# Physical Assessment of the Newborn: Part 2

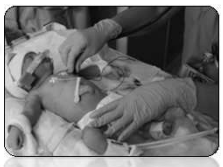
THE S.T.A.B.L.E.® program

Part 1: Gestational Age Assessment

Part 2: Physical Assessment – Growth, Vital Signs, Skin, Head

Part 3: Physical Assessment – Face, Eyes, Ears, Nose, Mouth, Chest and Lungs, Heart, Abdomen, Genitourinary, Musculoskeletal

THE S.T.A.B.L.E. program



Part 2: Physical Assessment – Growth, Vital Signs, Skin, Head

## Maternal and Family History

- Evaluate maternal history
  - Prenatal – complications, possible infections or environmental exposures, medications, substances of abuse
  - Prior pregnancies → spontaneous abortions, stillborns or infant / child deaths
  - Labor / delivery / perinatal complications
- Past medical and family history especially if there are anomalies
  - Familial traits, physical or developmental disorders
- Infant → how illness presented



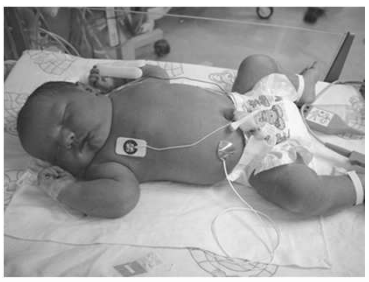
## Principles of Physical Exam

- Gentle and systematic
- Perform hand hygiene (hand sanitizer or wash)
- Wear personal protective equipment as indicated (gloves, mask, gown)
- Perform while infant in quiet state whenever possible
- Use clean equipment
- Keep infant warm, shield eyes from exam light
- Comfort during / after exam
- Change soiled diapers / redress following exam
- Perform hand hygiene after exam



## Principles of Physical Exam

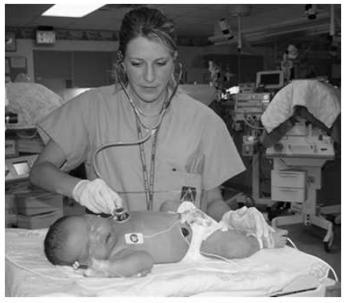
- Observe before touching





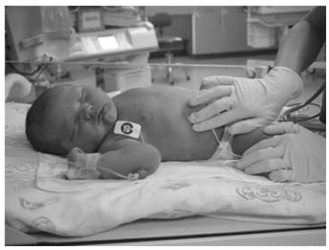
## Principles of Physical Exam

- Observe before touching
- Auscultate before palpation – in quiet environment



## Principles of Physical Exam

- Observe before touching
- Auscultate before palpation – in quiet environment
- Gentle palpation
  - Avoid if acute abdomen
  - Extra care with preterm infants

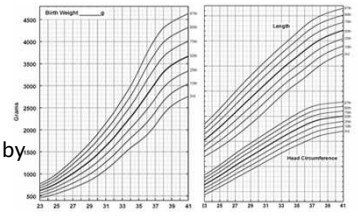




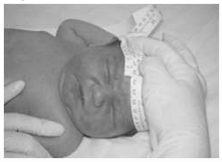
## Growth Assessment

Measurements

- Weight
- Length
- Head circumference
- Plot on growth chart by
  - Sex
  - Gestational age




*Growth charts reproduced with permission from Pediatrics, Olsen et al. Volume 125, p. e214-e244, ©2010 American Academy of Pediatrics.*





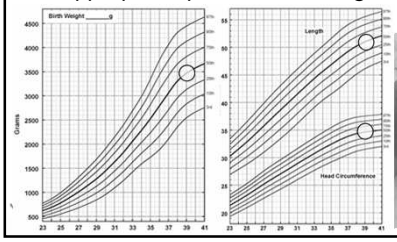
## Growth Assessment

- Fetal development influenced by maternal environment, uteroplacental function, and genetic growth potential
- Under *optimal* circumstances, fetal growth and development is appropriate
  - *Appropriate for Gestational Age (AGA)*
    - Well-nourished appearance



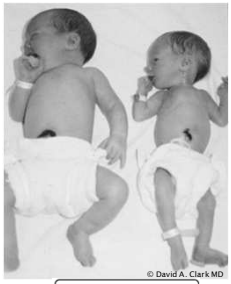
## Growth Assessment

- Fetal development influenced by maternal environment, uteroplacental function, and genetic growth potential
- Under optimal circumstances, fetal growth and development is appropriate
  - *Appropriate for Gestational Age (AGA)*




## Growth Assessment

- Fetal development influenced by maternal environment, uteroplacental function, and genetic growth potential
- Under *suboptimal* circumstances, fetal growth and development is impacted →
  - *Small for Gestational Age (SGA)*
  - *Intrauterine Growth Restriction (IUGR)*



© David A. Clark MD

Discordant twins

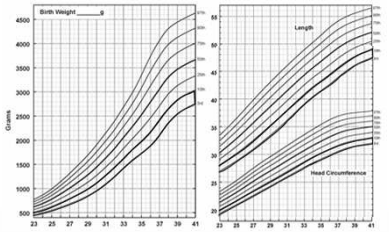


## Growth Assessment

Small for Gestational Age (SGA)

- Symmetric – proportionate decrease in all growth parameters for gestational age → usually defined as < 10th percentile
  - Evaluate for infective, placental, chromosomal or genetic causes

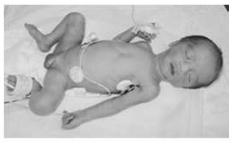
*Trisomy 18*



## Growth Assessment

Intrauterine Growth Restriction (IUGR)

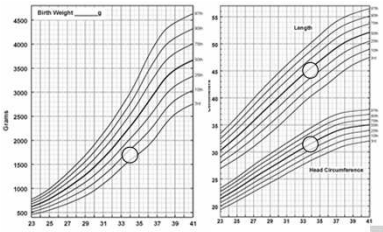
- Altered fetal growth in late gestation when lipid accumulation is greatest and growth is rapid
- Weight low for gestational age → may or may not be < 10th percentile (SGA)
- Variable impact on length
- Relatively less impact on brain growth "head sparing"
- May appear long, wasted and "thin"

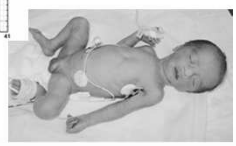




## Growth Assessment

Intrauterine Growth Restriction (IUGR)

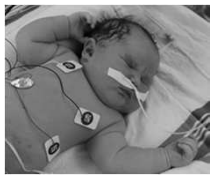


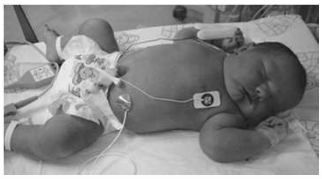



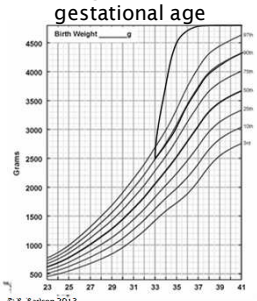


## Growth Assessment

- Large for Gestational Age (LGA)
  - Weight > 90th percentile for gestational age



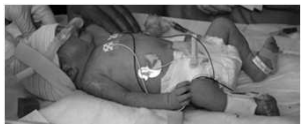




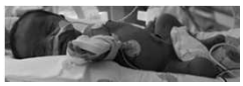



## Gestational Age Terminology

- *Low birth weight* (LBW): < 2500 grams



- *Very low birth weight* (VLBW): < 1500 grams



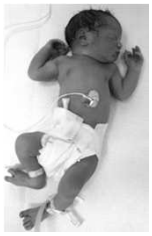
- *Extremely low birth weight* (ELBW): < 1000 grams

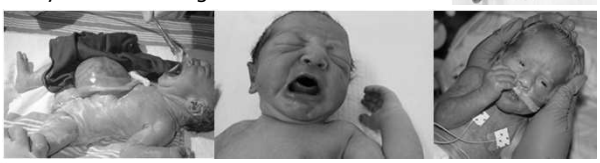


## Neurologic Assessment

Normal

- Active, alert
- Good tone
- Moderate flexion
- Strong cry, symmetric facies
- Symmetric strength and movement





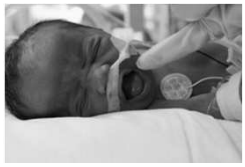


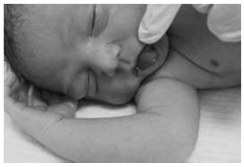
## Neurologic Assessment

Developmental Reflexes

- Root
  - Stroke cheek close to neonate's mouth
  - Head should turn towards stimulus and mouth should open

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 30 weeks | 34 – 36 weeks | 3 – 4 months |



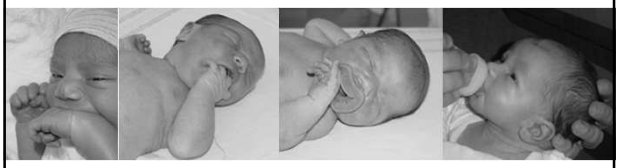


## Neurologic Assessment

Developmental Reflexes

- Suck

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 30 weeks | 34 – 36 weeks | 12 months |





## Neurologic Assessment

Developmental Reflexes

- Palmar grasp
  - Grasp when finger placed into infant's palm on ulnar side
  - Attempts to tighten grasp when finger withdrawn

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 28 – 32 weeks | 32 weeks | 6 months |



## Neurologic Assessment

Developmental Reflexes

- Plantar grasp → press against sole of foot just behind toes
  - Normal → flexion and adduction of all toes

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 25 weeks | 38 weeks | 12 months |

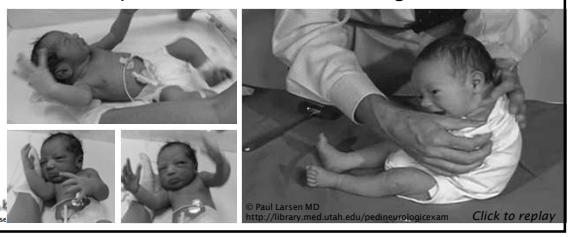



## Neurologic Assessment

Developmental Reflexes

- Moro
  - Arms extend, abduct, hands open
  - Followed by flexion of arms and closing of hands

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 28 – 32 weeks | 37 weeks | 6 months |






## Neurologic Assessment

Developmental Reflexes

- Truncal incurvation (Galant reflex)
  - Pelvis moves toward side of stimulus

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 28 weeks | 40 weeks | 3 – 4 months |




## Neurologic Assessment

Developmental Reflexes

- Stepping
  - Alternating stepping movements when soles of feet touch a flat surface

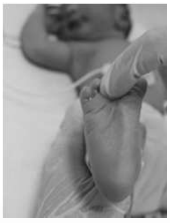
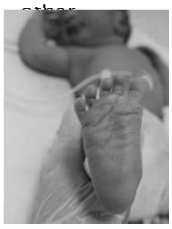
| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 34 – 36 weeks | 38 weeks | 3 – 4 months |

## Neurologic Assessment

Developmental Reflexes

- Babinski → stroke plantar surface from near heel toward ball of foot
  - Normal → dorsal flexion of great toe and spreading of toes

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 34 – 36 weeks | 38 weeks | 12 months |

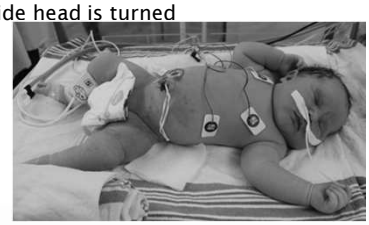
© K. Karlsen 2013

## Neurologic Assessment

Developmental Reflexes

- Tonic neck (fencing position)
  - Place infant supine with head turned to one side
  - Arm extends on side head is turned
  - Flexion of opposite arm

| | *Onset* | *Well Established* | *Disappears At* |
|---|---|---|---|
| | 35 weeks | 1 month | 6 – 7 months |

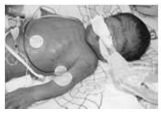
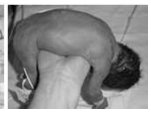


© K. Karlsen 2013

## Neurologic Assessment

Abnormal Findings

- Weak suck / poor feeding
- Weak / shrill cry
- Distressed facies
- Lethargy / irritability
- Hypotonia / hypertonia
- Accentuated or abnormal deep tendon reflexes (DTRs)
- Decreased or absent reflexes
- Seizures
- Coma


© Paul Larsen MD
http://library.med.utah.edu/pedineurologicexam *Click to replay*

© K. Karlsen 2013

## Neurologic Assessment

Neurologic Exam for Therapeutic (Neuroprotective) Hypothermia

Available for download from: *www.stableprogram.org* (instructor or student menu)

NEUROLOGICAL EXAM TO EVALUATE CANDIDACY FOR THERAPEUTIC HYPOTHERMIA

Circle findings for each domain.

