respiratory distress syndrome***

loss of maternal glucose → **Hypoglycemia***
jittery, seizures*, apnea, tachypnea, poor feeding

↓ Hyperglucagonemia → GI hypomotility

Small left colon syndrome
Delayed meconium passage; small risk of perforation but usually self-resolves; consider contrast enema

Traumatic birth
Shoulder dystocia
Need for C-section → **LGA, brachial plexus injuries, clavicular fractures, birth asphyxia***
Cardiomyopathy: septal hypertrophy/LVOT

↑ [cord EPO]
↓ [cord ferritin] → **Polycythemia, hyperviscosity** (Hct>65%)
Plethoric, lethargic, hyperbilirubinemia*, strokes*, seizures*, renal vein thrombosis, NEC

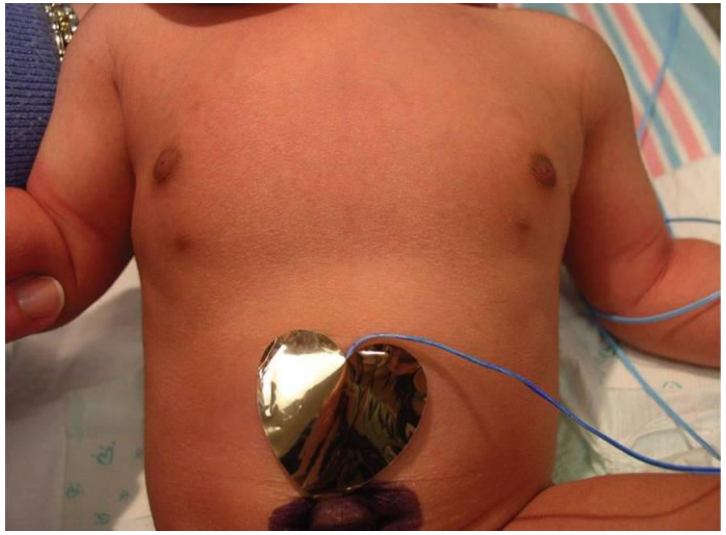
Altered iron distribution
strokes*, cardiomyopathy

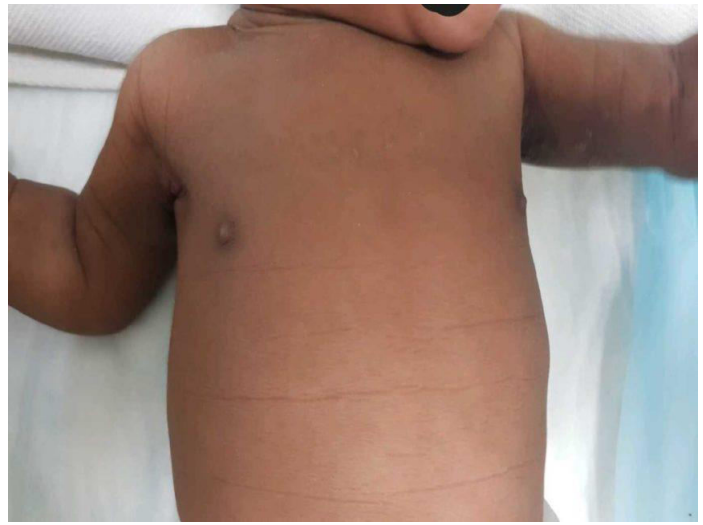
Chest, Abdomen, Genitalia, and Anus

Chest

Note chest shape, symmetry of movement.

- Fractures of the clavicles, identified on physical examination by crepitus during palpation along the clavicle.
- Supernumerary nipples
- Widely spaced nipples with a shield-like chest are common manifestations of Turner and Noonan syndromes.
- Breast hypertrophy is common in both males and females; small amounts of fluid are sometimes discharged in the first few days then it usually resolves.





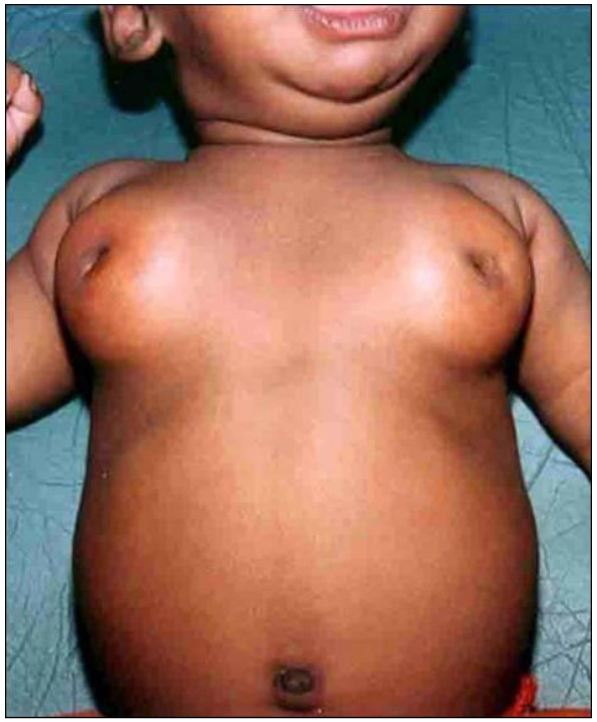


Figure 1: Giant Mastauxe of newborn.

Lungs

Count the respiratory rate and listen for additional noises with breathing
The respiratory rate is generally 30-50 breaths/minute (term neonate) and 40-60 (preterm) but can normally be as high as 60 breaths/ minute. Newborns normally have irregular breathing patterns with short (< 15-20 sec) respiratory pauses (periodic breathing).

look for signs of respiratory distress.

- Retractions are visible when the tissues between the ribs are sucked in during inspiration. They are normal during the first few minutes after birth; however, if they occur later it indicates airway obstruction, surfactant deficiency, or infection.

- Asynchronous chest wall movement.

Coughing is extremely unusual in neonates and can indicate a serious abnormality as pneumonia.

- Percussion of the newborn’s chest:: not useful
- Auscultation: by diaphragm, anteriorly, laterally, posteriorly
- assess: air entry on each side , any crackles , wheezes .
- Breath sounds in the healthy newborn have a bronchial quality compared to the older individual.
- stridor (mainly inspiratory) and on day 2-3 of life: laryngomalacia

Heart

By Inspection:

- pallor, cyanosis, sweating.

The point of maximal impulse is along the left side of the sternum at the 4th to 5th interspace, just medial to the midclavicular line.

A displaced PMI can be due to a tension pneumothorax, dextrocardia, cardiomegaly, or diaphragmatic hernia.

Heart rates are generally 100-140 bpm (term neonate) and 120-160 (preterm) in the first few hours of life.

A sustained heart rate of <80 is concerning.

Tachycardias >180 bpm can indicate:

fever, hypovolemia, drug withdrawal, congenital heart disease, anemia, hyperthyroidism.

Causes of bradychardia ?

Feel the femoral pulse on the mid inguinal points while abducting the hips. In coarctation of aorta, the femoral pulses are diminished or absent and the upper extremity pressure is > 20mmHg higher. (radiofemoral delay in adults)

- PDA causes a wide pulse pressure and bounding pulses. At birth it causes a short systolic murmur, later develops to machinery continuous murmur Palpate for parasternal heave and thrills

Auscultate the apex by the bell, then use the diaphragm for all positions looking for high-pitched sounds and murmurs.

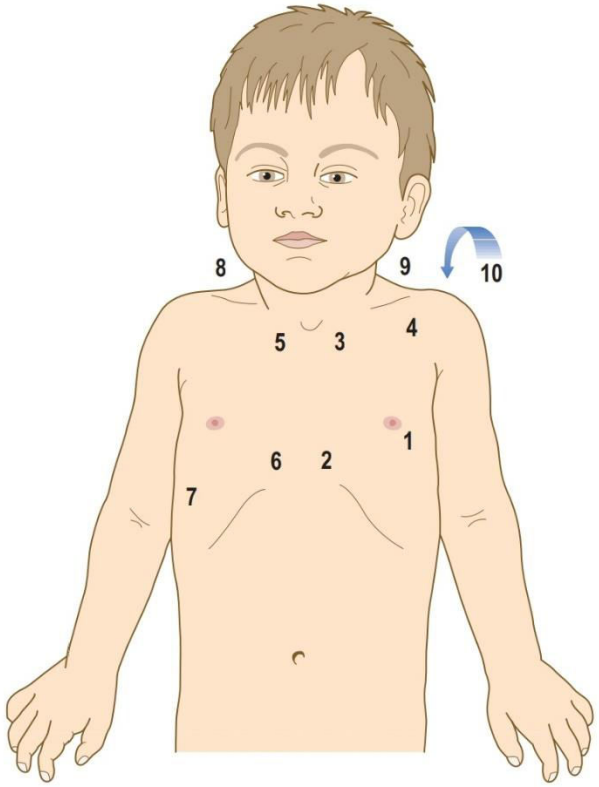


Fig. 15.6 Auscultation positions. Recommended order of auscultation: **1,** apex; **2,** left lower sternal edge; **3,** left upper sternal edge; **4,** left infraclavicular; **5,** right upper sternal edge; **6,** right lower sternal edge; **7,** right mid-axillary line; **8,** right side of neck; **9,** left side of neck; **10,** posteriorly.

15.10 Normal ranges or values for heart and respiratory rate in the newborn

Sign	Preterm neonate	Term neonate
Heart rate (bpm)	120–160	100–140
Respiratory rate (breaths/min)	40–60	30–50

Murmurs

- -heard in 2% of neonates, only a minority have a structural heart problem.
- -Echo is needed for a structural diagnosis, before discharge
- -Delayed Echo?? 5 indications.
- -Investigate any murmur that is present immediately after birth, accompanied by cyanosis, evidence of poor perfusion, louder than grade 2, with tachypnea, and persistent after the 2nd day of life.
- - Innocent murmurs ?

The Seven S's :

Key feature of Innocent Murmur

- Soft (low amplitude)
- Systolic murmur
- Short duration
- Sounds (S1 and S2) normal
- Symptomless
- Special tests normal (X-ray, EKG)
- Standing/Sitting (changes with position)

- -Do not measure BP for healthy babies.
- -In ill babies: cuff measurements overestimates values compared to invasive ones.
- cuff width at least ⅔ of the distance from elbow to shoulder tip
- -Palpate for hepatomegaly.

Abdomen

-Remove the nappy

-Inspect: abdomen, umbilicus, groins, notice swelling

-Palpate superficially then deeply

-Palpate the spleen: how??

-Liver: you can feel the liver edge, if you feel more than the edge, measure the distance in the mid clavicular line of the costal margin to the liver's edge.

-Inspect the anus, present? patent?, normal position?

-Digital Rectal Examination: unnecessary, it causes anal fissure.

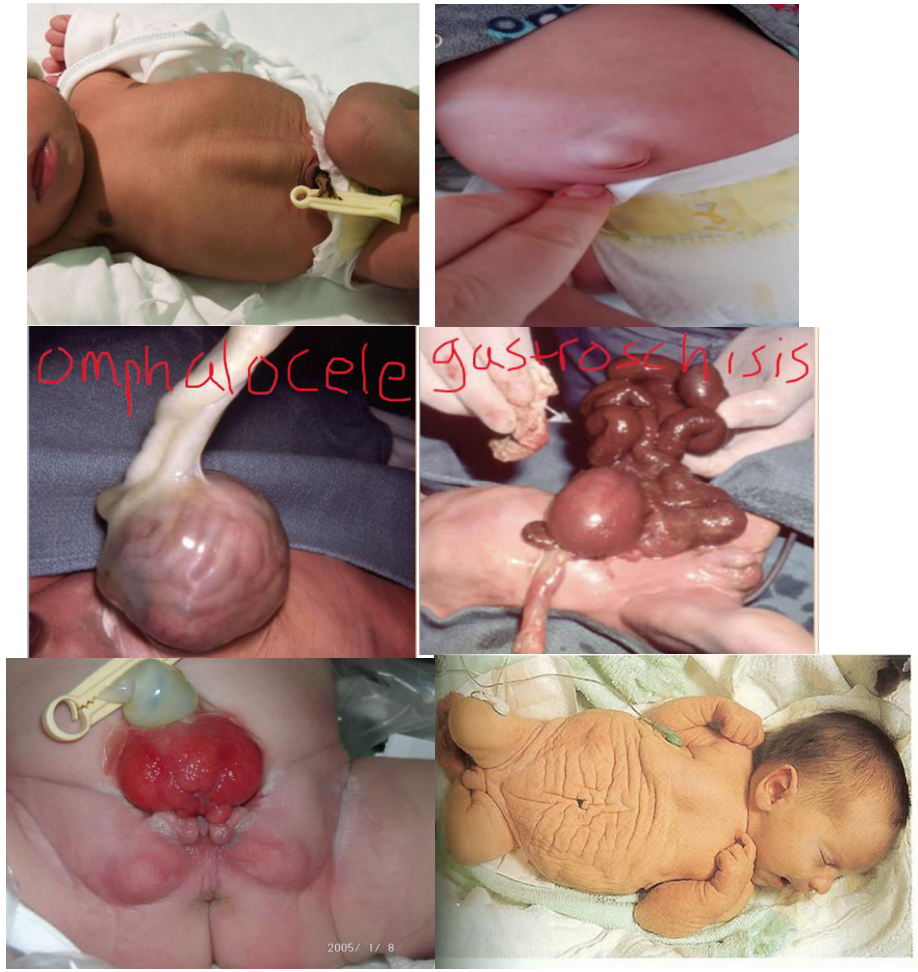
Iand done with your little finger.

In the newborn, the liver is normally palpated 1-2 cm below the right costal margin.. The kidneys are sometimes palpated, especially if enlarged or if the infant is preterm. If more than 2 cm is palpable, suspect hydronephrosis, cystic lesions, neoplasm, or renal vein thrombosis.

Abdominal masses commonly arise from the GU system (hydronephrosis, polycystic kidney disease, multicystic kidney). Less common origins include GI and neoplasms (Wilms tumor, neuroblastoma).