Patient is eligible for therapeutic hypothermia if 3 or more domains with findings in columns 2 or 3.

| Domain | 1 | 2 | 3 |
|---|---|---|---|
| Seizures | None | Common: focal or multifocal seizures<br>Note: If the infant is < 6 hours old and meets criteria for seizures, weight, and clinical gestational age criteria and has a witnessed seizure, patient is eligible for therapeutic hypothermia. Seizures in the rest of these exam findings | Uncommon (excluding decerebration)<br>Or<br>Frequent seizures |
| Level of consciousness | Normal<br>Hyperalert | Lethargic<br>Decreased activity in an infant who is aroused and responsive<br>• Can be irritable to external stimuli (i.e., touch) | Stuporous / Comatose<br>Not able to arouse and unresponsive to external stimuli |
| Spontaneous activity when awake or aroused | Active<br>Vigorous, doesn't stay in one position | Less than active, not vigorous | No activity whatsoever |
| Posture | Moving around and does not maintain only one position | Distal flexion, complete extension, or "frog-legged" position | Decerebrate with or without stimulation (all extremities extended) |
| Tone | Normal – resists passive motion<br>Hypertonic, jittery | Hypotonic or floppy, either focal or general | Completely flaccid like a rag doll |
| Primitive reflexes | Suck:<br>Vigorously sucks finger or ET tube<br>Moro – normal:<br>Extension of limbs followed by flexion with stimulus | Suck:<br>Weak<br>Moro:<br>Incomplete | Suck:<br>Completely absent<br>Moro:<br>Completely absent |
| Autonomic system | Pupils:<br>• Normal size (~3+ iris diameter)<br>• Reactive to light<br>Heart rate:<br>Normal, > 100 bpm<br>Respirations:<br>• Regular spontaneous breathing | Pupils:<br>• Constricted (<3 mm estimated), but react to light<br>Heart rate:<br>• Bradycardia (< 100 bpm, variable up to 120 bpm)<br>Respirations:<br>• Periodic, irregular breathing effort | Pupils:<br>• Skew gaze, fixed, dilated, not reactive to light<br>Heart rate:<br>• Variable, inconsistent rate, irregular heart rate, may be bradycardic<br>Respirations:<br>• Completely apneic, requiring positive pressure ventilation (PPV) and/or ET intubation and ventilation |

Neurologic Exam template courtesy of Neonatology Neurology Program at Children's National Medical Center, Washington, D.C. Adapted with permission.

© 2013 The S.T.A.B.L.E. Program – 4th edition – Reproduced with permission.
www.stableprogram.org

© K. Karlsen 2013

## Vital Signs • Temperature

- Normal: 36.5 to 37.5°C (97.7 to 99.5°F)
- Hypothermia*
  - Mild: 36.4 to 36°C (97.6 to 96.8°F)
  - Moderate: 35.9 to 32°C (96.6 to 89.6°F)
  - Severe: < 32°C (89.6°F)
- Hyperthermia: > 37.5°C (99.5°F)

*World Health Organization (1997). *Thermal protection of the newborn: A practical guide*


© K. Karlsen 2013

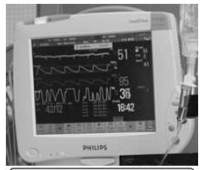
## Vital Signs • Heart Rate

Normal

- 120 to 160 beats per minute (bpm), normal sinus rhythm
- May range 80 to 200 bpm with rest or activity

Bradycardia

- Heart rate < 100 bpm
- Hypoxemia, hypotension, acidosis → depress conduction system
- Rule out heart block



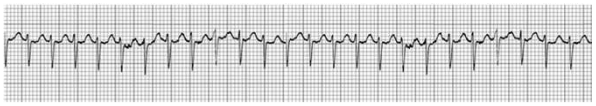
Complete heart block

© K. Karlsen 2013

## Vital Signs • Heart Rate

Tachycardia

- Sustained heart rate > 180 bpm at rest
  - May indicate shock, poor cardiac output and / or congestive heart failure
  - Rule out arrhythmias or other causes of tachycardia
- If > 220 bpm, consider supraventricular tachycardia (SVT)

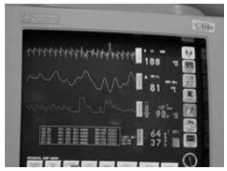




## Vital Signs • Heart Rate

Cardiac Output

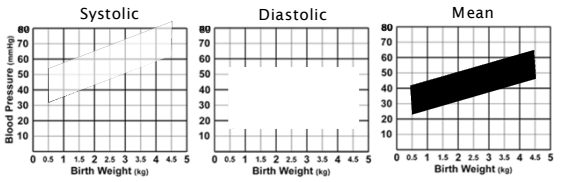
- Heart rate x stroke volume = cardiac output
- Neonatal myocardium poorly compliant → limited capacity to ↑ stroke volume
  - To ↑ cardiac output, heart rate will increase → *tachycardia* may be a sign of poor cardiac output





## Vital Signs • Blood Pressure

- Measure when calm / use correct cuff size
  - Undersized → overestimates BP
  - Oversized → underestimates BP
- Evaluate systolic, diastolic and mean blood pressure

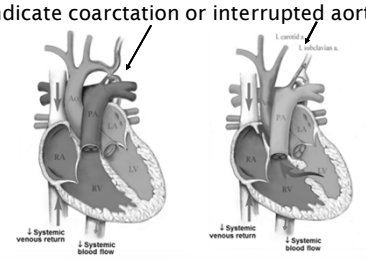



*Graphs adapted with permission from: Versmold, et al. (1981) Pediatrics, 67(5).*



## Vital Signs • Blood Pressure

- Compare right arm BP with leg BP
- Normal → leg slightly higher than arm
- Abnormal → arm 15 mmHg higher than leg
  - May indicate coarctation or interrupted aortic arch



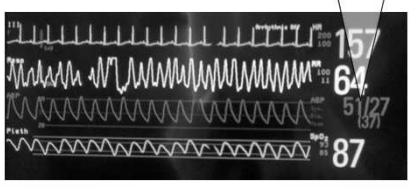



## Vital Signs • Blood Pressure

Evaluate Pulse Pressure

- To calculate → systolic minus diastolic
- Normal
  - Term: 25 to 30 mmHg
  - Preterm: 15 to 25 mmHg

Example: 51 – 27 = 24
Pulse pressure = 24 mmHg

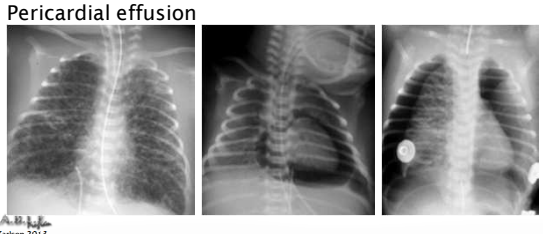





## Vital Signs • Blood Pressure

Narrow (Low) Pulse Pressure

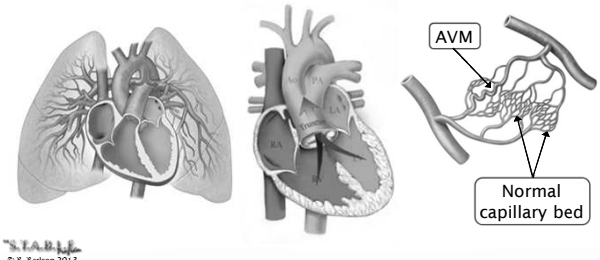
- Vasoconstriction, heart failure (low cardiac output)
- Compression from pneumopericardium
- Tension pneumothorax
- Pericardial effusion



## Vital Signs • Blood Pressure

Wide (High) Pulse Pressure

- Large aortic runoff lesion → patent ductus arteriosus, truncus arteriosus, arteriovenous malformation (AVM)

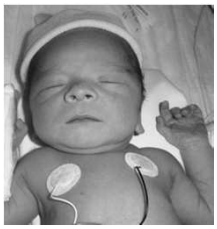





## Vital Signs • Respiratory Rate

Normal

- 30 – 60 breaths per minute
- Easy effort
  - Without nasal flaring, grunting, or retractions



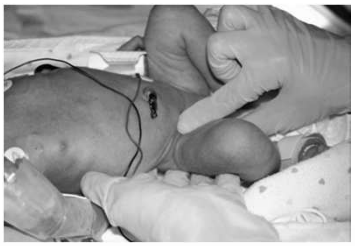
Abnormal

- > 60 breaths per minute
- < 30 breaths per minute if associated with other signs of respiratory distress
  - With labored breathing → sign of exhaustion
  - ! Gasping respirations → ominous sign of impending cardiorespiratory arrest



## Pulses • Normal Findings

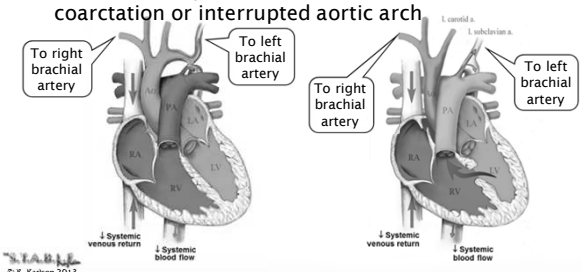
- Easy to feel
- Brachial and femoral pulses equal in strength
- Pedal pulses palpable
- All pulses equal right to left side





## Pulses • Abnormal Findings

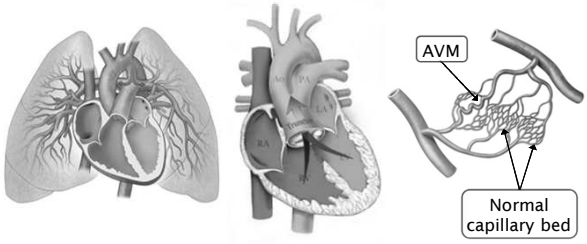
- Strength → pulses weak or absent
- Compare brachial to femoral
  - Brachial stronger than femoral → consider coarctation or interrupted aortic arch






## Pulses • Abnormal Findings

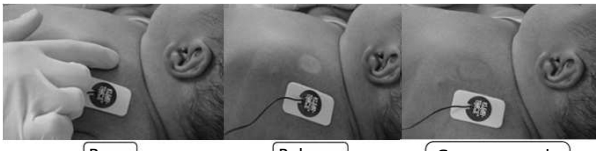
- Bounding → evaluate for *aortic run-off lesion*
  - Patent ductus arteriosus, truncus arteriosus, large arteriovenous malformation (AVM)





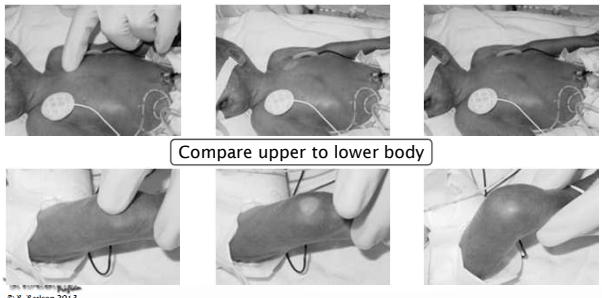

## Skin Perfusion

- Perfusion reflects cardiac output
- Normal capillary refill time (CRT) ≤ 3 seconds



## Skin Perfusion

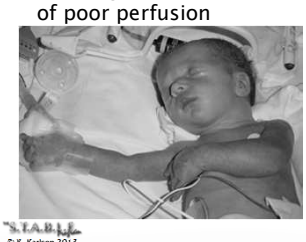
- Perfusion reflects cardiac output
- Normal capillary refill time (CRT) ≤ 3 seconds






## Skin Perfusion • Abnormal Findings

- Prolonged capillary refill time (> 3 seconds)
- Pallor
- Cool extremities
- Mottling → abnormal if associated with other signs of poor perfusion





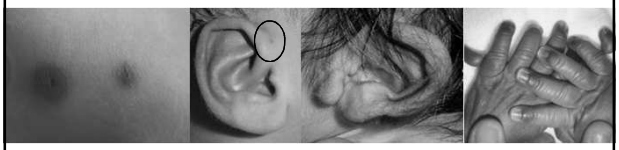

## Congenital Anomalies • Definitions

- Congenital anomaly → internal or external structural defect identifiable at birth ("birth defect")
- Incidence: 2 to 3 % of liveborn infants
  - Minor
  - Major
- Determine if the anomaly represents malformation, deformation, or disruption of normal development