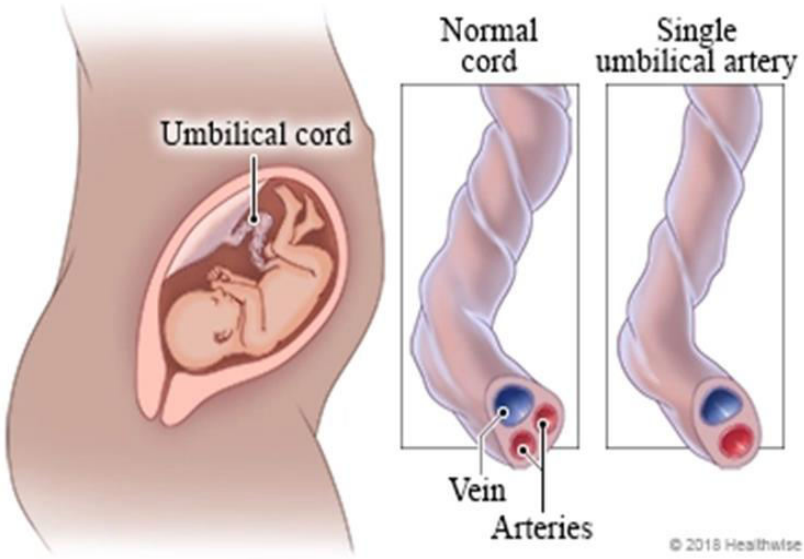
Abnormalities of the abdominal wall are fairly common and usually benign. Examples :

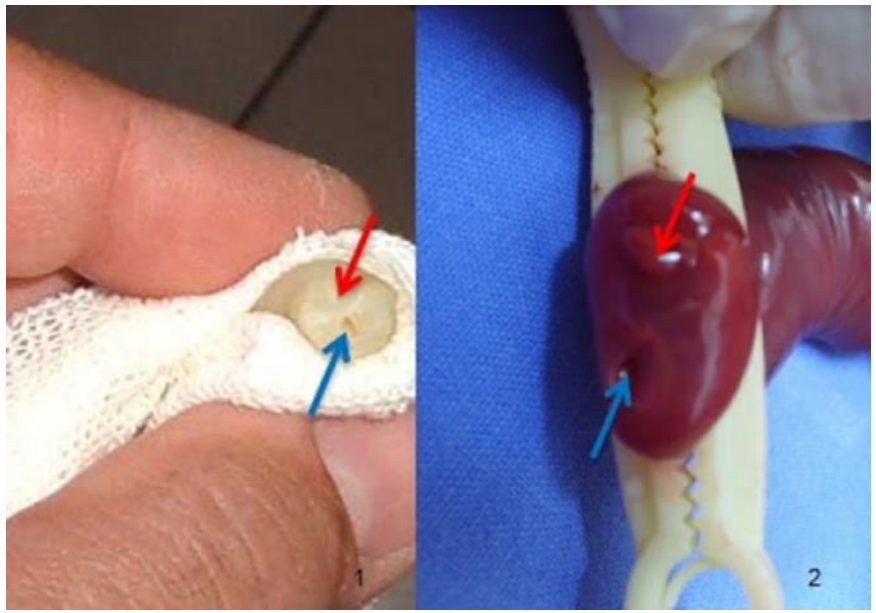
- Diastasis recti is characterized by a midline gap between the abdominal rectus muscle.
- Umbilical hernias, small defects in the periumbilical musculature of the anterior abdominal wall. common, easily reduced, low risk and close spontaneously.
- Omphalocele is formed by abdominal contents that pass through a periumbilical defect near the umbilical cord. Covered with a membrane that encloses the viscera.
- Gastroschisis an abdominal wall defect located above and to the right of the umbilicus and not involving the cord.
- Bladder exstrophy.
- Prune belly syndrome characterized by the absence of anterior abdominal wall musculature, UT anomalies, and cryptorchidism.

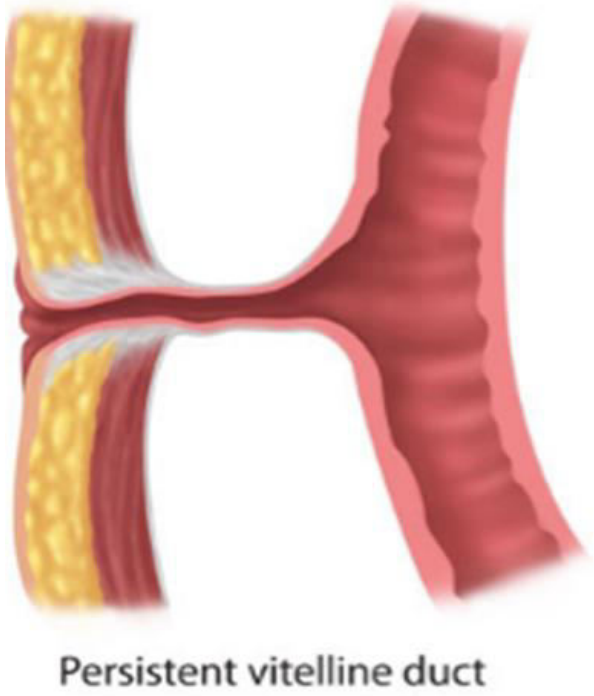


Umbilical abnormalities :

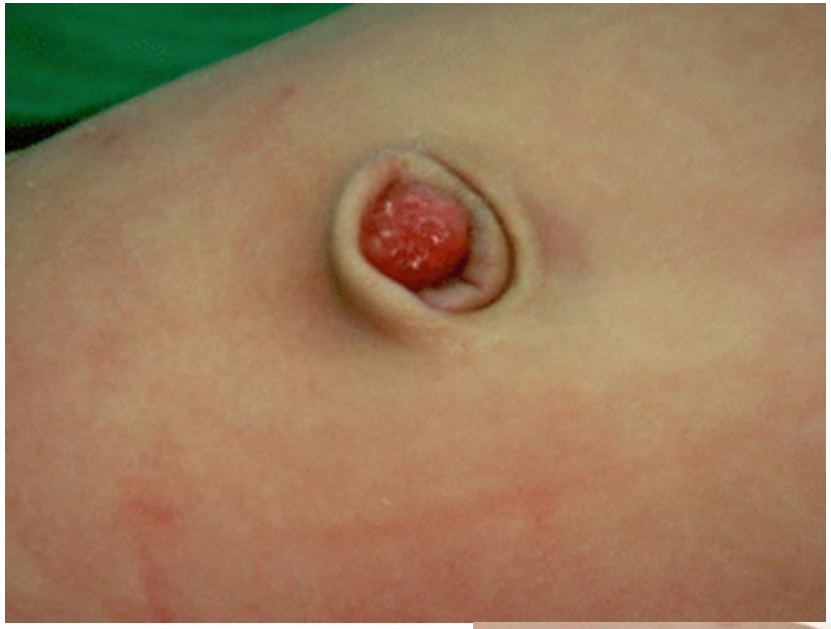
- Single –artery umbilical cord , up to 1% of newborns have a single artery; 15% of those have at least 1 other abnormality (Trisomy 18 is one of the more frequent abnormalities).
- Persistent vitelline duct can communicate with the umbilicus, with mucoid drainage visible from the umbilicus.
- Delayed umbilical cord separation, typically the umbilical cord falls off within 10-14 days, but its normal to take > 3 weeks. Delayed separation > 1 month occur in infants with leukocyte adhesion deficiency.



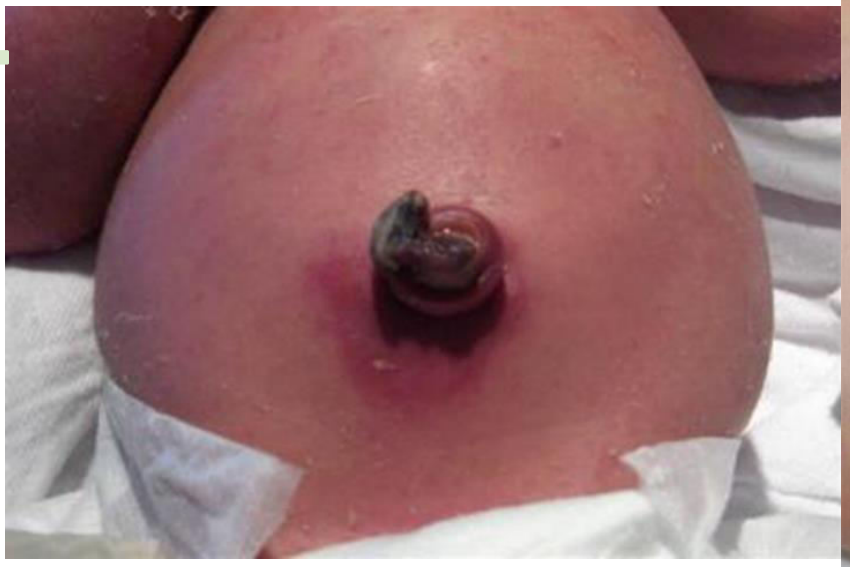


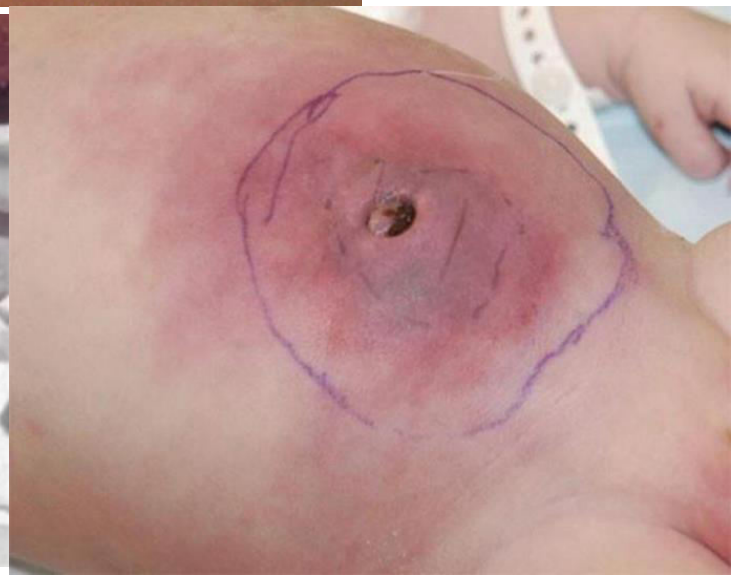


Umbilical granulomas are common lesions that persist after the detachment of the umbilical cord.



Omphalitis presents as redness around the umbilicus. This is potentially serious condition. The infection can spread along the umbilical vein to the portal venous sinus of the liver. Common causative organisms include *S.aureus*, *group A Streptococcus*, *E.coli*, *Klebsiella pneumoniae*, and *Proteus mirabilis*.

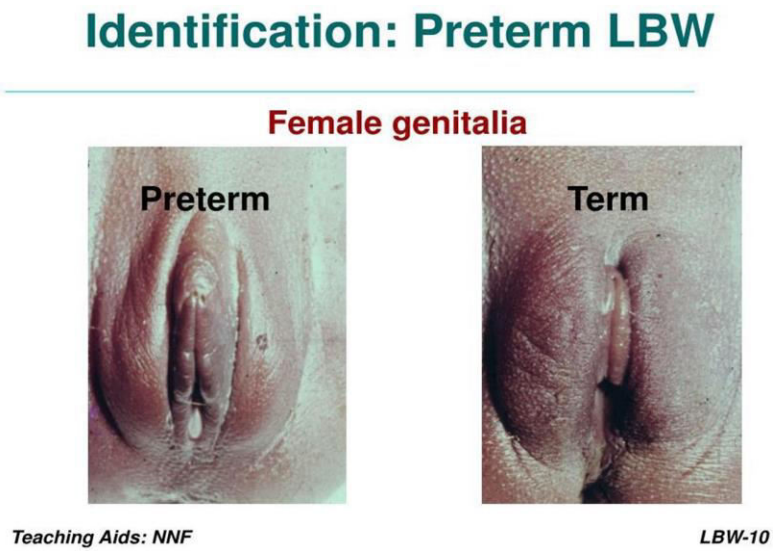


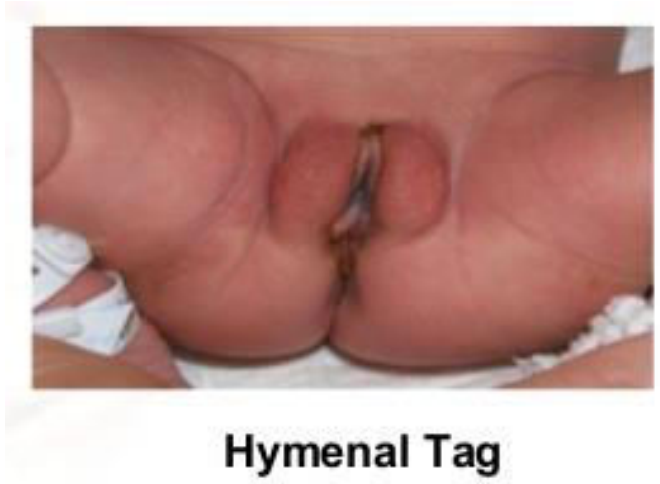


	Omphalocoele	Gastroschisis
Incidence	1:6,000-10,000	1:20,000-30,000
Delivery	Vaginal or CS	CS
Covering Sac	Present	Absent
Size of Defect	Small or large	Small
Cord Location	Onto the sac	On abdominal wall
Bowel	Normal	Edematous, matted
Other Organs	Liver often out	Rare
Prematurity	10-20%	50-60%
IUGR	Less common	Common
NEC	If sac is ruptured	18%
Associated Anomalies	>50%	10-15%
Treatment	Often primary	Often staged
Prognosis	20%-70%	70-90%

female Genitalia

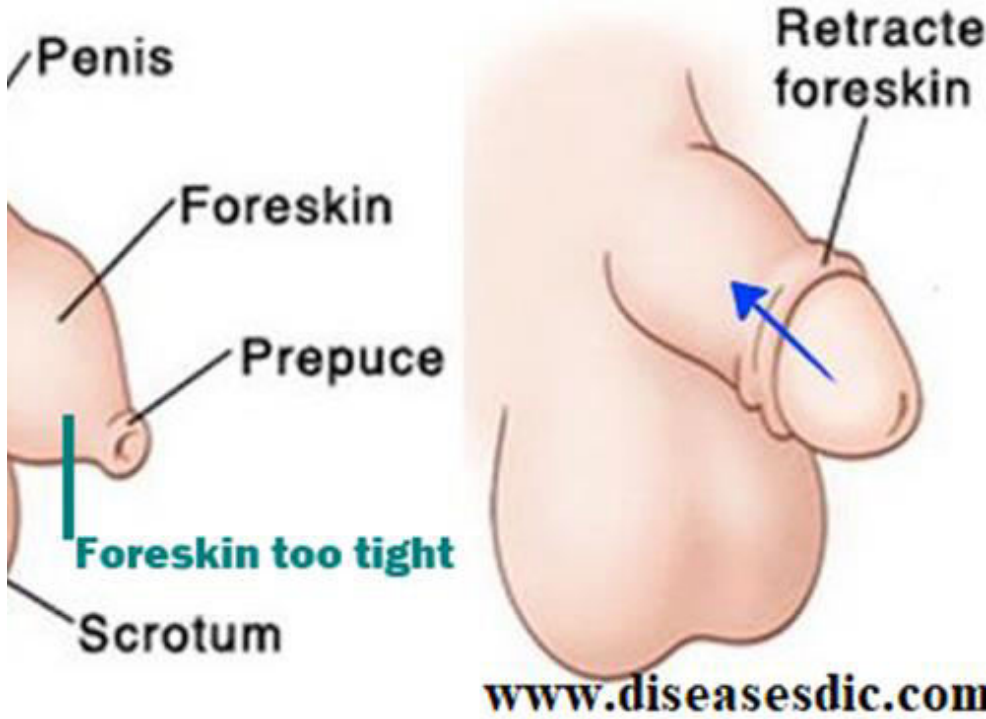
- The size and location of the labia, clitoris, meatus, and vaginal opening should be assessed.
- The labia minora should be separated to detect whether the hymen, which normally has some opening, is imperforate. An imperforate hymen or other causes of vaginal obstruction may result in **hydrometrocolpos** and a lower abdominal mass.
- A whitish vaginal discharge is normal and can persist for up to 2 months.
- In up to 10% of newborns, a hymenal tag is visible just at the vaginal orifice. Its characterized by flesh-colored, smooth surfaced, redundant hymenal tissue that protrudes from superior or inferior portions of the vagina.