## Congenital Anomalies • Definitions

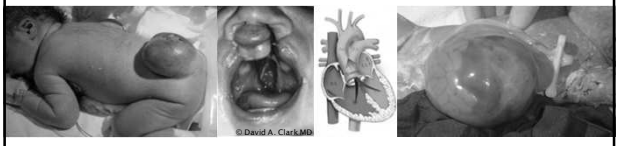
- Minor → cosmetic implications → no impact on life expectancy
  - Examples: supernumerary (accessory) nipple, preauricular skin tag, ear pits, accessory digit
  - ≥ 3 minor defects → ↑ risk for major malformation





## Congenital Anomalies • Definitions

- Major → functional implications → may impact life expectancy
  - Examples: myelomeningocele, cleft lip/palate, cardiac malformation, omphalocele
- Determine if the anomaly represents malformation, deformation, or disruption of normal development






## Congenital Anomalies • Definitions

| Terminology | Definition | Example |
|---|---|---|
| *Malformation* | Abnormal morphogenesis of underlying tissue (organ or region of body) → usually by 8th week of gestation; genetic, chromosomal, or teratogenic factors | • Structural cardiac disease<br>• Renal agenesis<br>• Intrauterine viral infection |
| *Deformation* | Alteration of extrinsically normal musculoskeletal tissue secondary to aberrant mechanical forces, intrauterine constraint<br>Occurs after organogenesis<br>May be reversible after birth | • Clubfoot<br>• Breech → head molding<br>• Hip dislocation |
| *Disruption* | Breakdown of normally formed tissue → affects a body part, or may impact organs | • Amniotic bands<br>• Intestinal atresia<br>• Gastroschisis |

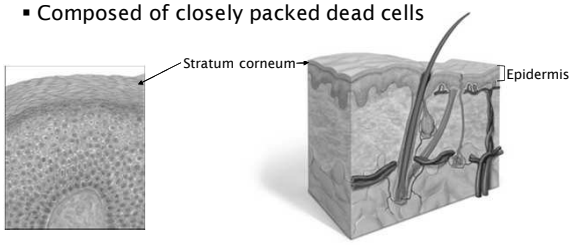
## Congenital Anomalies • Definitions

| Terminology | Definition | Example |
|---|---|---|
| *Sequence* | Recognizable pattern of anomalies → occurs when a single problem in morphogenesis cascades | Pierre Robin sequence (see part 3) |
| *Association* | ≥ 2 congenital anomalies occurring more often than expected by chance alone | VATER or VACTERL (see part 3) |
| | Nonrandom occurrence of multiple malformation → no specific etiology yet identified | |
| *Syndrome* | Recognized pattern of anomalies with a specific, usually heritable cause, similar natural history, known recurrence risk | Down Syndrome (Trisomy 21) |



## Skin • Maturation

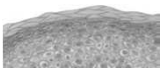
- Skin → largest organ in the body
- Epidermis → outermost layer of the skin
- Stratum corneum → outer layer of the epidermis
  - Composed of closely packed dead cells

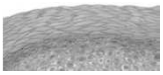


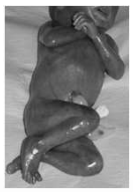



## Skin • Maturation

- Stratum corneum → outer layer of the epidermis
  - 22 weeks: begins to develop
  - 28 to 30 weeks: a few cell layers thick
  - 32 to 34 weeks: begins to provide some protection
  - By term: 10 to 20 cell layers thick
- Before epidermis and stratum corneum develop, skin is gelatinous, transparent and thin



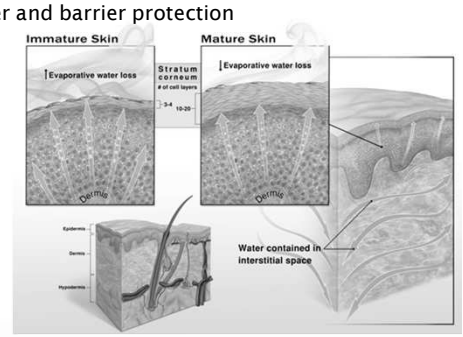






## Skin • Maturation

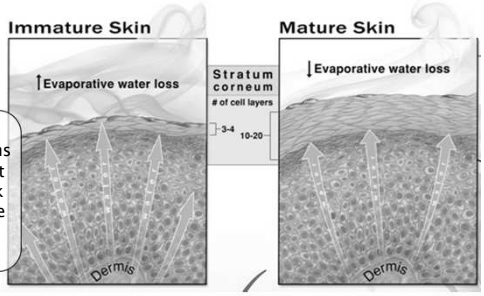
- Stratum corneum → primary function: conservation of body water and barrier protection






## Skin • Maturation

- Stratum corneum → primary function: conservation of body water and barrier protection



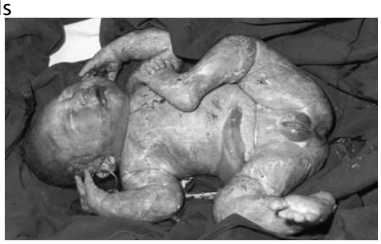

! Infants < 1000 grams (ELBW) are at greatest risk for excessive evaporative water loss



## Skin • Maturation

Vernix

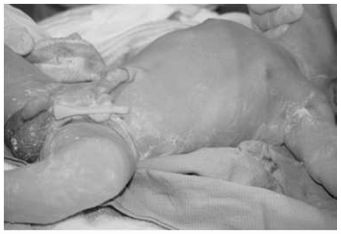
- Thick, lipid-rich, hydrophobic film → coats fetal skin
- Yellowish, greasy white
- Composed of sebaceous gland secretions and exfoliated skin cells



## Skin • Maturation

Vernix

- Synthesized during last trimester → gradually decreases as infant approaches term
- Interacts with developing epidermis → facilitates formation of stratum corneum

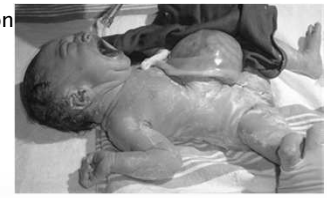




## Skin • Maturation

Vernix

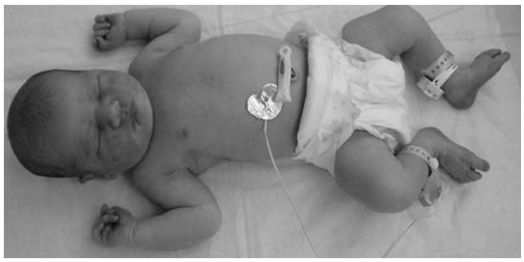
- Properties
  - Emollient (moisturizing) and cleansing functions
  - Anti-infective → contains antimicrobial peptides associated with the innate immune system
  - Anti-oxidant
  - Temperature regulation
- After birth, leave vernix intact and spread to allow absorption





## Skin Color • Normal Findings

- Pink and well perfused
- Skin intact

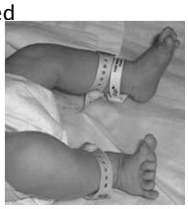




## Skin Color • Common Findings

Acrocyanosis

- Bluish discoloration of hands and feet
- No mucous membrane involvement
- Rule out hypothermia → infant will peripherally vasoconstrict in response to cold stress
- If persists beyond 48 hours → further evaluation indicated



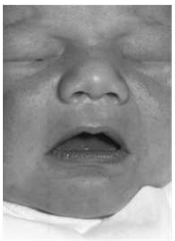




## Skin Color • Common Findings

Circumoral Cyanosis

- Bluish discoloration around the mouth
- Often associated with feeding
- Rule out central cyanosis



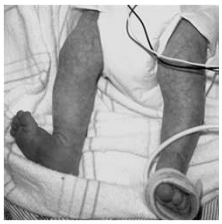


## Skin Color • Common Findings

Cutis Marmorata

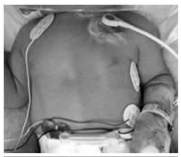
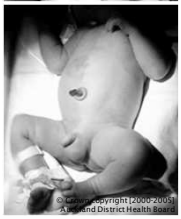
- Bluish marbling / mottling
- Caused by constriction of capillaries and venules in response to chilling or stress
- Persistent cutis marmorata may be observed with some trisomies or syndromes

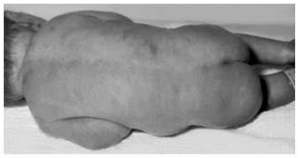




## Skin Color • Other Findings

Harlequin Sign
- Only occurs during newborn period
- Transient, benign phenomenon
- Cutaneous vessels → imbalance in autonomic regulatory mechanism
- More commonly observed in low birthweight infants

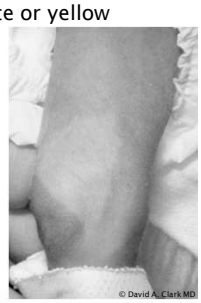







## Skin Color • Other Findings

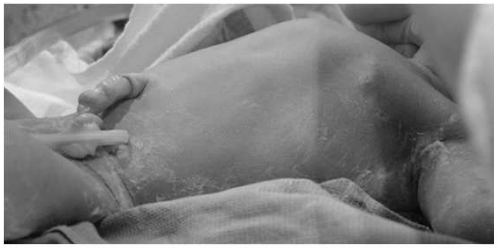
Vitiligo
- Occurs in all races
- Markedly reduced skin pigment, white or yellow hair, pink pupils, gray irides, photophobia, cutaneous photosensitivity






## Skin Color • Abnormal Findings

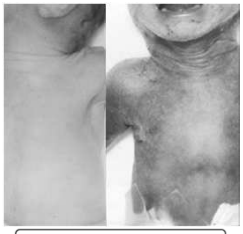
Central Cyanosis
- Bluish discoloration of tongue and mucous membranes
- Caused by desaturation of arterial blood
- Indicates cardiac and / or respiratory dysfunction

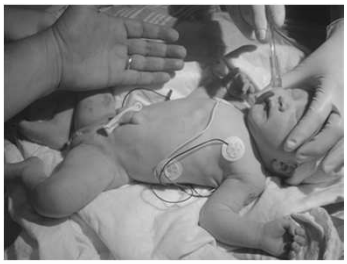




## Skin Color • Abnormal Findings

Pallor
- Anemia

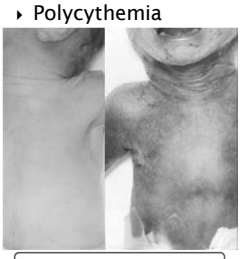

Twin-to-twin transfusion

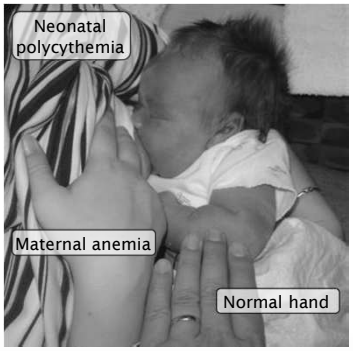




## Skin Color • Abnormal Findings

Plethora
- Polycythemia

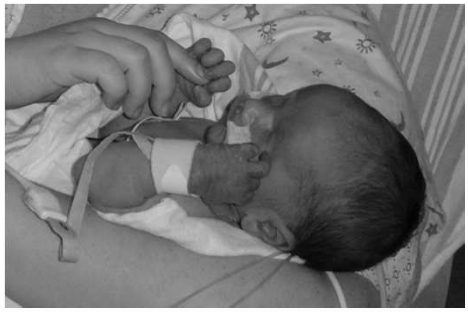

Twin-to-twin transfusion





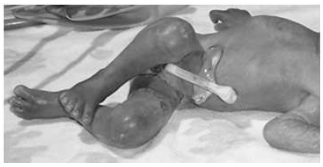

## Skin Color • Abnormal Findings

Jaundice
- Hyperbilirubinemia

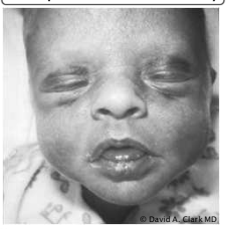


## Skin Color • Abnormal Findings

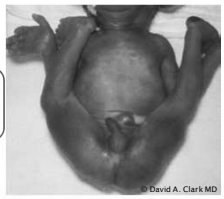
Bruising



Face presentation delivery

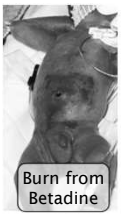



Preterm breech delivery

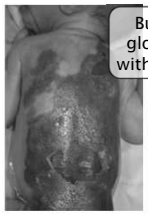



© K. Karlsen 2013

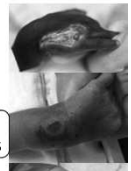
## Skin • Iatrogenic Injuries



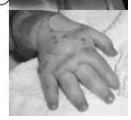
Burn from Betadine

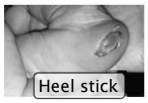


Burn from gloves filled with hot water



IV Infiltrates





Heel stick

Ischemia from umbilical artery catheters

© K. Karlsen 2013

## Skin • Types of Lesions

| Name | Description | Size |
|---|---|---|
| Purpura | Hemorrhagic spot | 1 to 3 mm |
| Vesicle | Raised, circumscribed, fluid filled lesion | < 1 cm |
| Pustule | Raised, circumscribed, blister-like lesion filled with purulent or cloudy fluid | < 1 cm |
| Macule | Flat, circumscribed, with skin discoloration | < 1 cm |
| Patch | Large macule | > 1 cm |