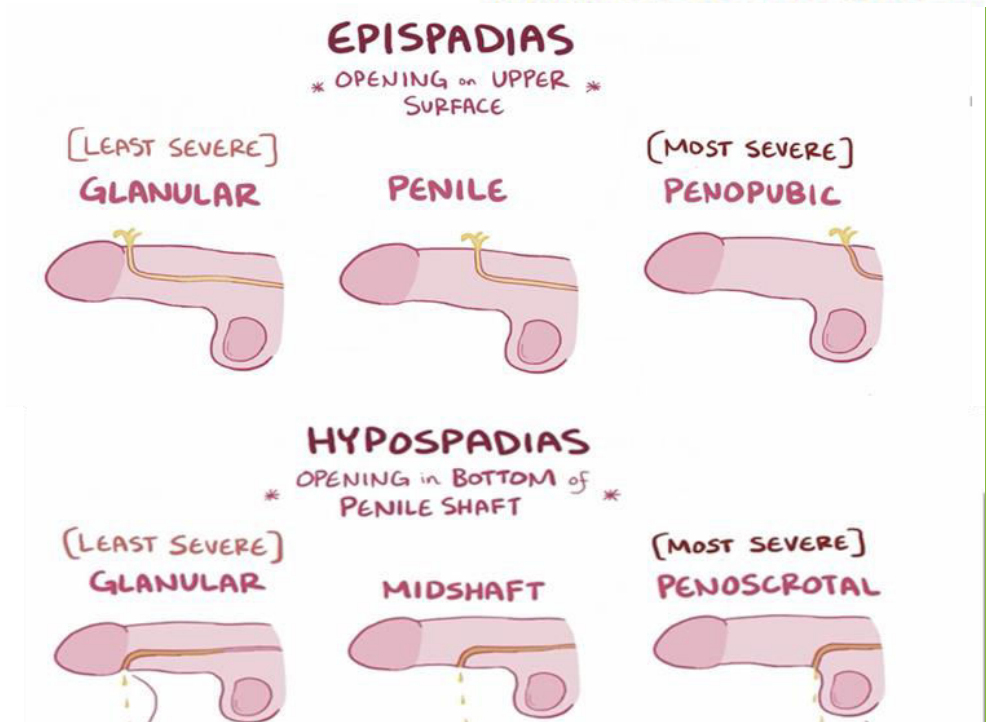


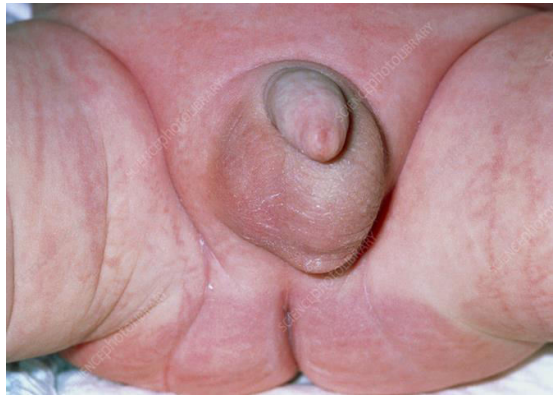


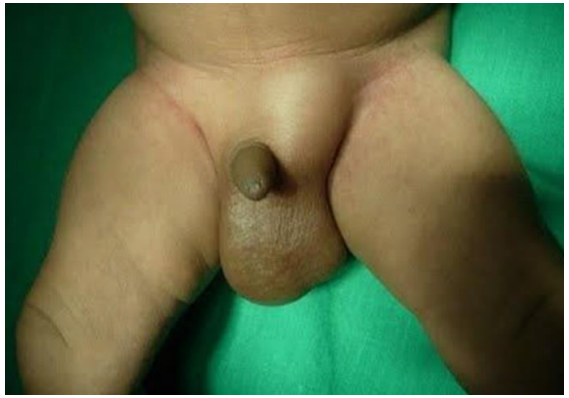
Male genitalia

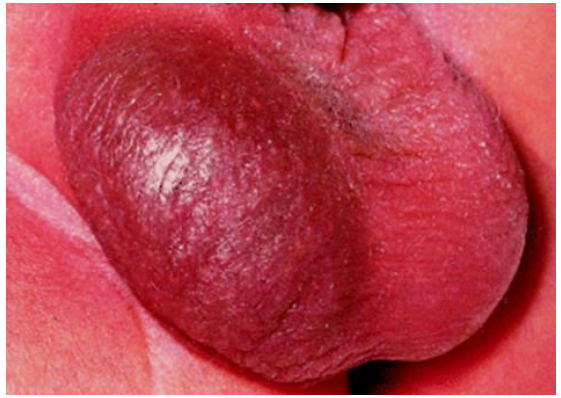
- Testes, size of the penis, appearance of the scrotum, and the position of the urethral opening should be evaluated.
- In term boys, the penis is 3-4 cm in stretched length, and the scrotum is pigmented and has rugae. A stretched penile length < 2cm is abnormal and requires endocrine evaluation.
- The prepuce is normally tight and adherent; it should not be forcibly retracted.
- Hypospadias is relatively common, ranging from a small ventral cleft at the distal end of the shaft to a major ventral defect along the length of the penis.
- Epispadias (urethral opening in the dorsum of the penis) is less common than hypospadias.

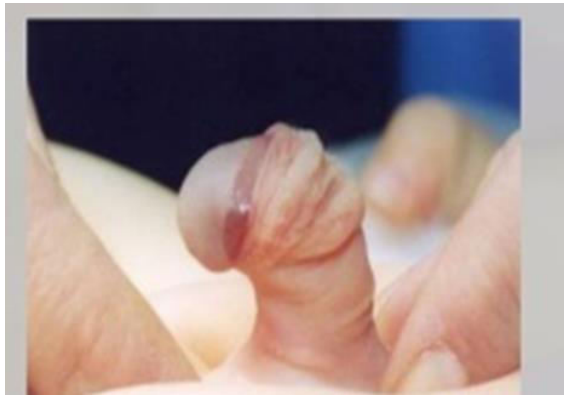




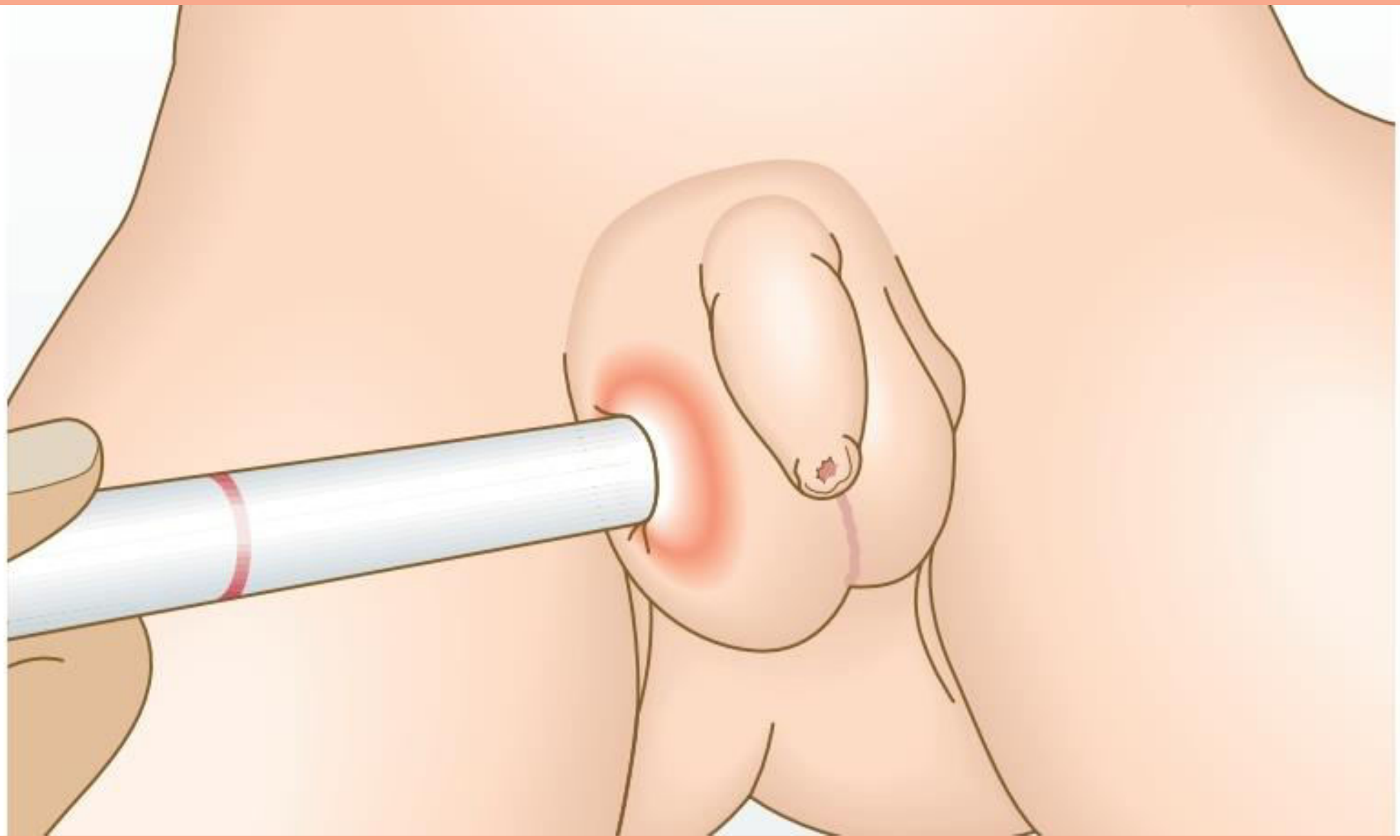








- Chordee, a ventral bend in the penis, often associated with hypospadias and tethering of the foreskin.
- Scrotal hydroceles are common at birth and resolve gradually. If it changes in size or persists it indicates an indirect inguinal hernia.
- Testicular torsion can occur in infancy and manifests as a painful, firm, and enlarged testis with overlying discoloration of the scrotum.

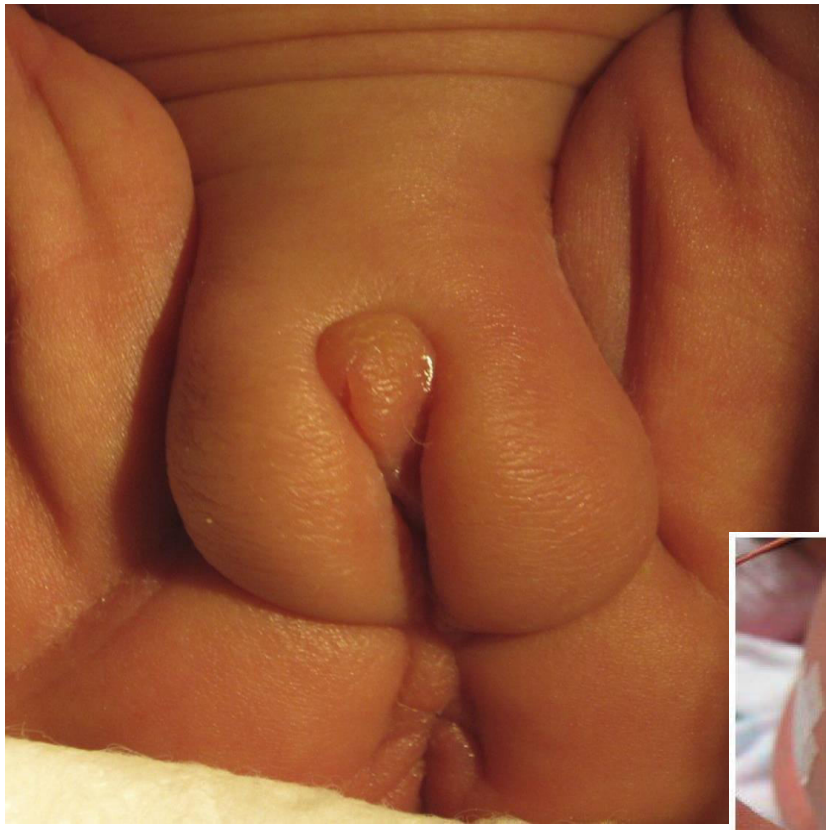


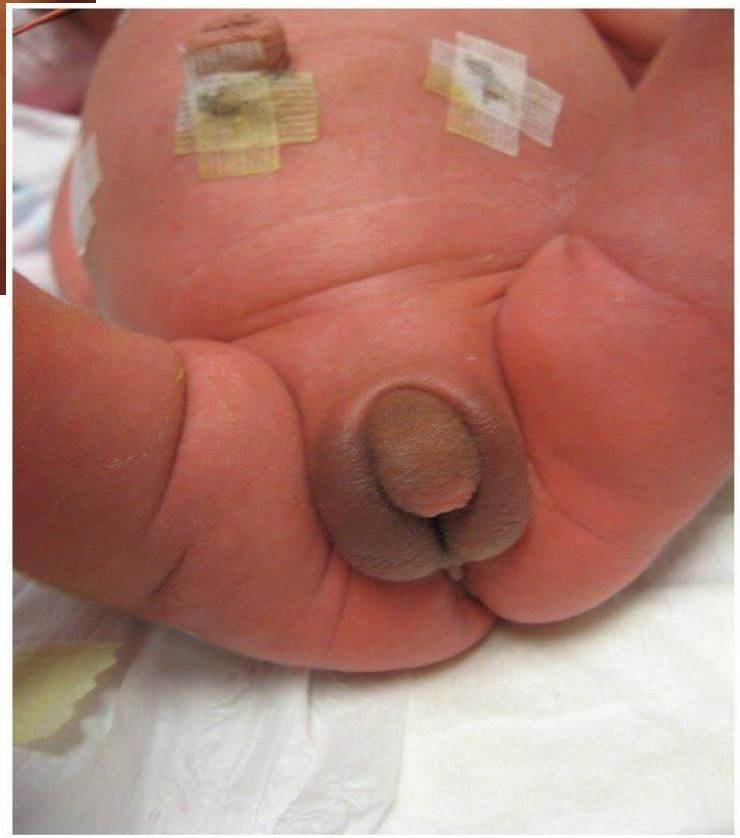
ambiguous genitalia

It requires immediate further investigation.