© K. Karlsen 2013

## Skin • Types of Lesions

| Name | Description | Size |
|---|---|---|
| Abscess | Raised, circumscribed, lesion filled with purulent fluid | > 1 cm |
| Bulla | Raised, circumscribed, fluid filled lesion (serous or seropurulent) | > 1 cm |
| Papule | Raised, circumscribed, solid lesion | > 1 cm |
| Plaque | Raised, circumscribed, plateau-like, solid, palpable | > 1 cm or fusion of several papules |

© K. Karlsen 2013

## Skin • Types of Lesions

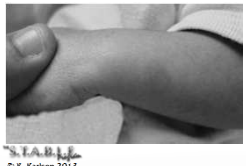
| Name | Description | Size |
|---|---|---|
| Nodule | Raised, circumscribed, solid lesion | ≤ 2 cm |
| Scale | Keratinization and/or exfoliation of dead or dying skin | Variable |
| Cyst | Raised, palpable, fluid-filled or semi-solid filled | Variable |
| Wheal | Raised, circumscribed, edematous, secondary to fluid collecting within the dermis | Variable |

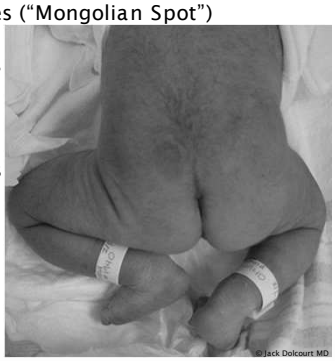
© K. Karlsen 2013

## Skin • Non-pathologic Lesions

Hyperpigmented Patches ("Mongolian Spot")

- Flat, blue-gray, blue-black or brown patches
- Most commonly on sacrum or lower back
  - Also buttocks, lower trunk and extremities



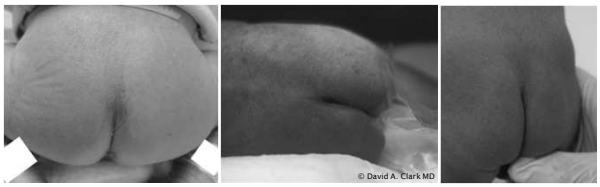



© K. Karlsen 2013

## Skin • Non-pathologic Lesions

Hyperpigmented Patches ("Mongolian Spot")

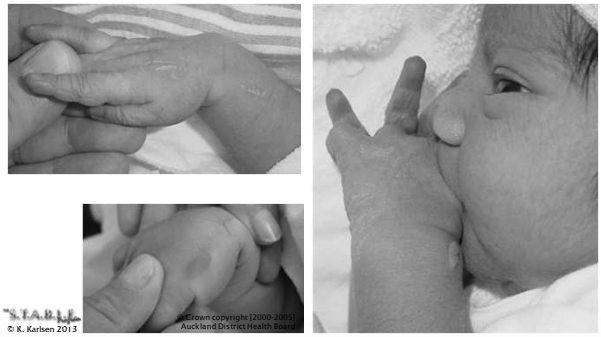
- If extensively distributed → evaluate for underlying disorders (such as lysosomal storage disorder)
- May be mistaken for trauma or abuse
- Most fade before adulthood






## Skin • Non-pathologic Lesions

Sucking Blisters

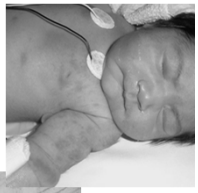


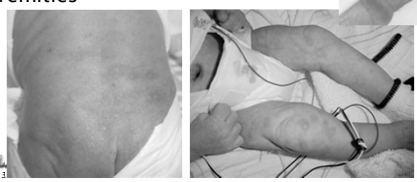



## Skin • Non-pathologic Lesions

Erythema Toxicum ("Newborn Rash")

- Most common benign skin rash → up to 70% of term infants
- Lesions appear first 1 to 2 days of life → may persist for 1 week
- Predominantly face, trunk, extremities



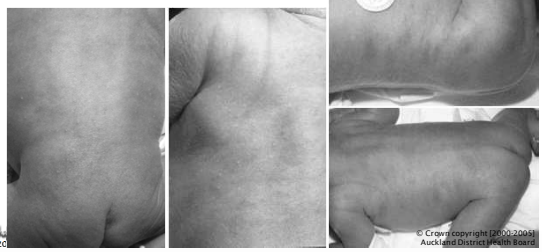




## Skin • Non-pathologic Lesions

Erythema Toxicum ("Newborn Rash")

- Small white or yellow papules or vesicles (1 to 2 mm) with erythematous base (1 to 3 cm diameter)
- *Wright Stain* → numerous

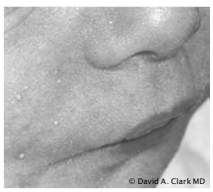


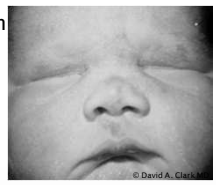



## Skin • Non-pathologic Lesions

Milia

- Benign, single, 1 to 2 mm white epidermal cysts
- Most often on cheeks, forehead, nose, chin
- Rarely on arms, legs, foreskin
- Retention of keratin within dermis
- Exfoliate within 2 weeks to 1 month
- *Wright stain* → keratinocyte debris






## Skin • Non-pathologic Lesions

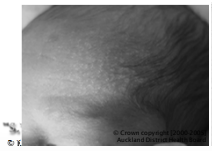
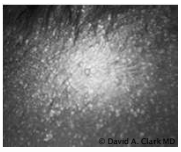
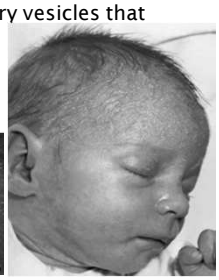
Sebaceous Hyperplasia

- Smooth white / yellow papules grouped into plaques
- No surrounding erythema
- Most prominent on face → especially nose and upper lip
- Androgen hormonal stimulation in utero from mother or infant → causes hypertrophy of sebaceous glands
- Benign finding
- Resolves spontaneously over first few weeks of life


## Skin • Non-pathologic Lesions

Milia Crystallina

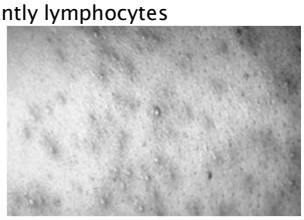
- Vesicular or pustular dermatitis secondary to sweat accumulation in obstructed eccrine ducts
- Thin-walled, clear, non-inflammatory vesicles that rupture easily
- Localized within stratum corneum
- *Wright stain* → few cells present

## Skin • Non-pathologic Lesions

Miliaria Rubra (Prickly Heat Rash)

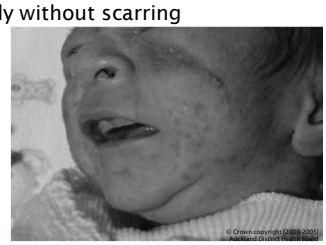
- Small erythematous grouped papules in skin folds or areas covered by clothing
- Involves deeper levels of epidermis
- Usually inflamed
- *Wright stain* → predominantly lymphocytes



## Skin • Non-pathologic Lesions

Neonatal Acne

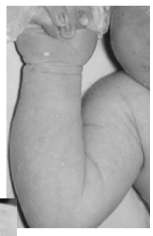
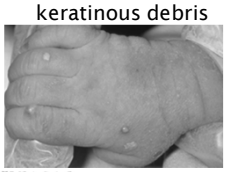
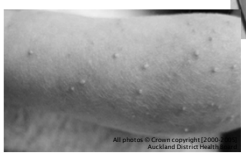
- Small red papules and pustules primarily over face
- May be difficult to differentiate from miliaria rubra
- Usually appears at 1 to 2 weeks of age
  - Resolves spontaneously without scarring

## Skin • Non-pathologic Lesions

Neonatal Pustular *Melanosis*

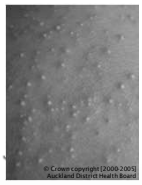
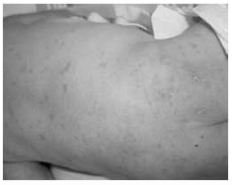
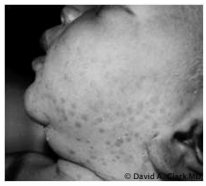
- Superficial vesiculopustular lesions
- Completely benign condition
- Most common in African Americans and those with darker pigmented skin
- *Wright stain* → neutrophils and keratinous debris

## Skin • Non-pathologic Lesions

Neonatal Pustular Melanosis

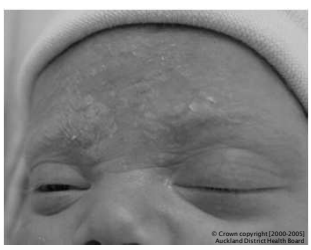
- Lesions evolve through 3 stages
  1. Superficial pustule appears → may occur in utero
  2. Pustule ruptures and leaves a fine scale (without erythema) → may present at birth in this stage
  3. Becomes a hyperpigmented macule that gradually disappears (~3 months)

## Skin • Lesions

Seborrheic Dermatitis

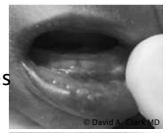
- Greasy, yellow, scaly plaques
- Primarily affects scalp (*"Cradle Cap"*), forehead, eyebrows, ears, nasolabial, axillary and perineal folds
- If present in skin creases, candida infection may occur

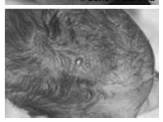
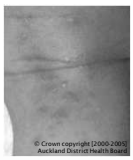


## Skin • Lesions

Herpes Simplex Virus – HSV

- Intrapartum transmission → 85% of cases
  - C-section delivery before rupture of membranes or before 4 to 6 hours of rupture can ↓ infection risk
- Lesions may be absent at onset of disease, however consider HSV anytime a newborn presents with a vesicular rash
- Tense vesicles, erythematous base → evolve into pustules or crusts
  - May be on presenting part
- Undiagnosed maternal infection → lesions at fetal scalp electrode and vacuum sites



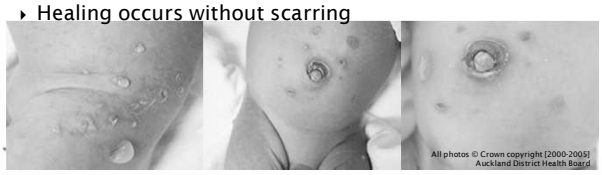






## Skin • Lesions

Bullous Impetigo

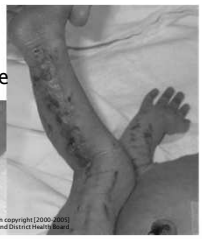
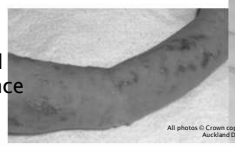
- One of most common neonatal skin infections → staphylococcus aureus
- Flaccid bullae with straw colored or turbid fluid
  - Lesions usually not closely grouped
  - Rupture easily leaving a red, moist denuded surface
- Healing occurs without scarring


## Skin • Lesions

Incontinentia Pigmenti (IP)

- At or shortly after birth, erythematous, vesiculobullous linear streaks or whorls and plaques on limbs / trunk
  - Resembles herpes simplex and bullous impetigo but linear configuration is unique to IP
  - Disorder of developing ectoderm
- Eosinophil count may be very high
- 1st stage resolves by 4 months of age
- 2nd and 3rd stages extend into childhood and adolescence

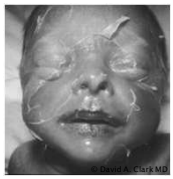



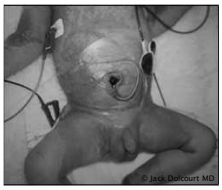



## Skin • Lesions

Staphylococcal Scalded Skin – "SSS"

- Staphylococcal aureus (S. aureus) produces a toxin that cleaves cell-to-cell adhesion proteins in epidermis
- Usually presents day 3 to 7 of life
- Blisters and fresh skin lesions do not contain bacteria
- Culture suspected portal of entry for S. aureus: nasopharynx, conjunctiva, umbilicus, abnormal skin, blood, urine
- Differentiate from toxic epidermal necrolysis (TEN)