The difficulty occurs in differentiating between a very enlarged clitoris with pigmented, fused labia vs. a very small penis with extensive hypospadias and a bifid scrotum.

Generally, this is a cause for emergent genetic and endocrine consultations. In particular, CAH in a genotypic female can present as a phenotypic male.





Anus

The anus is inspected for its location and patency.

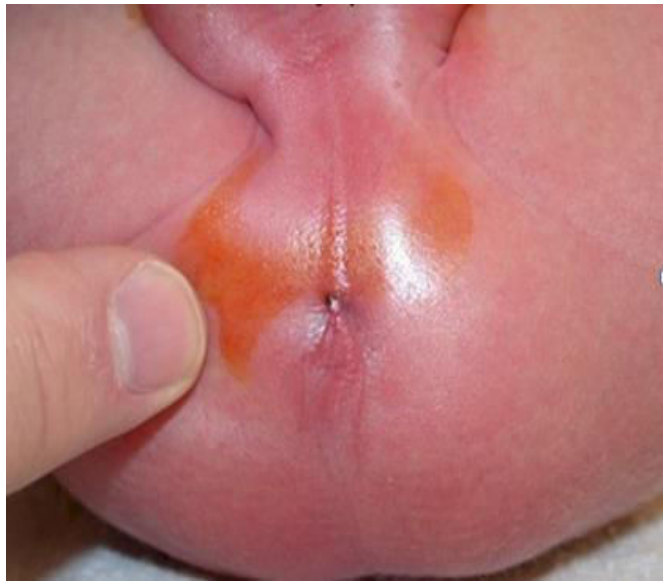
Imperforate anus is one of the most common and important abnormalities to identify. It can be associated with fistula, which opens ventral to the normal anus.

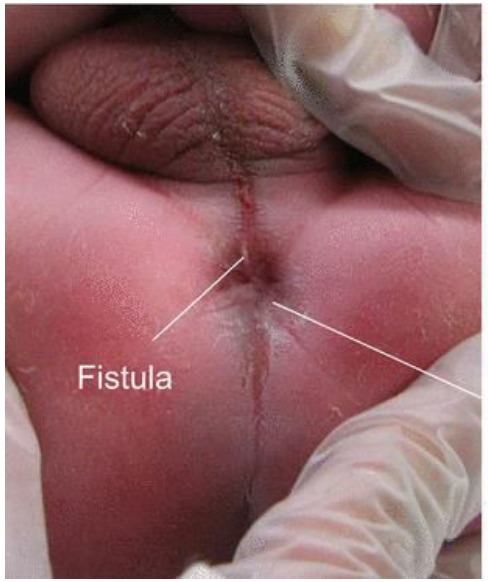
The presence of meconium does not rule out imperforate anus because it can pass through the fistula.

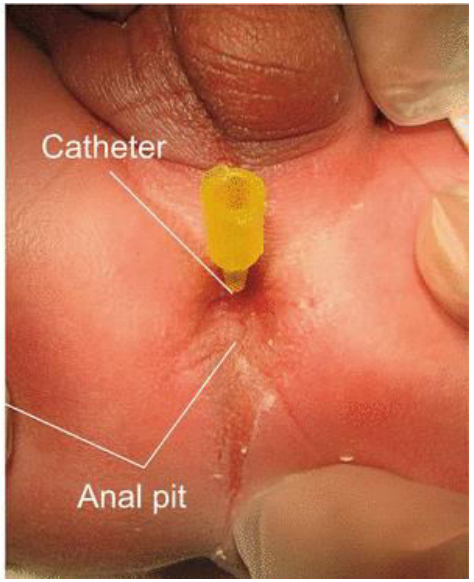
It can be associated with other anomalies such as VACTERL.

Most infants pass meconium within the first 24 hours of birth; 99% within by 48 hours.

Impaction of meconium can lead to intestinal obstruction (meconium ileus) and is often due to cystic fibrosis. Its also seen in small bowel atresia.







Extremities and spinal cord

Extremities

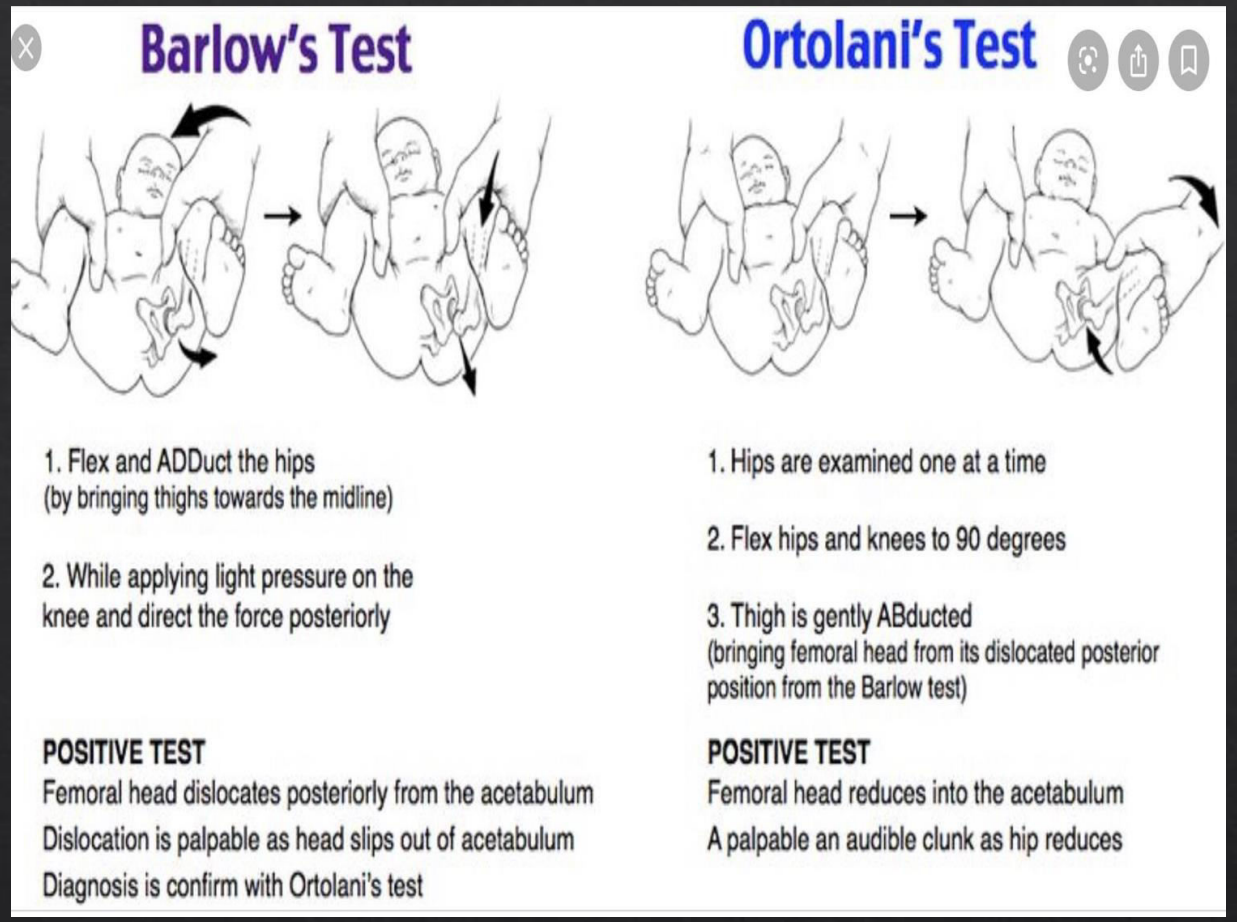
1) Hips

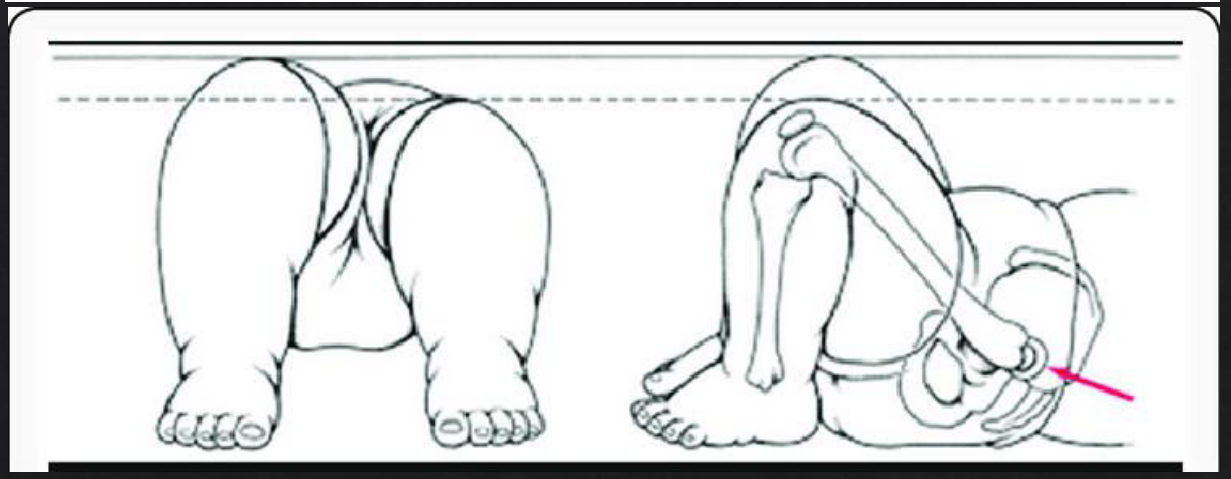
- Newborns often have physiologic laxity of the hip due to maternal estrogen effect and immaturity of the acetabulum during first several weeks; the laxity resolves and the acetabulum proceeds to develop normally.

- If the hips are flexed to 90, the legs normally can be abducted until the knees touch or nearly touch the table. If this is not possible investigate for DDH.

- Specific maneuvers to examine for DDH include :

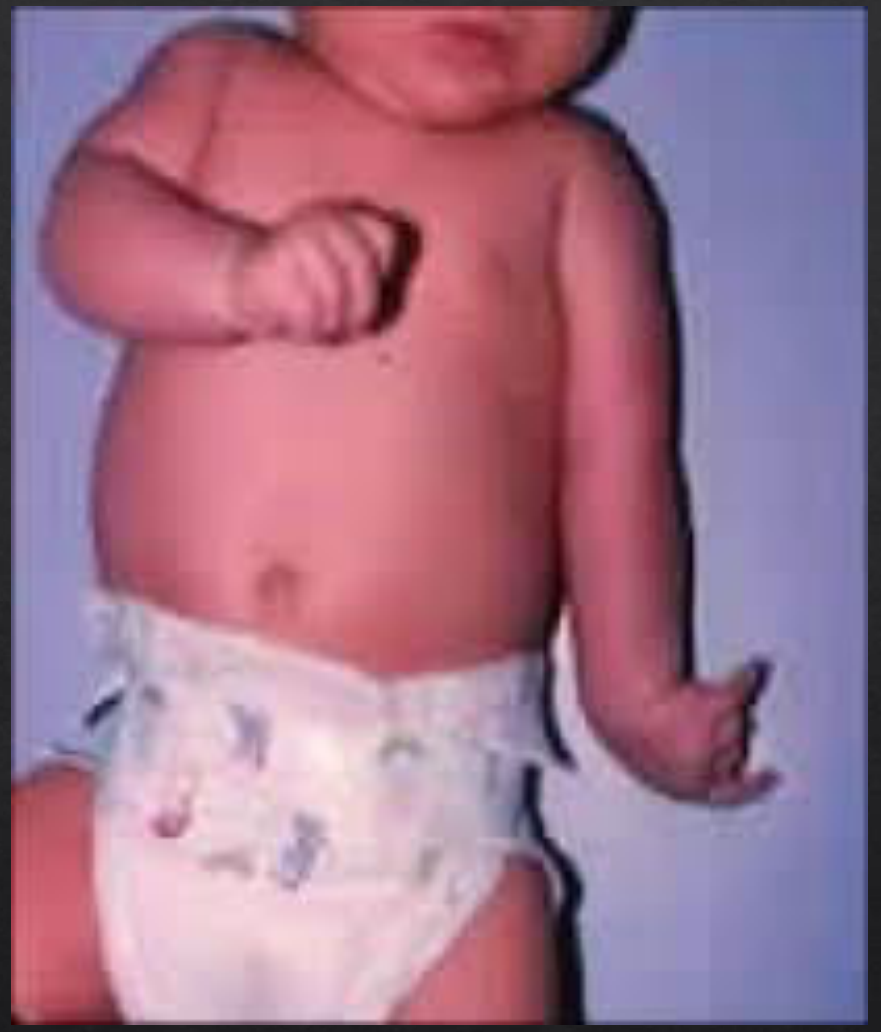
1- Barlow 2- Ortolani 3- Galeazzi





2) Palsies

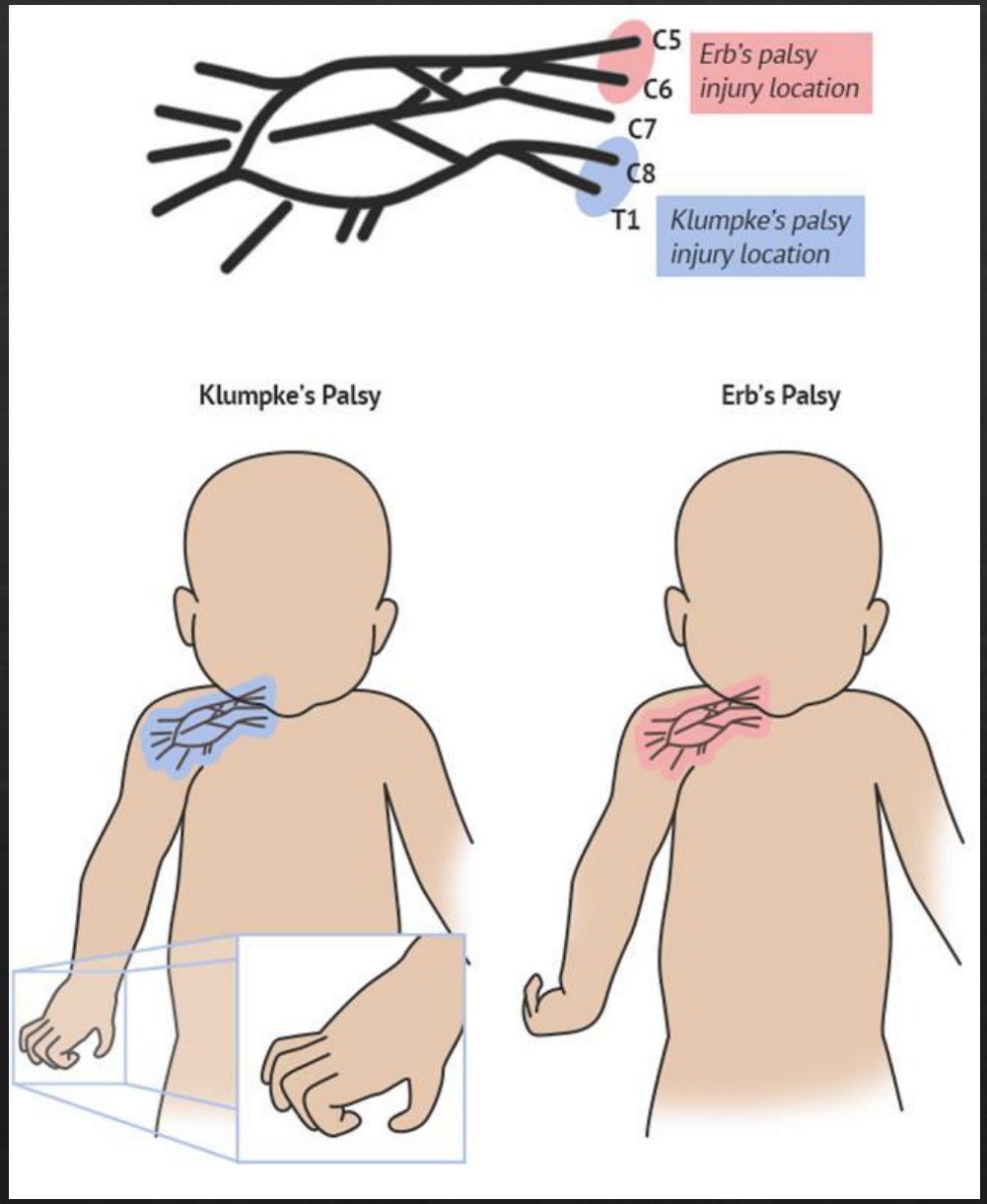
- Erb palsy occur when there is significant lateral traction during delivery, resulting in damage to the upper part of the brachial plexus where C5 and C6 roots; if C7 involved its referred to as Erb palsy plus. The arm is held alongside the body in internal rotation (waiter's tip) position. It accounts for up to 50%. Ipsilateral clavicular fractures are common. Infants are at risk of associated phrenic nerve involvement leading to diaphragmatic paralysis.



Congenital Facial Palsy

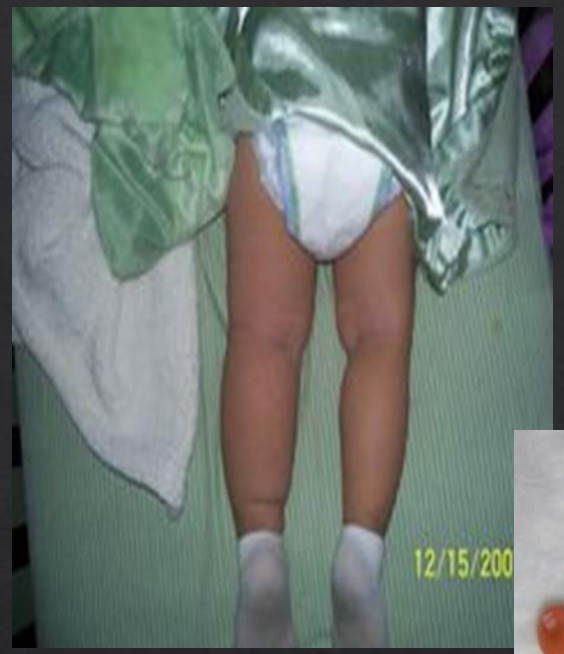
- 80-90% are associated with birth trauma
- 10 -20 % are associated with developmental lesions

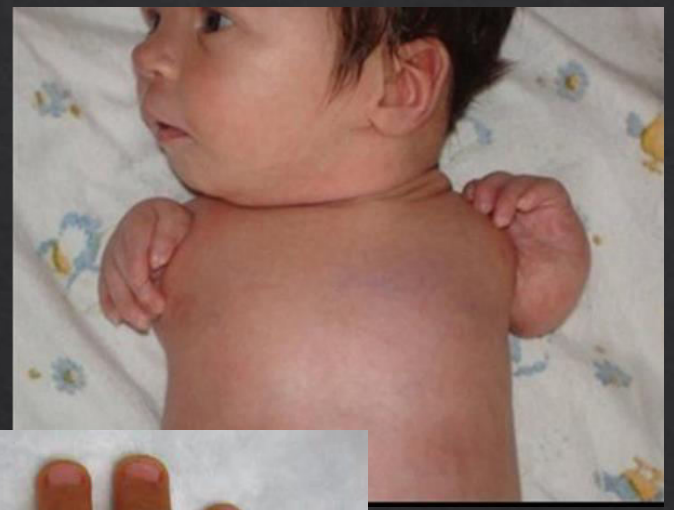
- Klumpke palsy occurs when the lower part of the brachial plexus is damaged. It involves C8 and T1 nerves, resulting in a clawlike posturing of the hand. Injury to the sympathetic fibers of the T1 nerve causes Horner syndrome. Its mostly seen with breech deliveries.

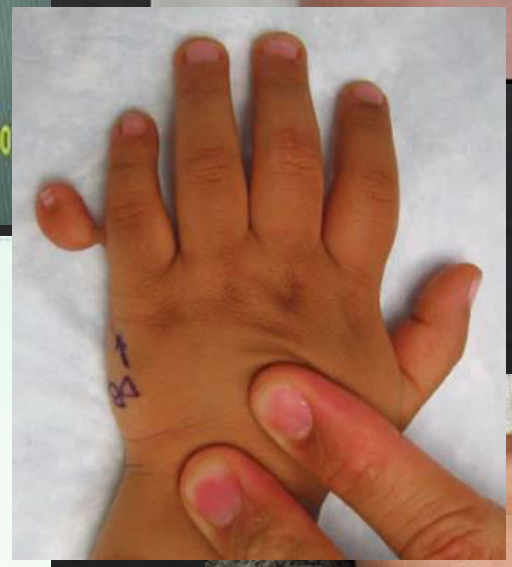


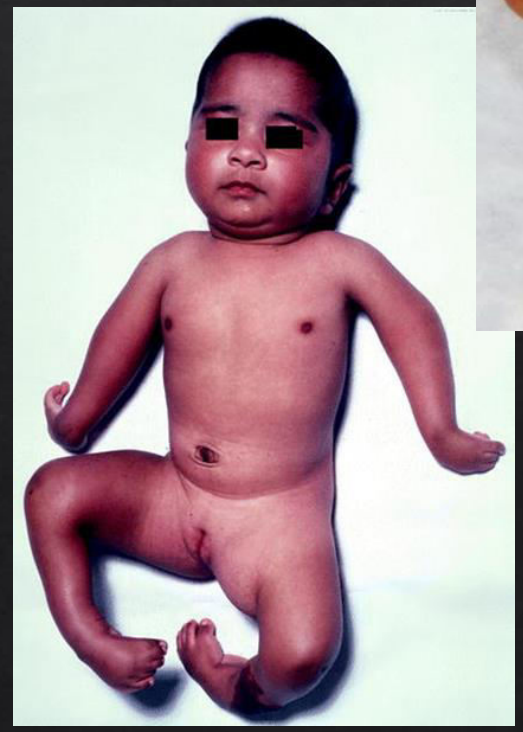
3) Limbs

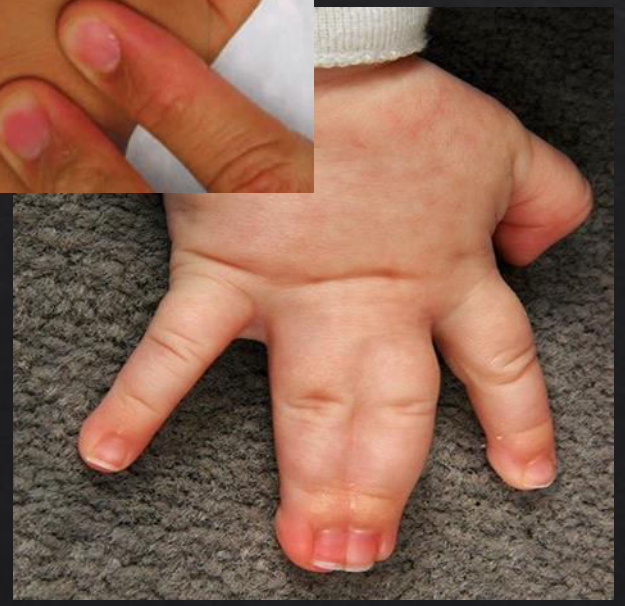
- Hemihypertrophy usually associated with Wilms tumor, hepatoblastoma, and adrenal carcinoma.
- Phocomelia is an abnormal shape of the limb and was once common in infants of mothers who took thalidomide during pregnancy.
- Short limbs also occur with achondroplasia.
- Arthrogryposis multiplex congenita is characterized by severe contractures of multiple joints.
- Syndactyly and polydactyly are common.