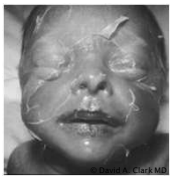


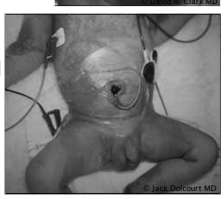



## Skin • Lesions

Staphylococcal Scalded Skin – "SSS"

- Skin tenderness and erythema
  - Starts on face and spreads quickly – within hours to days
  - Areas of flexion are also involved
  - Bullae are flaccid and rupture easily → skin peels off in sheets and resembles a scald
- 2 to 3 days after treatment started → flaky desquamation
- Resolution 3 to 5 days after desquamation phase



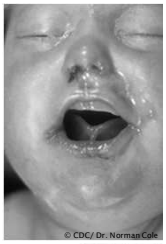


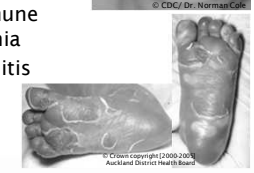



## Skin • Lesions

Congenital Syphilis

- Transplacental transmission of spirochete → positive RPR or VDRL
- Maculopapular copper colored, round lesions → perioral or nasal, diaper area, also may affect palms and soles
- Symptoms develop 4 to 8 weeks of life
- Signs at birth → IUGR, nonimmune hydrops, myocarditis, pneumonia
- Other signs hepatomegaly, rhinitis ("snuffles") → nasal secretions *highly contagious*

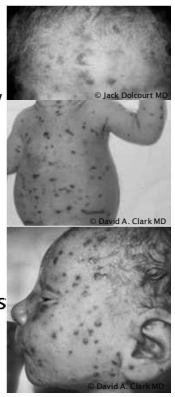




## Skin • Lesions

Dermal Extramedullary Hematopoiesis
"Blueberry Muffin" Skin Lesions

- Pathologic process due to bone marrow failure secondary to viral infections:
  - Congenital rubella
  - Cytomegalovirus infection (CMV)
  - Other viruses: coxsackievirus B2 and parvovirus B19 infection
- Lesions usually on head, neck and trunk → bluish, papular eruption
- May have extramedullary hematopoiesis in liver, spleen, adrenal glands, thyroid gland, pancreas, endocardium, brain

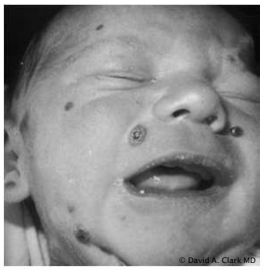



S.T.A.B.L.E.


## Skin • Lesions

Varicella ("Chicken Pox")

- Congenital → infection within first 10 days of life
  - Transplacental transmission
  - ↑ Risk for infant mortality
  - Maternal infection 5 days before to 2 days after birth
- Postnatally acquired
  - Onset of infection between 10 and 28 days

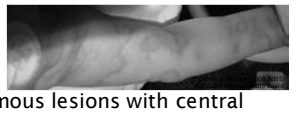


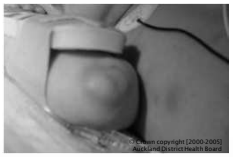

S.T.A.B.L.E.


## Skin • Lesions

Neonatal Lupus Syndromes

- Round or elliptical erythematous, papulosquamous lesions with central clearing, annular erythema, and fine scale
- Usually on face, scalp, neck, trunk, extremities
- Maternal autoantibodies target fetal and neonatal tissues → rashes, cytopenias, hepatobiliary disease, heart block, cardiomyopathy
  - ½ of mothers are asymptomatic
  - ½ have a rheumatic condition
- Improvement with clearance of maternal autoantibodies
- Potential for significant morbidity



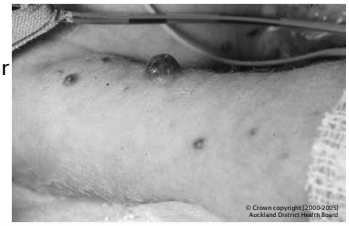



S.T.A.B.L.E.


## Skin • Lesions

Neuroblastoma

- Most common malignant tumor in neonates
  - Primary tumor is usually adrenal, cervical or thoracic
- Skin manifestations include small, round, blue, firm, papule / nodule
  - May resemble "blueberry muffin" lesion → evaluate for viral exposure




S.T.A.B.L.E.


## Skin • Lesions

Junctional Nevus

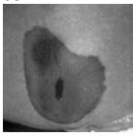
- Nevus cells found at the junction between epidermis and dermis
- Initially smooth, macular (nonpalpable)
- Enlarge slowly and become papular
- ↑ Risk to develop into melanoma

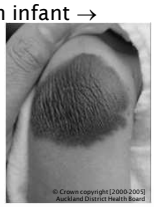

S.T.A.B.L.E.


## Skin • Lesions

Congenital Melanocytic Nevi

- May be present at birth or within first months of life
- Proliferations of nested melanocytes in dermis
  - Tan or light pink at birth / may contain hair → darkens with age and hair becomes more prominent
  - Smooth, nodular, or rough in texture
  - Brown macules grow proportionally with infant → may develop into papules or plaques
- Classified by greatest diameter
  - Small: ≤ 1.5 cm
  - Medium: 1.5 to 20 cm
  - Large: segmental distribution – "giant"



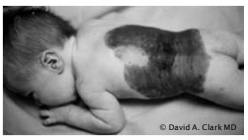



S.T.A.B.L.E.

## Skin • Lesions

Large Congenital Melanocytic Nevus

- Also known as "giant hairy", "bathing trunk", or "garment" nevus
- Darkly pigmented hairy patches
- Often upper or lower back
- Risk of developing malignant melanoma
  - Small and medium size → 1 to 4% risk
  - Large → 10 to 30% lifetime risk / first decade of life → 2 to 15% risk

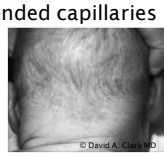



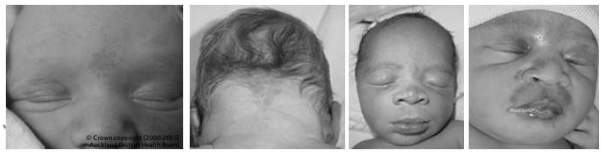

S.T.A.B.L.E.
© K. Karlsen 2013

## Skin • Vascular Lesions

Nevus Simplex ("Stork Bite", "Salmon Patch")

- Most common birthmark → up to 50% of newborns
- Macule → irregular border, dilated/distended capillaries
- Location → nape of neck, glabella, forehead, eyelids, upper lip
- Blanches with pressure → more prominent with crying
- Fades over time

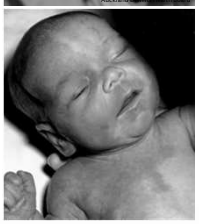



## Skin • Vascular Lesions

Nevus Flammeus (Port Wine Nevus)

- Pale pink to reddish purple in color
- Dilated, congested capillary / venous malformation under epidermis
  - *Does not blanch with pressure*
  - Sharply demarcated and flat during infancy
- May be small or cover large portion of body
  - Face most common – usually unilateral
- Does not resolve spontaneously

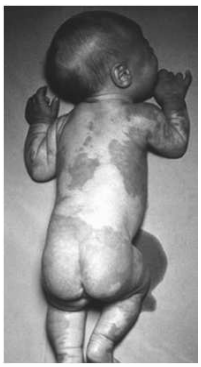



S.T.A.B.L.E.
© K. Karlsen 2013

## Skin • Vascular Lesions

Nevus Flammeus (Port Wine Nevus)

- If involving skin innervated by V1 or V2 branches of trigeminal nerve → may signal defect in eye
- Scalp location → may signal CNS malformation, especially if hair tuft or whorl present
- Lumbo-sacral location → may signal spinal anomaly

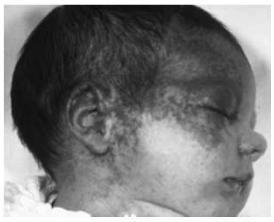


S.T.A.B.L.E.
© K. Karlsen 2013

## Skin • Vascular Lesions

Sturge-Weber Syndrome

- Facial port wine stain with CNS involvement
- Usually cutaneous distribution of first branch of trigeminal nerve
- May present with seizures, hemiparesis, glaucoma

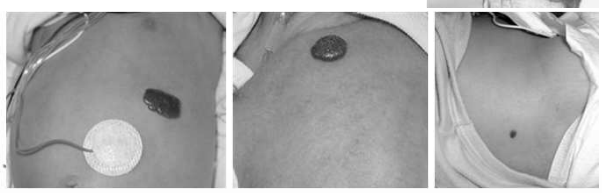



S.T.A.B.L.E.
© K. Karlsen 2013

## Skin • Vascular Lesions

Superficial ("Strawberry") Hemangioma

- Benign tumors of dermal and subdermal vascular endothelium
- More common in females and preterm



## Skin • Vascular Lesions

Superficial ("Strawberry") Hemangioma

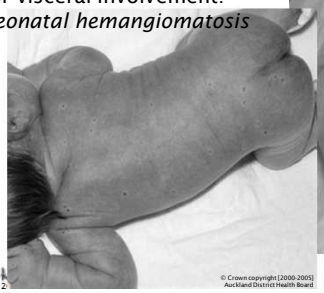
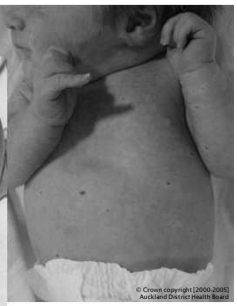
- Initial proliferative growth (usually lasts 6 months), then slow, spontaneous involution over ≥ 2 years
  - Bright red, slightly elevated, compressible plaque, 2 mm to 2 cm in diameter
- Complications → bleeding, ulceration, infection, organ compression, disfiguring scar




## Skin • Vascular Lesions

Diffuse Hemangiomas

- ≥ 5 skin lesions → evaluate for visceral involvement: *neonatal hemangiomatosis*

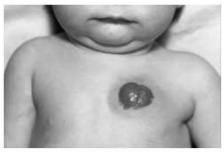
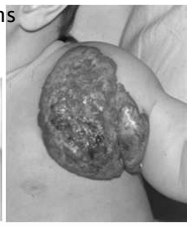





## Skin • Vascular Lesions

Cavernous ("Deep") Hemangioma

- Involves deeper tissues → dermis and subcutaneous
- Bluish/red in color, can have poorly defined borders
- Palpation → soft, compressible, "doughy"
- May enlarge with blood when in dependent position
- Proliferative phase over 6 to 12 months
- Involutes spontaneously

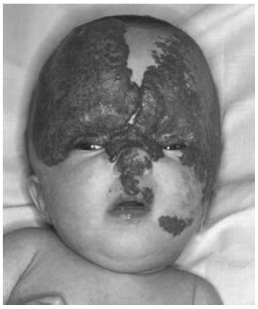





## Skin • Vascular Lesions

Cavernous ("Deep") Hemangioma

- *Locations requiring emergency* specialty evaluation
- Periorbital and lid lesions
- Lower face / airway lesions → evaluate for stridor and respiratory distress





## Skin • Vascular Lesions

Kasabach-Merritt Syndrome

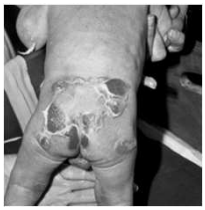
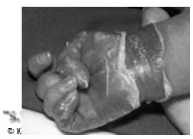
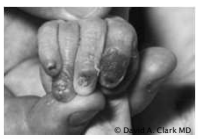
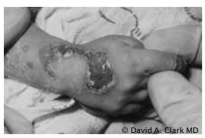
- Rapidly enlarging vascular lesion – "giant hemangioma" or "cavernous hemangioma"
- Complicated by hemolytic anemia, thrombocytopenia, and coagulopathy
- Massive tumors, deep red-blue color
- Firm and grow rapidly
- Proliferate for 2 to 5 years
- May require transcutaneous arterial embolization
- High mortality rate




## Skin • Abnormal Findings

Epidermolysis Bullosa

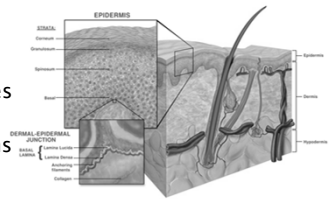
- Blistering or erosion of skin
  - May include epithelial lining of organs
- Lesions first occur at friction points: heels, wrists, knees, sacrum
- Fluid in bullae is usually clear or hemorrhagic