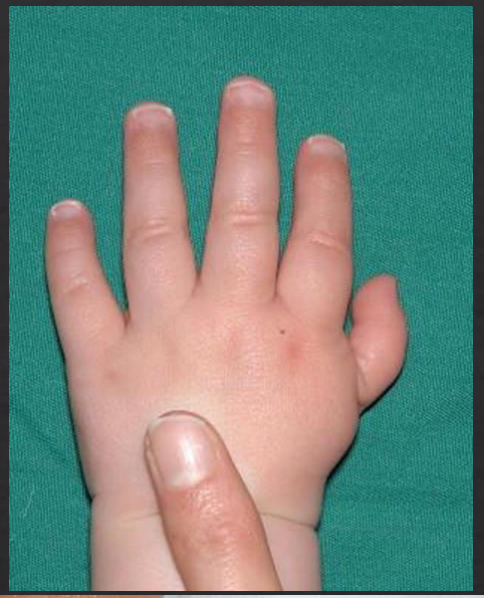


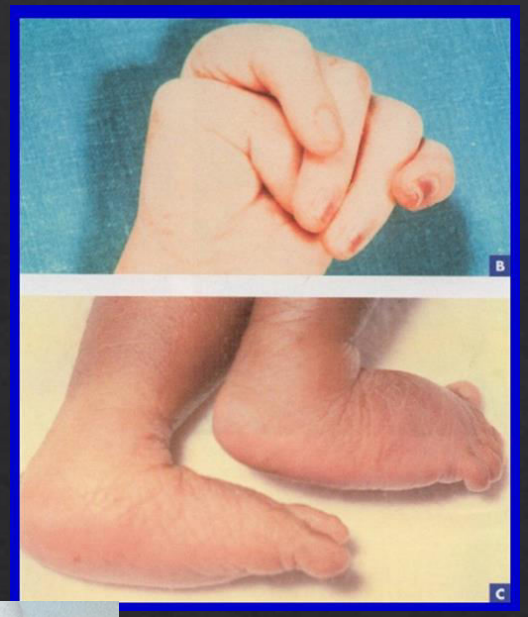


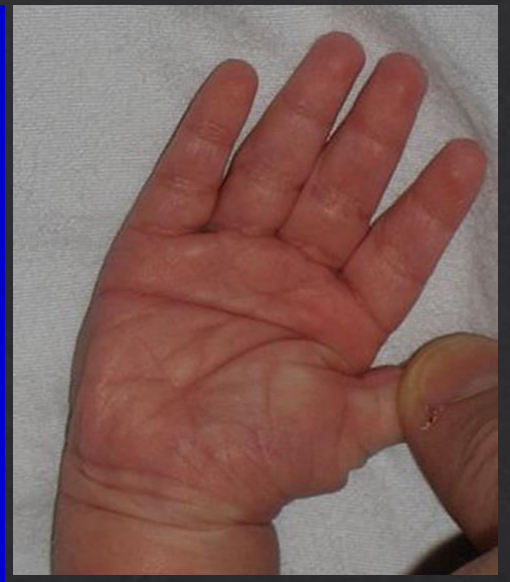


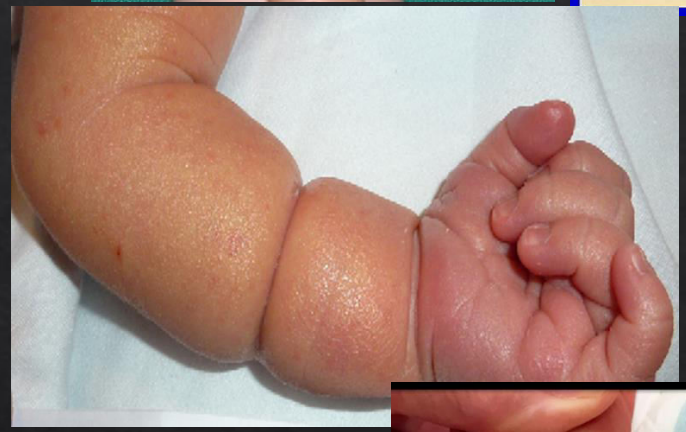


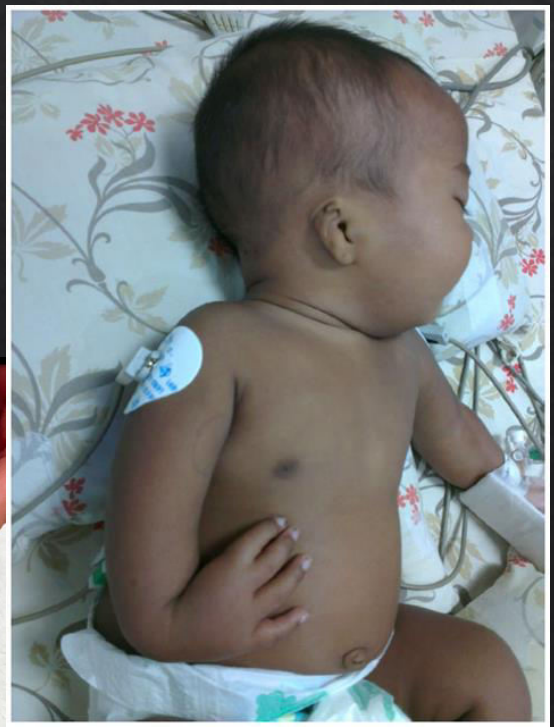
- Clenched hands with overriding index finger and rocker bottom foot are seen in Trisomy 18.
- Simian crease seen in Down syndrome.
- Thumb hypoplasia is a common clinical feature of Fanconi anemia.
- Bilateral absent radii in TAR syndrome.
- Amniotic bands wrap tightly around a limb and result in sharp, deep creases or depressions.









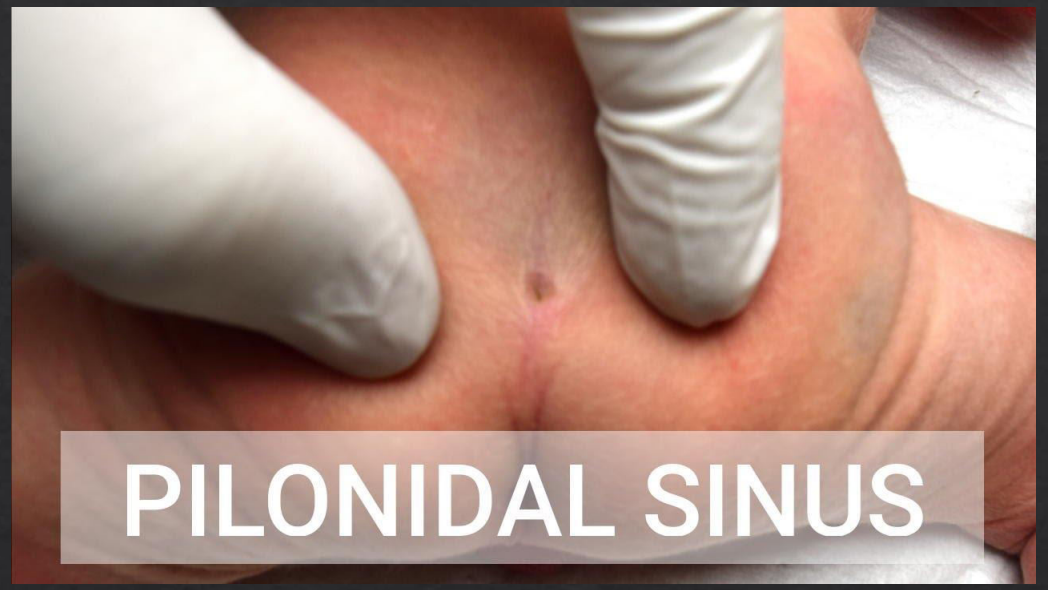


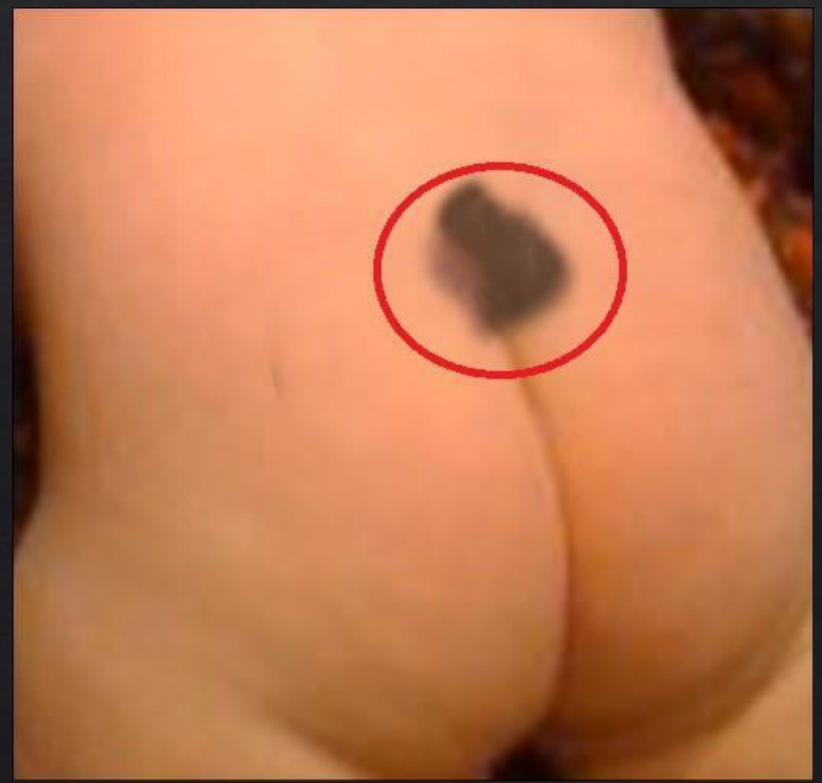
Spinal Column

- Midline abnormalities include a small dimple, tufts of hair, or pilonidal sinuses. Observe these carefully for a seepage of fluid. It can indicate an occult spina bifida or tethered cord.

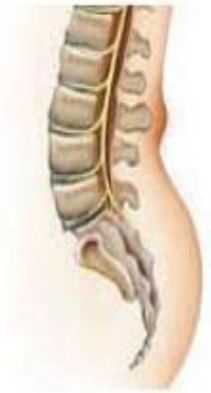
- Neural crest defects include meningoceles, myelomeningoceles, and rachischisis. These defects are common among infants born in the late fall and early winter and far less frequent when women receive folic acid supplementation.

- Spinal tumors at birth are almost always due to teratoma.



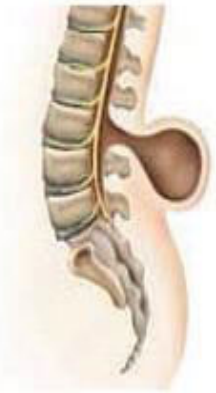


Types of spina bifida



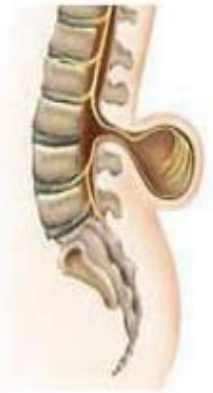
Occulta

Spina bifida occulta is the least serious and most common type. It is usually discovered only on x-rays or scans. Most people never become aware of their condition.



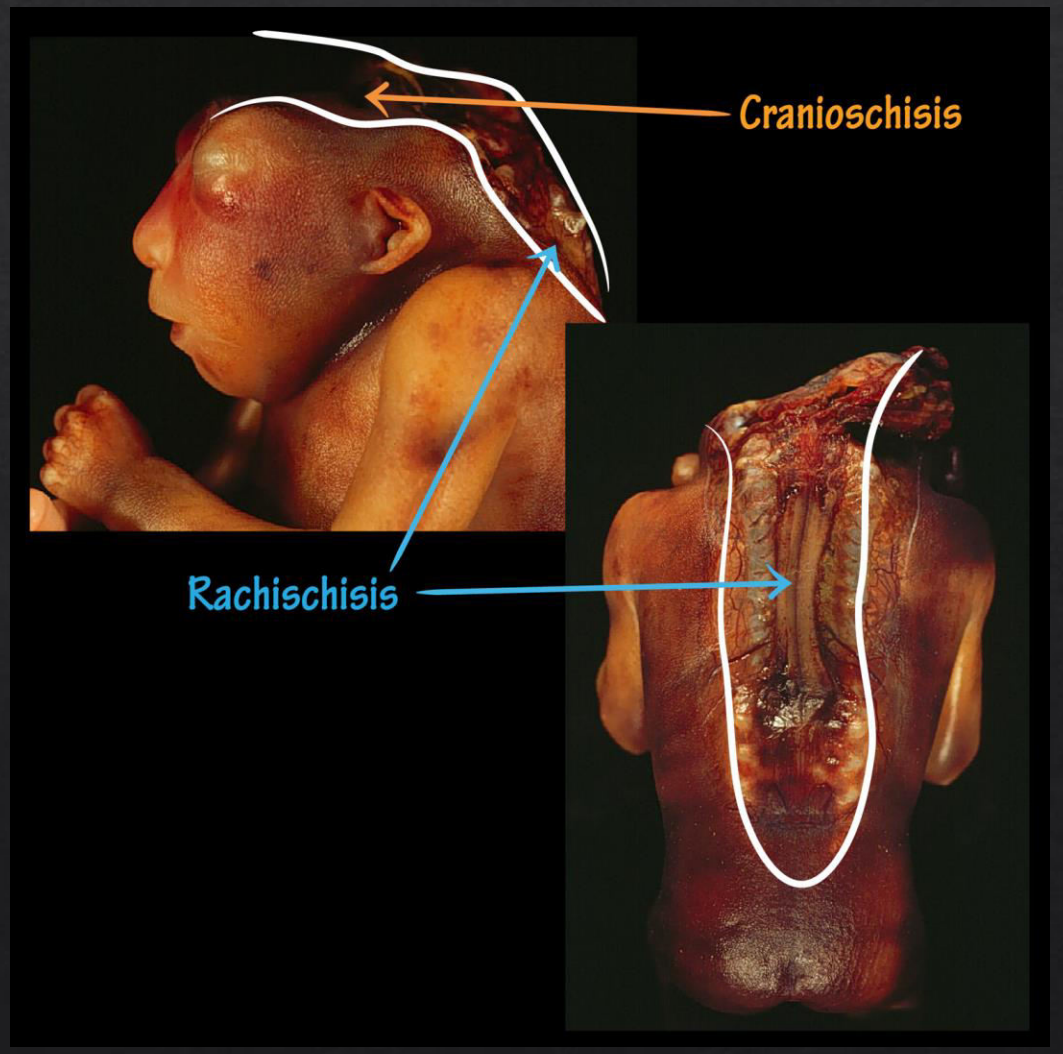
Meningocele

In the next most serious type, meningocele the coverings of the spinal cord (meninges) pass back through the opening in the spine to form a cyst-like swelling.



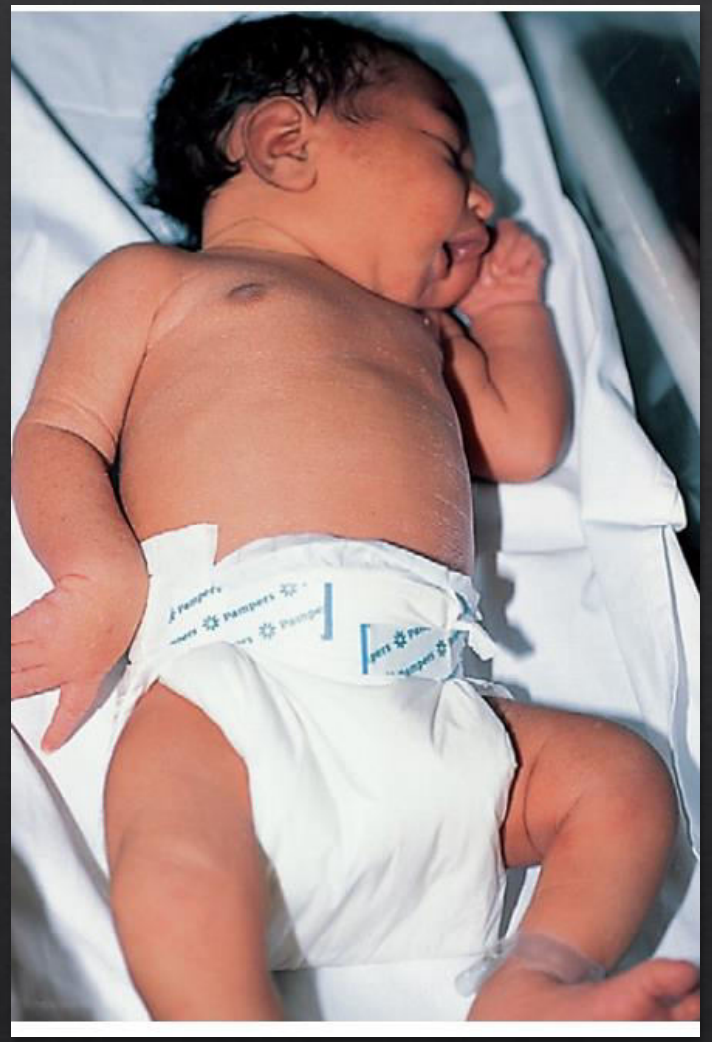
Myelomeningocele

If the spinal cord is enclosed in the cyst the condition is called myelomeningocele. This is the most serious type of spina bifida.



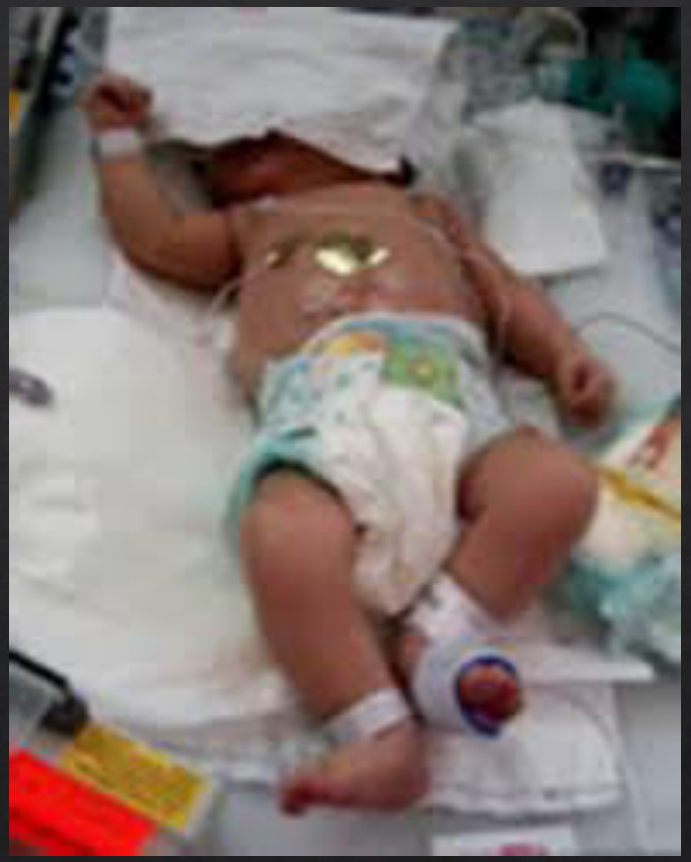
Neurological examination This includes tone, posture, movement and primitive reflexes

- Look for asymmetry in posture and movement and for muscle wasting.
- To assess tone, pick the baby up and note if he is stiff or floppy. Note any difference between each side.
- Power is difficult to assess and depends on the state of arousal. Look for strong symmetrical limb and trunk movements and grasp.
- Tendon reflexes are only of value in assessing infants with neurological or muscular abnormalities.
- Check sensation by seeing whether the baby withdraws from gentle stimuli. Do not inflict painful stimuli or use a pin or needle.
- Check eyesight by carrying the alert baby to a dark corner where she may open her eyes wide. If moved to a bright area she will then screw up her eyes.
- Test hearing by noting the startle response to a sound. Ideally electronic audiological screening should be performed in the newborn period.

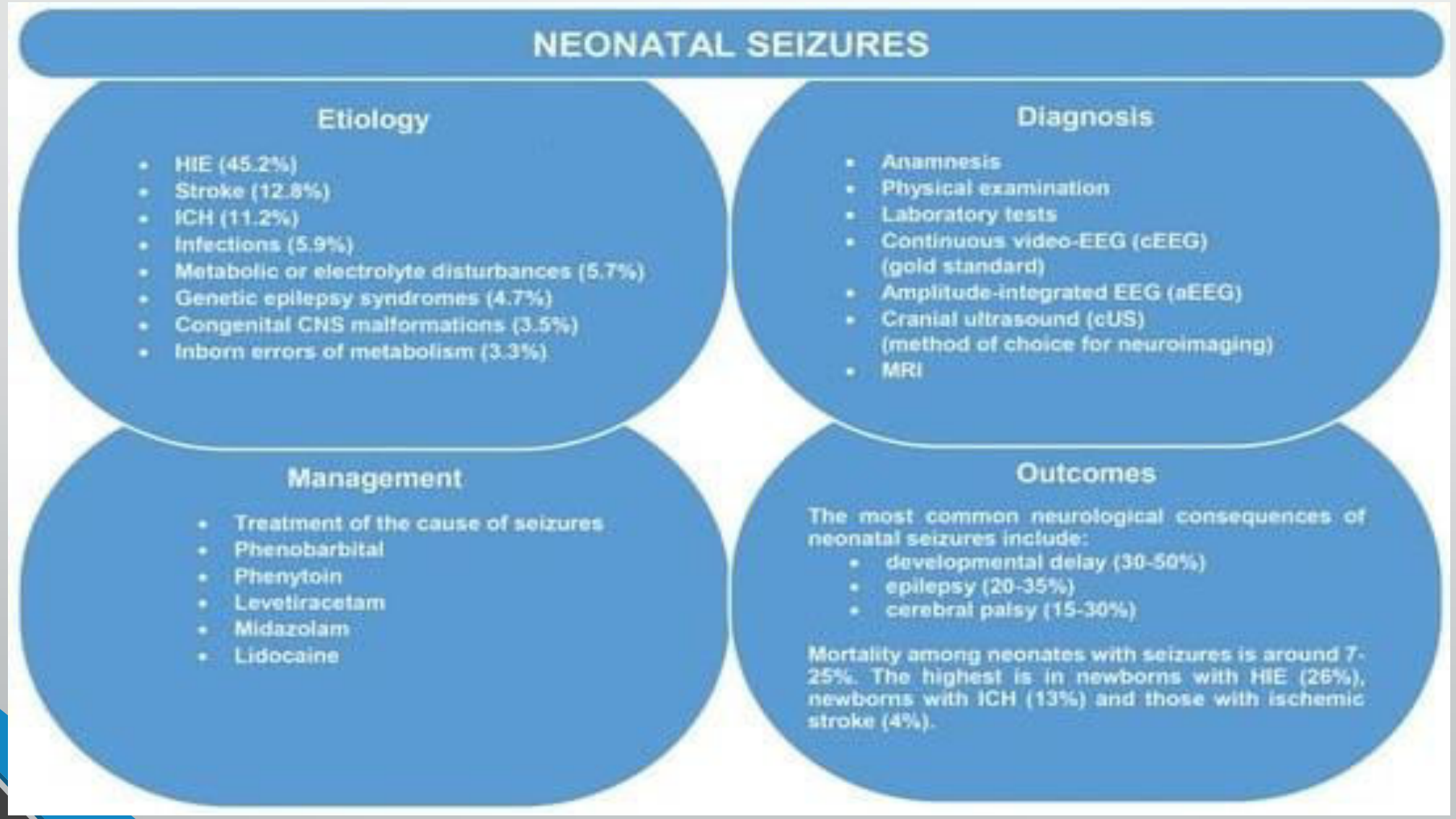


Jitteriness

- is an involuntary movement that is particularly frequent in the newborn
- Its hallmark is tremor
- The pathogenesis is poorly understood
- Jitteriness is often accompanied by other signs of central nervous system excitation, such as hypermotility, hypertonicity, pre-peri-or postnatal events
- It must **be differentiated** from myoclonus and seizure, although they may coexist



Neonatal Seizures



Neonatal Seizures Vs Jitteriness		
Characteristic	Seizures	Jitteriness
Can External stimulus initiate?	No	Yes
Movements	Irregular and Jerky	Symmetrical Fine Tremors
Associated Rise In Heart Rate	Yes	No
Associated Breath Holding	±	No
Can Movements Be Easily Stopped?	No Self Limited Movements	Yes Gently Bending/Holding Lmb Or Making The Baby Suck

Primitive reflexes

Developmental reflexes are also called primitive reflexes. They are mediated at the brainstem or spinal cord level and are generally present at birth They resolve in a fairly set time course with maturation of descending, inhibitory projections from the cerebral cortex to subcortical motor systems. These reflexes may reappear later in life in the presence of degenerative disorders.

Developmental reflexes are abnormal if they are:

- Absent during the neonatal period
- Asymmetric (suggesting hemiplegia or monoplegia)
- Persist beyond the age by which they should have normally disappeared

The developmental reflexes include the following

- ●Moro reflex − Moro reflex is elicited by the sudden dropping of the infant's head in relation to the trunk. It results in abduction and extension of the infant's arms and opening of the hands, followed by flexion . It is present starting at 32 weeks gestation, well-established by 37 weeks gestation, and disappears by three to six months of age .

- ●Stepping reflex is obtained by holding the infant in a vertical position with the feet in contact with a flat surface . This initiates a slow alternate stepping action of flexion and extension of the legs . It is present starting at 32 weeks gestation and disappears by one to two months of age

- ●Grasp reflexes (palmar and plantar) are well established by 32 weeks of age . The palmar grasp reflex is generally present until three months of age in full-term infants, whereas the plantar grasp reflex is generally present until age six months in full-term infants (figure 8). The absence of the plantar grasp reflex in the term newborn has been reported to be associated with an increased risk of developing cerebral palsy .

- ●Asymmetrical tonic neck reflex (ATNR) is characterized by extension of the upper and lower extremities on the side to which the head and neck is turned with flexion of the contralateral upper extremity (fencing posture) . This reflex is due to decreased cerebral cortical inhibition of the labyrinthine-brainstem-spinal cord pathway that subserves limb extension. ATNR that is seen as a resting posture rather than being elicited is never normal. ATNR appears at 35 weeks gestation, is well-established by one month postnatal age, and disappears by three to four months of age in a term infant, concurrent with maturation of descending inhibitory projections from the cerebral cortex .

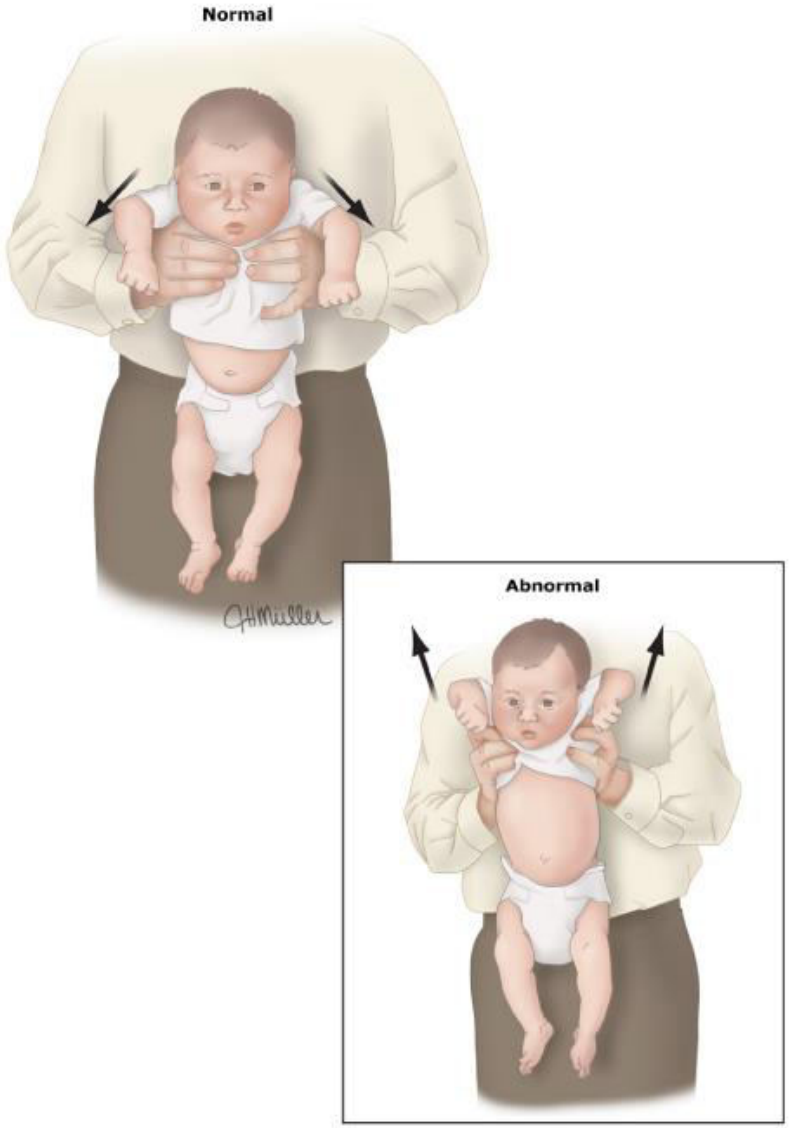
- ●Galant reflex (trunk incurvation) is obtained by placing the baby in ventral suspension and then stroking the paravertebral region from the thorax to the lumbar area. This will elicit movement of the infant's trunk and hips towards the side of the stimulus.