## Skin • Abnormal Findings

Epidermolysis Bullosa

- Classified into 3 main groups – many sub-types
- Caused by mutations in skin's structural proteins



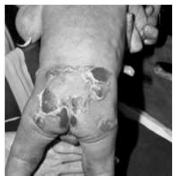
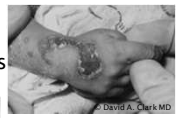

| Classification | Cleavage |
|---|---|
| Epidermolysis Bullosa Simplex (EBS) | Epidermolytic: within basal cells of epidermis |
| Junctional Epidermolysis Bullosa (JEB) | Lucidolytic: within lamina lucida of basement membrane zone |
| Dystrophic Epidermolysis Bullosa (DEB) | Dermolytic (subepidermal): beneath lamina densa of basement membrane |

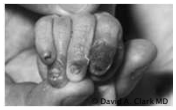


## Skin • Abnormal Findings

Epidermolysis Bullosa

- Evaluate family history for blistering diseases
- Skin biopsy for immunofluorescence mapping and structure
- Treatment is supportive → protect skin from frictional trauma and secondary infection, open and drain tense vesicles with sterile needle, use wrapping (no adhesive tape!), overheating may increase blistering



## Skin • Abnormal Findings

Cutis Laxa

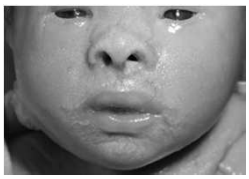
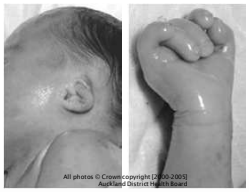
- Generalized elastolysis → skin resilience diminished – skin hangs in folds
- Outcome dependent upon form of inheritance
  - Autosomal dominant → normal life span, few complications
  - Autosomal recessive → other body elastic fibers affected (hernias, GI and pulmonary disorders, aortic aneurysm), growth and skeletal dysplasia, IUGR, congenital hip dislocation, facial feature abnormalities




## Skin • Abnormal Findings

Collodion Baby

- Thickened stratum corneum → cellophane-like membrane
  - Distorts facial features and digits
  - May restrict movement → difficulty sucking, closing eyes, and at times respiration
  - Usually sloughs by 1st month
- Defective cutaneous barrier function → ↑ risk for dehydration, temperature instability, infection

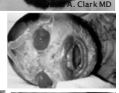






## Skin • Abnormal Findings

Harlequin Ichthyosis

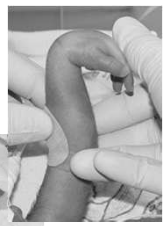
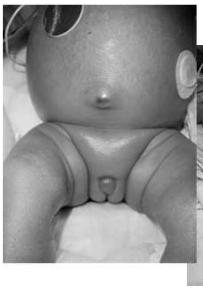
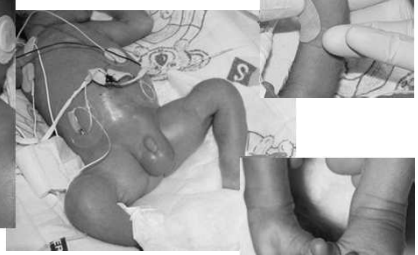
- Thickening of skin keratin layer → most severe form of congenital ichthyosis
- "Armor-like", hard, thick, contracted skin with deep crevices
  - Cracking most prominent over areas of flexion → inelasticity of skin limits movement
- Rigid skin around eyes → ectropion
- Ears /nose flat, underdeveloped
- Lips everted / gaping → "fish-mouth"
- Hair sparse or absent
- Hands and feet – poorly developed





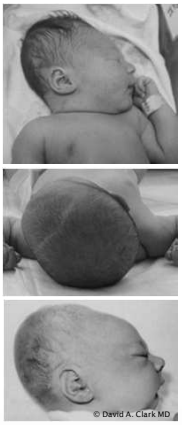

## Skin • Abnormal Findings

Edema

## Head

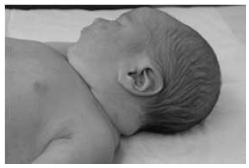
- Size and shape
- Sutures and bones
- Fontanels
- Anomalies
- Scalp
  - Injuries
  - Lesions
  - Swellings

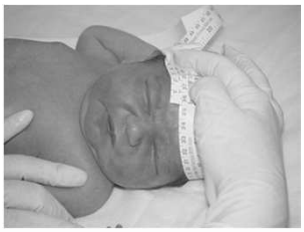





## Head • Size

- Indication of normal versus abnormal brain growth
- Record largest measurement above ear and eyebrow ridges
  "Occipitofrontal Circumference" (OFC)
- Varies with molding and scalp swelling

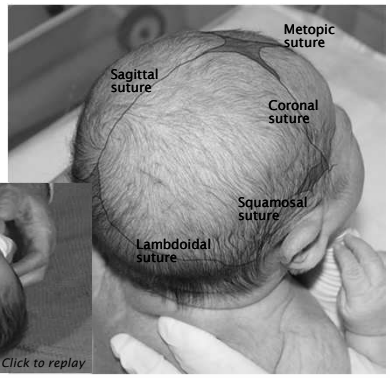






## Head • Sutures

Assessment
- Normal
  - Approximated
  - Mobile

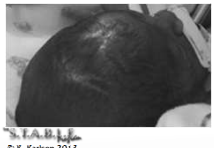


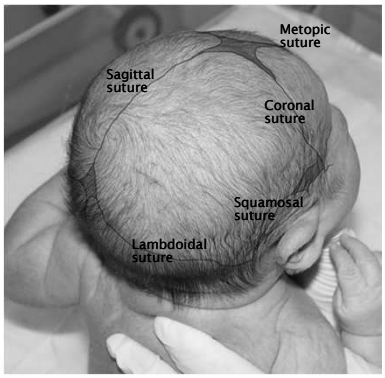




## Head • Sutures

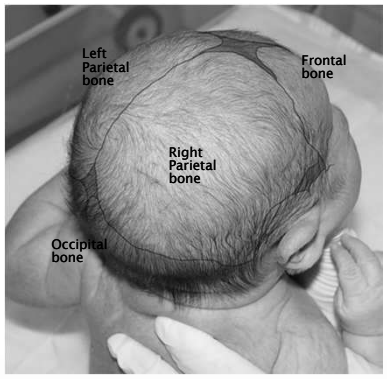
Assessment
- Normal
  - Approximated
  - Mobile
- Abnormal
  - Overlapping
  - Wide-spaced
  - Fused








## Head • Bones

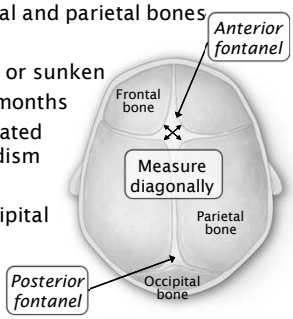





## Head • Fontanels

Anterior Fontanel
- Located at junction of frontal and parietal bones
- Normal → flat and soft
- Abnormal → tense, bulging or sunken
- Usually closes by 12 to 18 months
- Large size → may be associated with congenital hypothyroidism

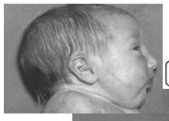
Posterior Fontanel
- Junction of parietal and occipital bones
- Closes by 6 months of life

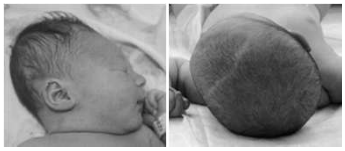


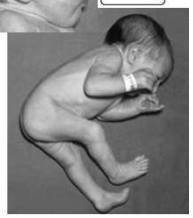
## Head • Common Findings

Molding

- Skull bones move to accommodate passage through birth canal – may overlap
- Breech position → posterior molding, prominent occiput







## Head • Common Findings

Craniotabes

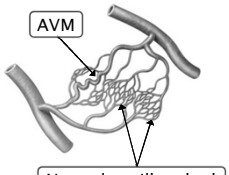
- Soft areas of skull, usually on occipital and parietal bones along lambdoidal sutures
- Easily depressed and pops right back out
- Benign finding unless associated with rickets or osteogenesis imperfecta
- Exact etiology unknown → may be secondary to vitamin D deficiency in utero or early engagement of the fetal head

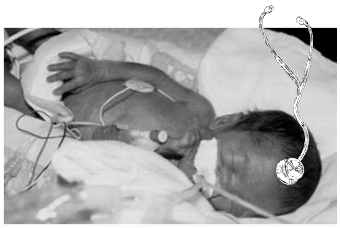


## Head • Abnormal Findings

Bruit

- If bruit heard over anterior fontanel → may indicate arteriovenous malformation (AVM)
  - Bruit – sound made when blood flows through a narrow or tortuous vessel





## Head • Abnormal Findings

Craniosynostosis

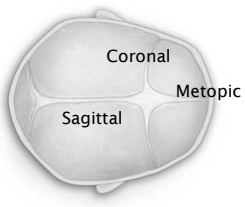
- Premature fusion of one or more cranial sutures
- May be isolated defect or part of a syndrome
- Classification based on number of sutures fused
  - Simple → one suture involved
  - Complex (or compound) → two or more sutures involved
- Skull grows in a parallel direction to fused suture(s)

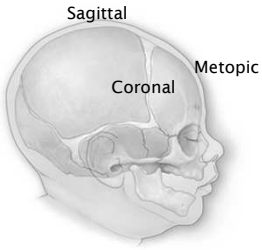


## Head • Abnormal Findings

Craniosynostosis

- Sutures most commonly involved → sagittal, coronal, metopic



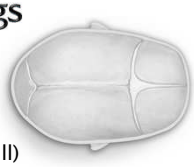



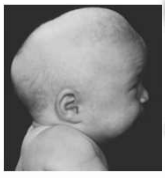



## Head • Abnormal Findings

Sagittal Suture Synostosis → "Scaphocephaly"

- ↑ Anteroposterior (AP) length
- ↓ Bitemporal diameter (width of skull)
- Frontal and occipital bossing
- Most common → 40 to 60% of synostosis cases
- Male to female ratio 4:1

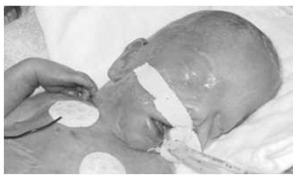


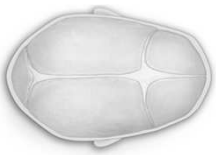


## Head • Abnormal Findings

Positional Skull Deformity (no synostosis) → "Dolichocephaly"

- ↑ AP length head → head flattened side to side *without* craniosynostosis
- Often observed with preterm or hypotonic infants







## Head • Abnormal Findings

*Coronal Suture Synostosis*

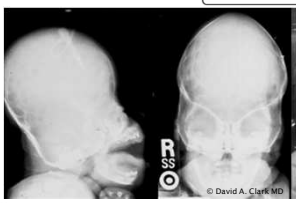
- 15 to 30% of cases
- Unilateral → *"Plagiocephaly"*
  - Asymmetrical skull
- Bilateral → *"Brachycephaly"*
  - Wide, taller skull – anteroposterior growth restriction (shortened AP dimension)
  - More likely to have an associated syndrome

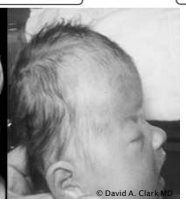


## Head • Abnormal Findings

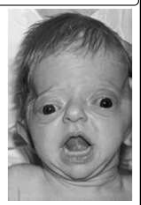
Bilateral Coronal Suture Synostosis → "Brachycephaly"

*Crouzon Syndrome*




*Apert Syndrome*

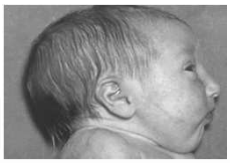




## Head • Abnormal Findings

Positional Skull Deformity (no synostosis) → also called "Brachycephaly"

- Flat back, side, or top of head
- May be normal finding / familial or ethnic → Asian or American Indian
- Risk factors → multiple births, oligohydramnios, LGA, breech or transverse position
- ↑ Incidence since "back-to-sleep" campaign to reduce sudden infant death syndrome



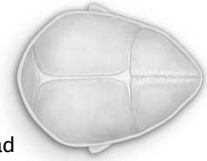
Flat top of head secondary to breech positioning



## Head • Abnormal Findings

Metopic Suture Synostosis → "Trigonocephaly"

- 10 to 20% of cases of isolated craniosynostosis
- Males 3:1
- Triangular shaped / narrow head, pointed forehead, prominent bony ridge palpated in middle of forehead
- Eyes appear hypoteloric (close together), upward slanting of palpebral fissures
- 8 to 15% of cases may have central nervous system, cardiac, or genitourinary anomalies

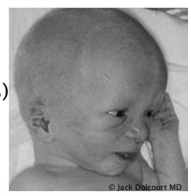




## Head • Abnormal Findings

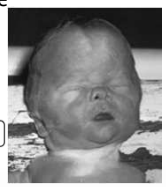
Macrocephaly

- Head circumference > 90th percentile or > 2 standard deviations above mean for age, gender, gestation
- Causes – 3 general etiologies
  1. *Enlarged brain* → macrencephaly
  2. *Enlarged cerebrospinal fluid spaces* → hydrocephaly
  3. *Enlarged structures* → vascular lesions (vein of Galen malformation, tumor), trauma (intracranial hemorrhage), infection (brain abscess)



## Head • Abnormal Findings

Macrocephaly
- Other causes
  - May be a *benign familial trait* → one or both parents may have an abnormally enlarged head, but may also occur sporadically without affected parent(s)
  - *Generalized disorders of growth* → Beckwith-Wiedemann Syndrome, Sotos Syndrome (cerebral gigantism), Achondroplasia (most common form of dwarfism)

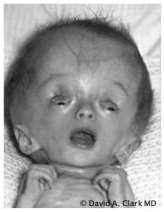


*Achondroplasia*

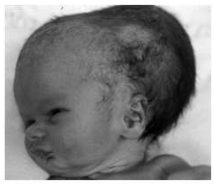


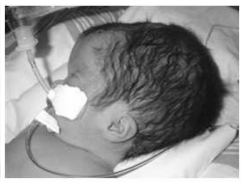
## Head • Abnormal Findings

Hydrocephalus – Congenital Causes
- Chiari II malformation
- Aqueductal stenosis
- Encephalocele
- Universal craniosynostosis





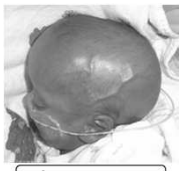




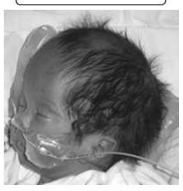


## Head • Abnormal Findings

Hydrocephalus – Acquired Causes
- Hemorrhage → post-hemorrhagic hydrocephalus (PHH) is a consequence of germinal matrix hemorrhage
  - Ventriculomegaly
  - Elevated intracranial pressure
  - Increasing head circumference
- Infection
- Tumor with mass effect
- Venous hypertension



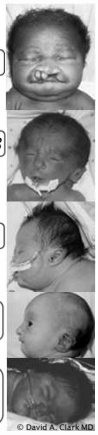
Infants with PHH





## Head • Abnormal Findings

Microcephaly
- Head circumference < 2 standard deviations below the mean for age, gender, gestation
- *Primary causes*
  - Genetic disorders
    - Chromosomal anomalies → trisomy (13, 18, 21), deletion and translocation syndromes
    - Somatic syndromes → Rubinstein-Taybi, Cornelia de Lange, Prader-Willi, Smith-Lemli-Opitz (and more)



*Trisomy 13*

*Trisomy 18*

*Trisomy 21*

*4 P Syndrome*

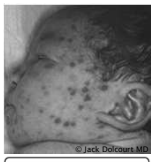
*Cornelia de Lange Syndrome*





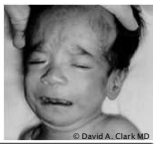
## Head • Abnormal Findings

Microcephaly
- *Primary causes*
  - Intrauterine infections → rubella, cytomegalovirus, toxoplasmosis, herpes virus, coxsackievirus, syphilis
  - Intrauterine exposure to drugs and chemicals → alcohol, cocaine, phenytoin, trimethadione, methyl mercury
  - Maternal illnesses → diabetes, malnutrition, hypertension





*Congenital CMV*





*Fetal Alcohol Syndrome*



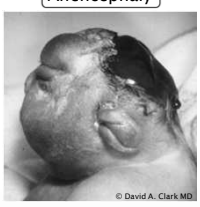
## Head • Abnormal Findings

Microcephaly
- *Primary causes*
  - Congenital disorders → anencephaly, holoprosencephaly, lissencephaly (and more)

Holoprosencephaly



Anencephaly

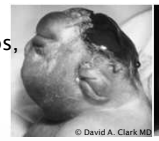


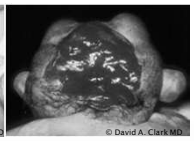
## Head • Abnormal Findings

Microcephaly → Due to Anencephaly

- Accounts for approximately half of all neural tube defects
- Occurs by 24 days of gestation
- Incidence worldwide ranges from 1 to 10 per 1000 live births
- Affects girls more often than boys
- Many are stillborn
- Maternal history may include polyhydramnios, elevated serum alpha-fetoprotein


© CDC, National Center on Birth Defects and Developmental Disabilities


© David A. Clark MD

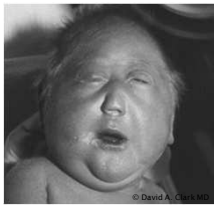

© David A. Clark MD



## Head • Abnormal Findings

Microcephaly → Due to Holoprosencephaly

- Failure of forebrain (prosencephalon) to separate into two distinct cerebral hemispheres
- Occurs by 5th week of gestation
- Midline facial abnormalities
- Severity depends upon separation degree of cerebral hemispheres
  - Alobar → no cerebral cortical separation – most severe form
  - Semilobar → some development of interhemispheric fissure
  - Lobar → relatively normal hemispheres posteriorly, but poorer separation of anterior and basilar structures

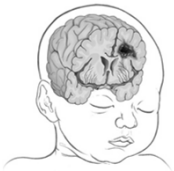

© David A. Clark MD

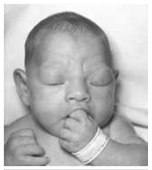


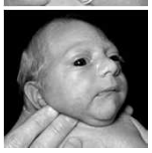
## Head • Abnormal Findings

Microcephaly

- *Secondary causes* → destruction of already formed brain in last 2 months of 3rd trimester, or during perinatal period
  - Trauma
  - Anoxic injury
  - Infections
  - Metabolic disorders
- *Other*
  - Craniosynostosis → usually of multiple sutures





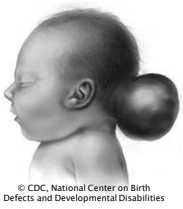


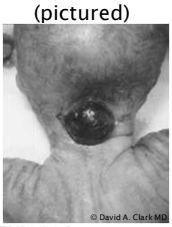


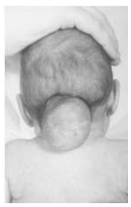
## Head • Abnormal Findings

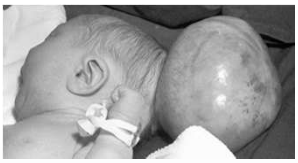
Encephalocele

- Brain protrudes through cranial defect
- 80% occur in occipital region (pictured)


© CDC, National Center on Birth Defects and Developmental Disabilities


© David A. Clark MD





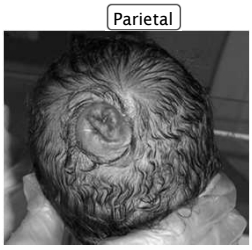


## Head • Abnormal Findings

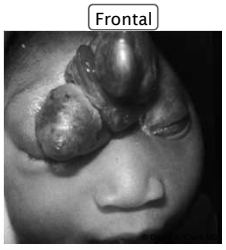
Encephalocele

- Brain protrudes through cranial defect
- 20% occur in parietal, frontonasal, intranasal, or nasopharyngeal regions

Parietal



Frontal



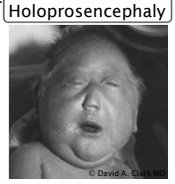


## Head • Abnormal Findings

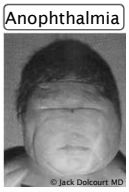
Encephalocele

- Hydrocephalus present in approximately 50% of cases
- Half of affected infants have other major congenital anomalies
  - Microcephaly, holoprosencephaly, anophthalmia, cleft lip or palate, craniosynostosis, severe congenital heart disease

Holoprosencephaly


© David A. Clark MD

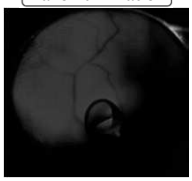
Anophthalmia


© Jack Dolcourt MD

## Head • Abnormal Findings

Hydranencephaly

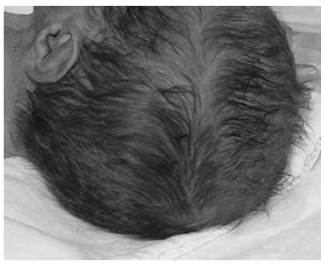
- 2nd trimester → major vascular insult / occlusion of cerebral arteries
  - Brain liquifies → leaves meningeal sac that contains CSF
  - Spares diencephalon, brainstem, posterior fossa structure
- Infant may appear normal at birth
  - Functions initially at a subcortical reflex level
  - Several weeks old → developmental arrest, decerebration, hypertonia, hyperreflexia
- Most die by 6 to 12 months

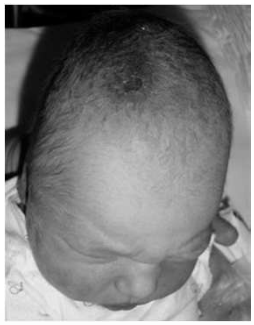





## Scalp • Abnormal Findings

Injury Secondary to Scalp Electrode



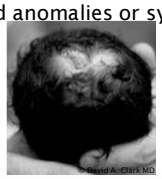




## Scalp • Abnormal Findings

Cutis Aplasia

- Cutaneous anomaly → some or all skin layers absent
- Marginated ulcer, bullae, or scar 1 to 3 cm in diameter
- Usually midline along scalp in parietal or occipital region
  - More rarely → may involve face, trunk, extremities
  - Generally heals over weeks to months
- Evaluate for associated anomalies or syndromes

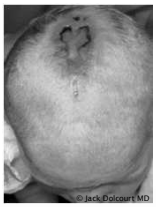




## Scalp • Abnormal Findings

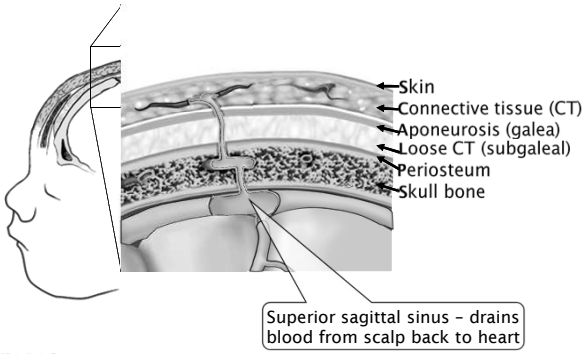
Cutis Aplasia

- May be isolated defect or associated with other anomalies
  - Evaluate for midline defects, trisomy 13, cleft lip and palate, limb anomalies, epidermolysis bullosa



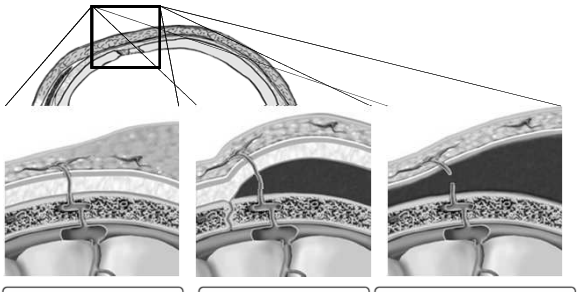


## Scalp • Skull Anatomy



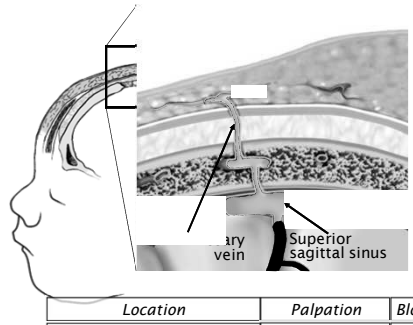



## Scalp Swellings • Types



Caput Succedaneum | Cephalohematoma | Subgaleal Hemorrhage

## Scalp Swellings • Caput Succedaneum

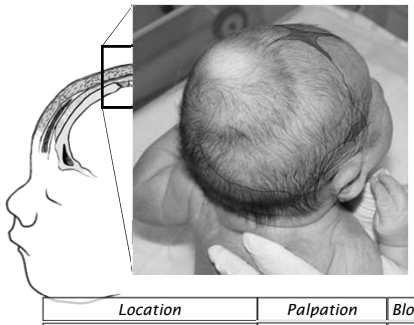



Accumulation of serosanguineous fluid in subcutaneous tissues of scalp

| *Location* | *Palpation* | *Blood Loss* | *Duration* |
|---|---|---|---|
| Edema of presenting part<br>Usually crosses suture lines<br>Shifts with positioning | Soft and spongy<br>Pits on pressure | Minimal | Resolves in 48 – 72 hours |