Common developmental reflexes

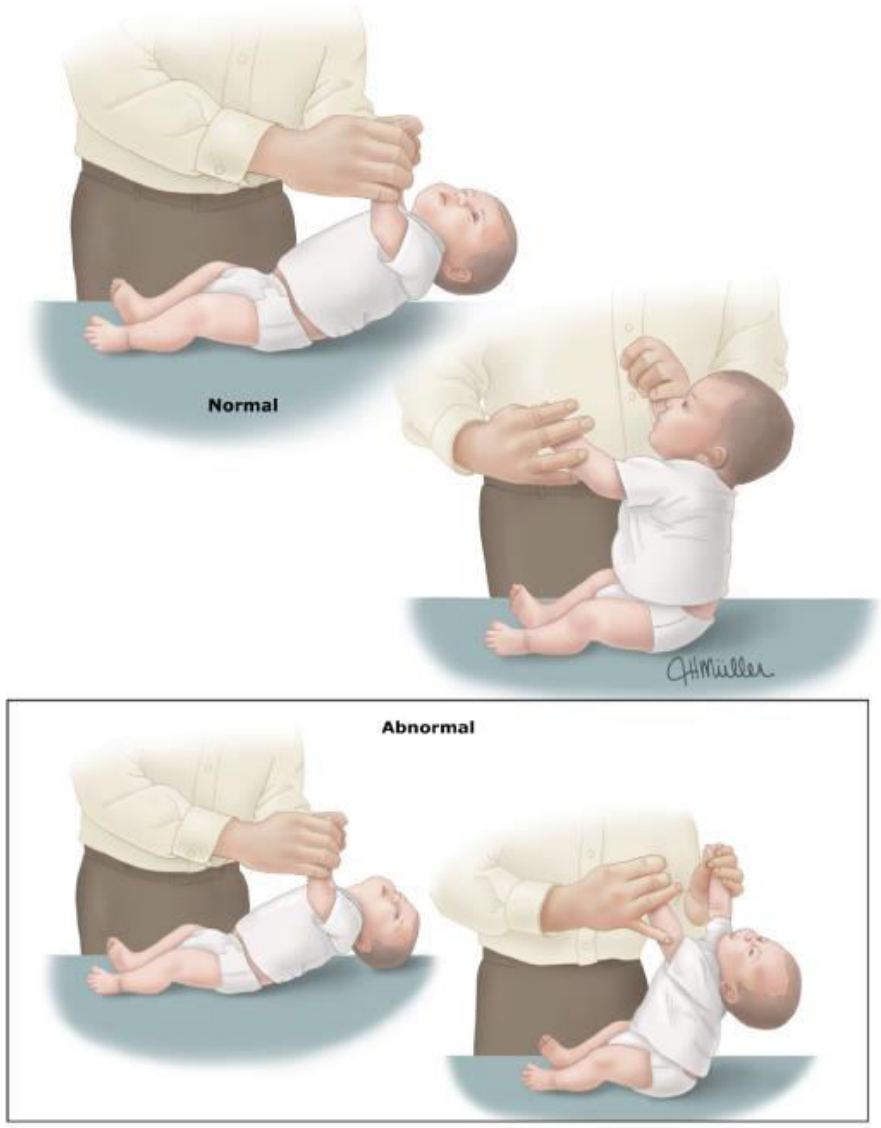
Reflex	Description	Age at appearance	Age at resolution
Moro (startle)	The examiner holds the infant supine in their arms, then drops the infant's head slightly but suddenly. This leads to the infant extending and abducting the arms, with the palms open, and sometimes crying. Alternatively, the examiner may lift the infant's head off the bed by 1 to 2 inches and allow it to gently drop back; this maneuver elicits a similar response.	34 to 36 weeks PCA	5 to 6 months
Asymmetric tonic neck reflex	With the infant relaxed and lying supine, the examiner rotates the head to one side. The infant extends the leg or arm on the side towards which the head has been turned while flexing the arm on the contralateral side (fencing posture).	38 to 40 weeks PCA	1 to 3 months
Trunk incurvation (Galant)	With the infant in a prone position, the examiner strokes or taps along the side of the spine. The infant twitches their hips toward the side of the stimulus.	38 to 40 weeks PCA	6 months
Palmar grasp	The examiner places a finger in the infant's open palm. The infant closes their hand around the finger, tightens the grip if the examiner attempts to withdraw the finger.	38 to 40 weeks PCA	5 to 6 months
Plantar grasp	The examiner places a finger under the infant's toes. The infant flexes the toes downwards to "grasp" the finger.	38 to 40 weeks PCA	9 to 10 months
Rooting	The examiner strokes the infant's cheek. The infant turns the head toward the side that is stroked and makes sucking motions.	38 to 40 weeks PCA	2 to 3 months
Stepping reflex	The infant is held upright and the plantar aspect of the foot and hallux is stimulated by light placing on a surface to reflexively produce a stepping gait.	38 to 40 weeks PCA	2 to 3 months
Parachute	The infant is held upright, back to the examiner. The body is rotated quickly forward (as if falling). The infant reflexively extends the upper extremities towards the ground as if to break a fall.	8 to 9 months of age	Persists throughout life

The stepping response can be obtained in infants greater than 32 weeks conceptional age. It is elicited by holding the infant in a vertical position with his or her feet in contact with a flat surface. This initiates a slow alternate stepping action of flexion and extension of the legs.

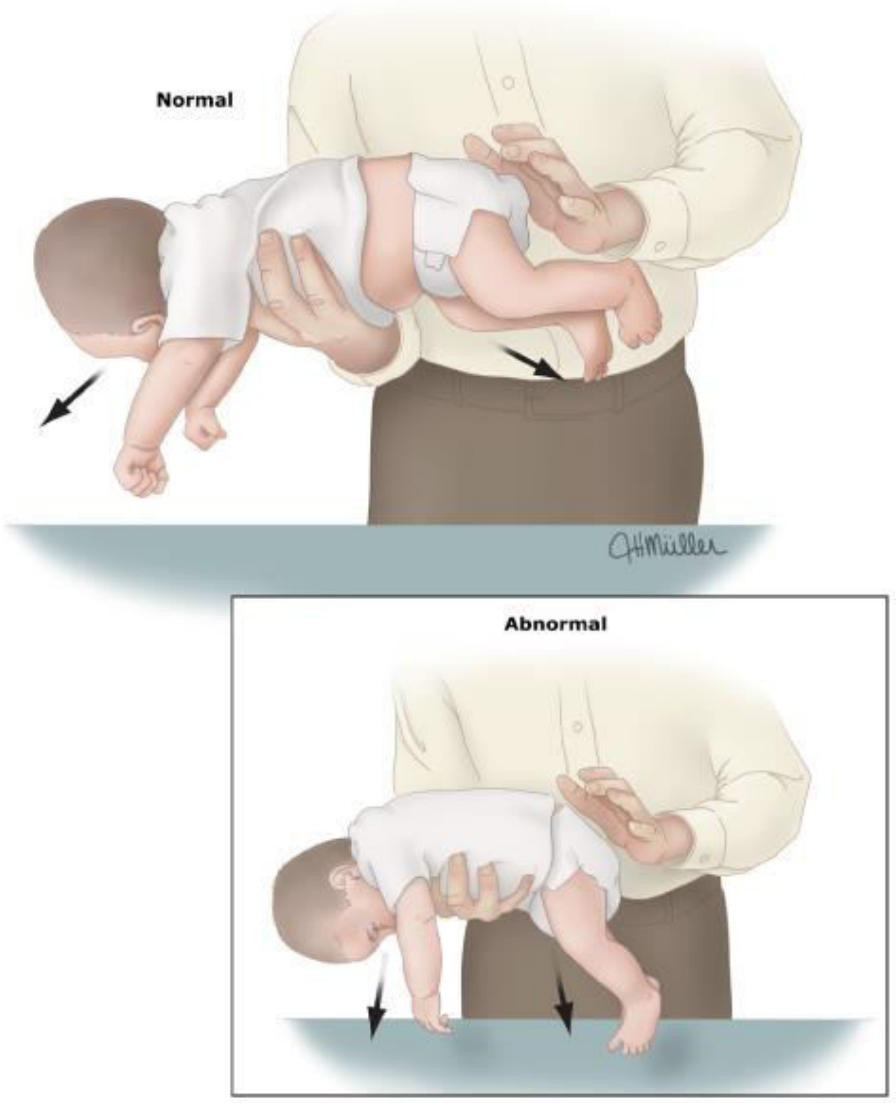
Vertical suspension measures the strength of the neonate's shoulder girdle. The examiner holds the infant in an upright position by placing the hands under the arms and around the chest with the feet unsupported. In infants with decreased tone of the shoulder girdle (shown in the inset of an abnormal response), the infant begins to slip through the examiner's hands and the legs are extended. Vertical suspension is also helpful in evaluating for subtle increases in muscle tone in the lower extremities. In the presence of lower extremity hypertonicity, there may be adduction at the hips combined with hyperextension at the knees and ankles. The lower extremities may appear to cross over each other (scissoring posture).



By 40 weeks conceptional age, the infant has sufficient neck and truncal strength to normally maintain the head in line with the trunk for one to two seconds while being pulled from a supine to sitting position. In infants with hypotonia (shown in the inset), the head lags behind as the infant is pulled from the supine to sitting position and continues to lag when the sitting position is reached.



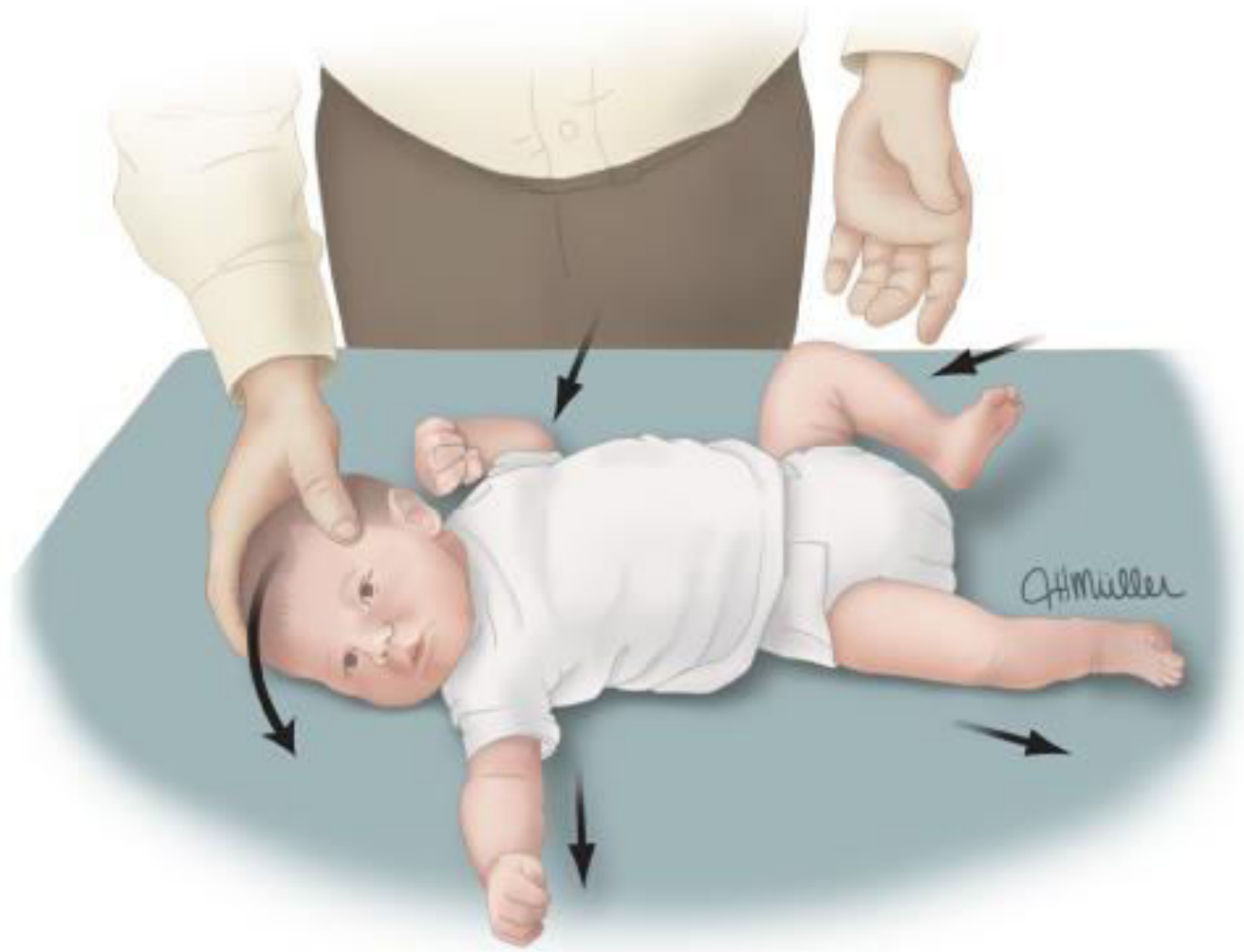
Ventral suspension measures the strength of the infant's trunk and neck. The infant is held in a suspended prone position in the air by placing a hand under the chest. A normal term infant will keep his/her head in the horizontal plane momentarily with flexion of both the upper and lower extremities. An infant with decreased muscle tone will appear limp with extended limbs and a drooping head, as shown in the inset.



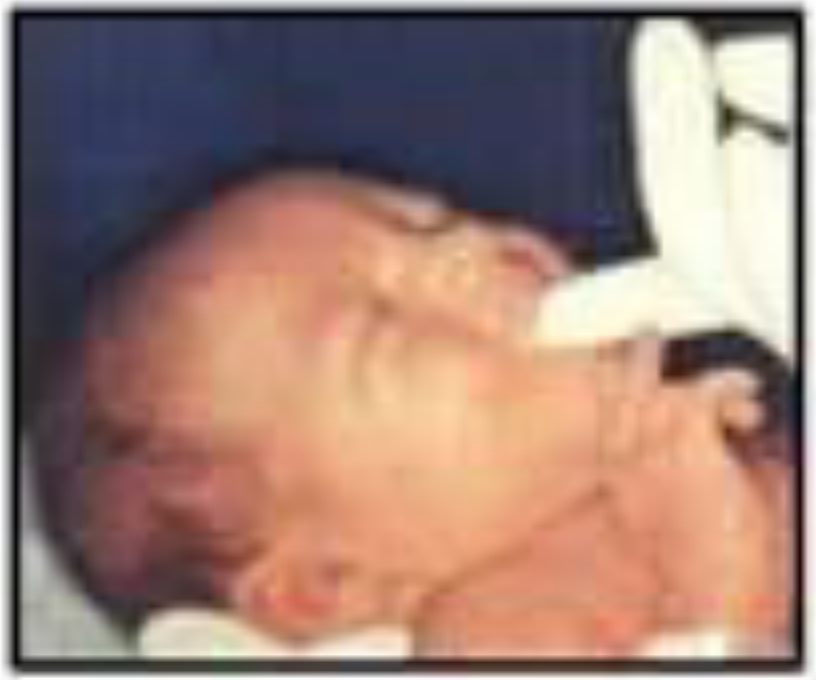
The Moro reflex is present starting at 32 weeks gestation and disappears by three to six months of age. It is elicited by the sudden dropping of the infant's head in relation to the trunk and results in abduction and extension of the infant's arms and opening of the hands, followed by flexion.

The plantar reflex is well established by 32 weeks conceptional age and typically disappears by six months of age. During the normal plantar grasp, the toes plantar flex around the examiner's finger when it is brought across the ball of the foot.

Asymmetrical tonic neck reflex is characterized by extension of the upper and lower extremities on the side to which the head and neck is turned with flexion of the contralateral upper extremity (fencing posture). It appears beginning at 35 weeks gestation, is well established by one month of age, and disappears by three to four months of age in a term infant.



- **Sucking / Swallowing reflex**



- Touching lips or placing something in baby's mouth causes baby to draw liquid into mouth by creating vacuum with lips, cheeks & tongue

- Onset – 28 weeks IU
- Well established – 32-34weeks IU
- Disappears around 4 months

THANK YOU