## Scalp Swellings • Caput Succedaneum



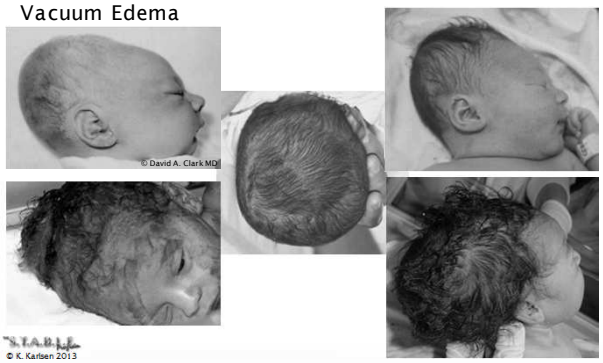
Accumulation of serosanguineous fluid in subcutaneous tissues of scalp

| *Location* | *Palpation* | *Blood Loss* | *Duration* |
|---|---|---|---|
| Edema of presenting part<br>Usually crosses suture lines<br>Shifts with positioning | Soft and spongy<br>Pits on pressure | Minimal | Resolves in 48 – 72 hours |



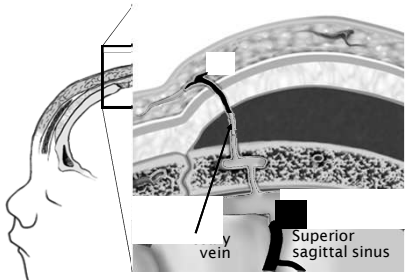
## Scalp Swellings • Caput Succedaneum

Vacuum Edema






## Scalp Swellings • Cephalohematoma

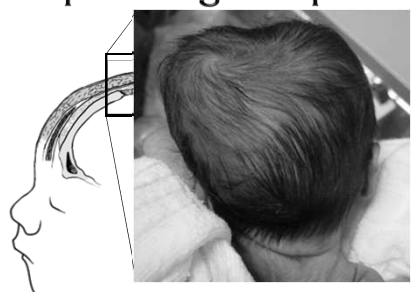



Blood accumulation between skull bone and periosteum

| *Location* | *Palpation* | *Blood Loss* | *Duration* |
|---|---|---|---|
| Stops at sutures<br>Parietal and occipital bones<br>May be bilateral | Initially firm<br>More fluctuant after 48 hrs | Rarely severe<br>X-ray if skull fracture suspected | Resolves in 2 weeks to 3 months |



## Scalp Swellings • Cephalohematoma

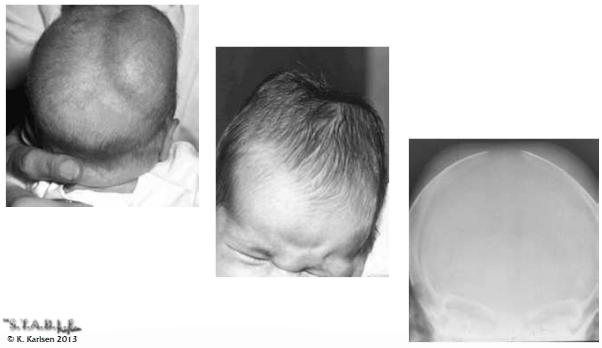


Blood accumulation between skull bone and periosteum

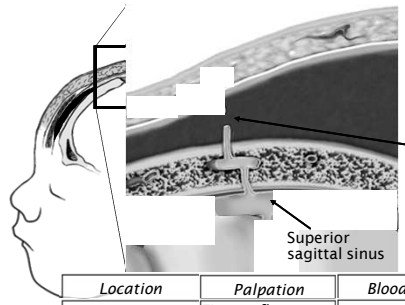
| *Location* | *Palpation* | *Blood Loss* | *Duration* |
|---|---|---|---|
| Stops at sutures<br>Parietal and occipital bones<br>May be bilateral | Initially firm<br>More fluctuant after 48 hrs | Rarely severe<br>X-ray if skull fracture suspected | Resolves in 2 weeks to 3 months |



## Scalp Swellings • Cephalohematoma



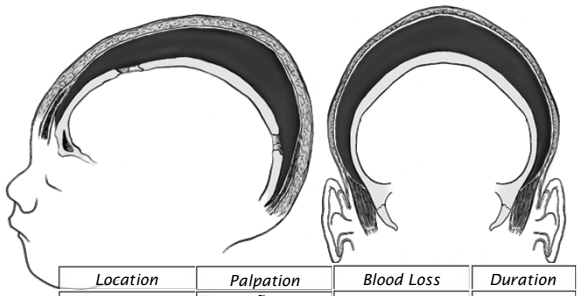
## Scalp Swellings • Subgaleal Hemorrhage




| *Location* | *Palpation* | *Blood Loss* | *Duration* |
|---|---|---|---|
| Crosses suture lines – may extend from eyes to nape of neck | Firm to fluctuant – "boggy" Dependent swelling | May lead to severe anemia and hypovolemic shock | Resolves over 2 – 3 weeks High morbidity |



Scalp Swellings • Subgaleal Hemorrhage



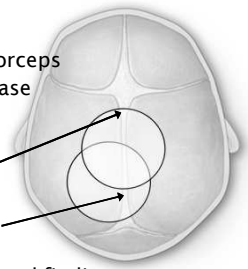
| *Location* | *Palpation* | *Blood Loss* | *Duration* |
|---|---|---|---|
| Crosses suture lines – may extend from eyes to nape of neck | Firm to fluctuant – "boggy" Dependent swelling | May lead to severe anemia and hypovolemic shock | Resolves over 2 – 3 weeks High morbidity |

S.T.A.B.L.E. © K. Karlsen 2013

## Scalp Swellings • Subgaleal Hemorrhage

Risk factors for Development of SGH

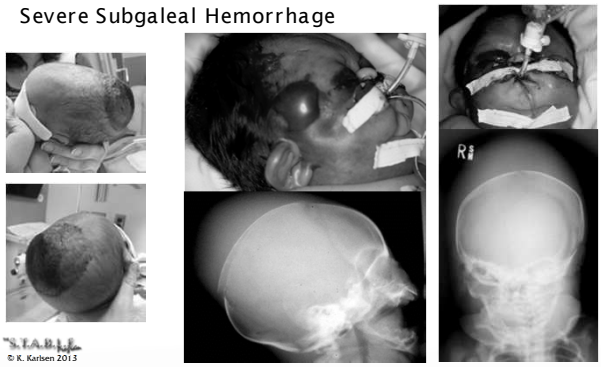
- Nulliparous mother
- Failed vacuum extraction
- Sequential use of vacuum and forceps
- Pop-offs → unintended cup release
  - Safe number not established
- Improper cup applications:
  - Leading edge of cup < 3 cm from anterior fontanel
  - Cup centered >1 cm lateral to to the sagittal suture
  - Inspect vacuum marks and record findings





Scalp Swellings • Subgaleal Hemorrhage

Severe Subgaleal Hemorrhage





Scalp Swellings • Subgaleal Hemorrhage

- Stable infant
- Note fluid wave, tachypnea and retractions

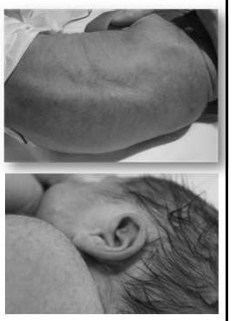

*Video courtesy of Swiss Society of Neonatology*



## Hair • Abnormal Findings

Quantity

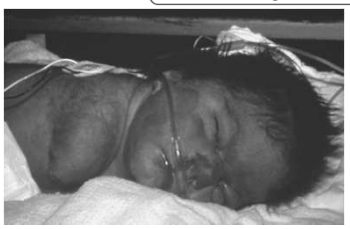
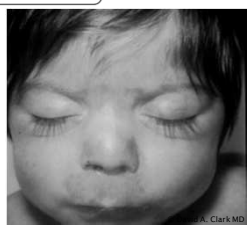
- ↑ or ↓ quantity → assess for congenital anomalies
- Hirsutism
  - Typical of some syndromes → Cornelia de Lange, fetal alcohol, fetal hydantoin
  - May be a familial characteristic and/or ethnic → Hispanic, Middle-Eastern, American Indian



## Hair • Abnormal Findings

Quantity

*Cornelia de Lange Syndrome*
Hirsutism, long lashes, low hairline

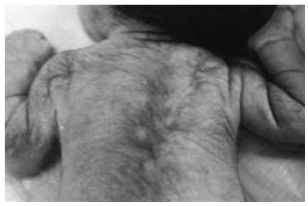
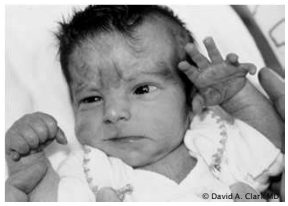



© K. Karlsen 2013

## Hair • Abnormal Findings

Quantity

*Rubinstein-Taybi Syndrome*
Heavy eyebrows, hairiness

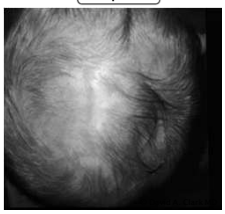
© K. Karlsen 2013

## Hair • Abnormal Findings

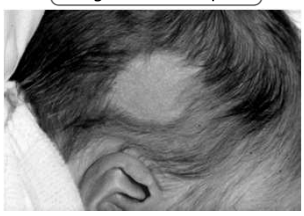
Quantity

- Alopecia or bald patches

Alopecia



Congenital absence of hair growth – bald patch



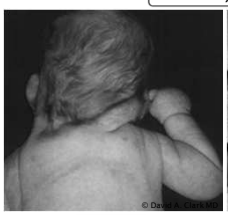
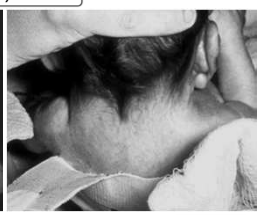
© K. Karlsen 2013

## Hair • Abnormal Findings

Distribution

- Low posterior hairline → occurs with short or webbed neck
- Assess for Turner Syndrome, Noonan Syndrome

*Turner Syndrome*

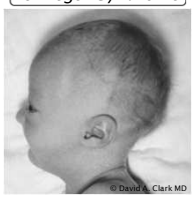
© K. Karlsen 2013

## Hair • Abnormal Findings

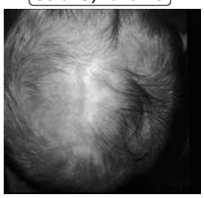
Texture

- Sparse, short, brittle, kinky, or uneven → may affect scalp, eyebrows, or eyelashes → assess for congenital anomalies

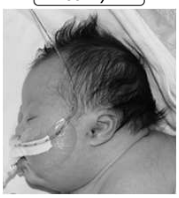
*Zellweger Syndrome*



*Goltz Syndrome*

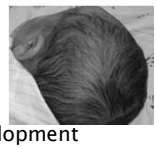


*Trisomy 21*



© K. Karlsen 2013

## Hair • Abnormal Findings



Hair Whorls

- Reflects posterior scalp skin growth between 10th and 16th week of fetal development
- Normal → 95% of infants have single whorl to right or left of midline and within 2 cm anterior to posterior fontanelle; 5% have two whorls
- Abnormally placed (more central or posterior), or absent whorl, may reflect abnormal brain growth → assess for microcephaly
- > 2 whorls → assess for congenital anomalies

*Trisomy 21*
Double whorl

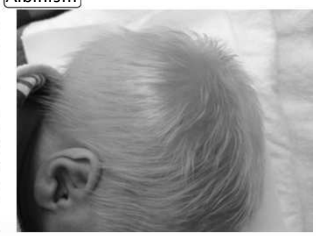
© K. Karlsen 2013

## Hair • Abnormal Findings

Color

- *Oculocutaneous albinism* → absence of pigment of skin, hair, and eyes


Albinism





*Movies drawn from the **Neurologic Exam and PediNeurologic Exam** websites are used by permission of Paul D. Larsen, M.D., University of Nebraska Medical Center and Suzanne S. Stensaas, Ph.D., University of Utah School of Medicine. Subsequent re-use of any materials outside of this program, presentation, or website requires permission from the original producers.*

*Movies © Paul Larsen MD*

*http://library.med.utah.edu/pedineurologicexam*

THE S.T.A.B.L.E. program

Close this section and open Part 3:
Face, Eyes, Ears, Nose, Mouth, Chest and Lungs, Heart, Abdomen, Genitourinary, Musculoskeletal