Pediatric Physical Exam

Adapted from Mosby’s Guide to Physical Examination, 6th Ed.

M.JARI.MD
خدايا: خداه دارد آن که تورا ندارد و چه ندارد آن که تو را
دارد (امام حسین ع)
Age Descriptors

Newborn  birth to 1 months
Infant    0-1 year
Toddler  1-2 years
Child     2+ years
Vitals

- Pulse
- Respiration
- Blood pressure
- Temp
- Height
- Weight

infants and children
Pulse

- Apical pulse
  - 5th intercostal space in the midclavicular line

- Femoral pulse
  - use a point halfway from the pubic tubercle to ASIS as a guide
<table>
<thead>
<tr>
<th>Age</th>
<th>Beats per minute</th>
</tr>
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<tbody>
<tr>
<td>Newborn</td>
<td>120-170</td>
</tr>
<tr>
<td>1 year</td>
<td>80-160</td>
</tr>
<tr>
<td>3 years</td>
<td>80-120</td>
</tr>
<tr>
<td>6 years</td>
<td>75-115</td>
</tr>
<tr>
<td>10 years</td>
<td>70-110</td>
</tr>
</tbody>
</table>
Respiration

Infants – rise and fall of the abdomen facilitates counting

- Rate, regularity and rhythm
- Depth
- Respiratory Effort
  - Retraction (ribs, supraclavicular notch)
  - Contraction of SCM’s
  - Flaring of nostrils
  - Paradoxic breathing
<table>
<thead>
<tr>
<th>Age</th>
<th>Respirations per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>30-60</td>
</tr>
<tr>
<td>1-2 mo</td>
<td>30-60</td>
</tr>
<tr>
<td>2-12mo</td>
<td>20-50</td>
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<tr>
<td>1-2 years</td>
<td>20-40</td>
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<tr>
<td>2-6 years</td>
<td>16-30</td>
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</tbody>
</table>
Blood Pressure

- Cuff size (children)
  - Width should cover ~2/3 of the upper arm or thigh

Too wide - underestimate BP
Too narrow - artificially high BP
Temperature

- Tympanic thermometers are becoming increasingly popular
  - Accuracy depends on correct technique
  - Must read tympanic membrane
    - Shares blood supply with hypothalamus
Temperature – Young Infants

- Traditional routes may be more accurate

Newborns: axillary temp correlates well with core temp due to the infant’s small body mass and uniform skin blood flow
Head Circumference

- Done at every “health visit” until 2 years of age; yearly from 2-6 years of age

- Measure the largest circumference with the tape snug
  - Occipital protuberance to the supraorbital prominence
Chest Circumference

- Measure around the nipple line to the nearest 1/8 in (0.5 cm)
  - Firmly but not tight enough to cause an indentation in the skin
What if…?

- Head circumference increases rapidly or rises above percentile curves
  - Increased intracranial pressure
    - dDX: Hydrocephalus, etc.

- Head circumference grows slowly or falls off percentile curves
  - Microcephaly
    - dDx: Craniosynostosis, etc.
Congenital Syndromes…

- Down Syndrome & Turner Syndrome
  - associated with short stature
Skin
Newborn – Expected Variants

- Transient puffiness of the hands, feet, eyelids, legs, pubis or sacrum occurs in some newborns. Not a concern if it disappears within 2-3 days.

- Some newborns are bald while others are born with an inordinate amount of head hair. Sheds within 2-3 months and replaced by more permanent hair (new texture and color).

- Dark-skinned newborns do not always manifest the intensity of melanosis that will be readily evident in 2-3 months. Exceptions: nail beds and skin of the scrotum.

- Skin may look very red the first few days of life. Skin color is partly determined by subcutaneous fat.
- **Cutis marmorata**
  - Transient mottling when infant is exposed to decreased temperature

- **Acrocyanosis**
  - Cyanosis of hands & feet
  - A common response to cold
    - An underlying cardiac defect should be suspected if acrocyanosis is persistent or more intense in the feet than hands
Vernix caseosa

- Whitish, moist, cheeselike substance
  - Mixture of sebum and skin cells
- Covers the infant’s body at birth
- Protective
Lanugo

- Fine, silky hair covering the newborn
  - shoulders and back
- Shed within 10-14 days

Lanugo. This fine body hair resembling peach fuzz is present on infants of 24 to 32 weeks' gestation.
Telangiectatic nevi

aka “stork bites”

- Flat, deep pink, localized areas usually seen in back of neck

Stork bite, or salmon patch. A typical light red splotchy area is seen at the nape of the neck.
Mongolian spots

- Irregular areas of deep blue pigmentation usually in sacral and gluteal regions
  *Seen predominantly in African, Native American, Asian or Latin descent*
Erythema toxicum

- Pink papular rash with vesicles superimposed
  - thorax, back, buttocks, and abdomen
- May appear 24-48 hrs after birth and resolves after several days
Milia

- Common during the first 2-3 months
- Small white discrete papules on the face and bridge of the nose
  - Plugged sebaceous glands
Miliaria

aka “Heat rash”

- Caused by occlusion of sweat ducts during periods of heat and high humidity

“Prickly Heat”
(crystalline)
Rashes

- **Allergic rash**
  - Contact dermatitis
  - Medications, supplements
  - Food sensitivity

- **Diaper rash**
  - Acid urine output
  - Yeast?
Eczematous rash

Younger children
- Face, elbow, knees

Older children & adults
- Hands, neck, inner elbows, back of knees, ankles
- Face (less often)
Seborrheic Dermatitis

aka “Cradle Cap”

- scalp Lesions are scaling, adherent, thick, yellow, and crusted
- can spread over the ear and down the nape of the neck

*Can be also be seen on back, intertriginous & diaper areas*
Impetigo

“Honey colored crusts”

- Highly contagious Staph. or Strep. infection
- Causes pruritis, burning, and regional lymphadenopathy
Ring worm

- Tinea corporis
- Tinea capitis
Strawberry hemangioma

Expected resolution:

- Birth: often not present or noticeable
- 1-2 months: becomes noticeable
- 1-6 months: grows most rapidly
- 12-18 months: begins to shrink
Trichotillomania

May be related to:

- Excessive emotional stress
  - Family circumstances, hospitalization, etc.
- Obsessive Compulsive Disorder
External Clues to Internal Problems
Faun tail nevus

- Tuft of hair overlying the spinal column usually in the lumbosacral area
- Associated with spina bifida occulta
Café au lait spots

- Evenly pigmented patches
  - light, dark brown, or black in dark skin
- Present at birth or shortly thereafter

May be related to:
- Neurofibromatosis
- Pulmonary stenosis
- Temporal lobe dysrhythmia
- Tuberous sclerosis

Suspect neurofibromatosis if you note >5 patches with diameters >1cm in a child under 5
Axillary Freckling or Inguinal Freckling

- May occur in conjunction with café au lait spots
- Associated with neurofibromatosis
Facial port-wine stain

When it involves the ophthalmic division of the trigeminal nerve it may be associated with:

- Sturge-Weber syndrome
  - seizures
- Occular defects
Supernumerary nipples

Especially in the presence of other minor abnormalities…

- associated with renal abnormalities
Examining the Newborn for Hyperbilirubinemia

* Natural daylight is preferred

- Examine the oral mucosa and sclera
- Inspect the whole body for “dermal icterus”
  - Starts on the face and descends
  - Bilirubin level is not high if only the face (5mg/dl)
  - May be at a worrisome level if jaundice descends below the nipples (>12 mg/dl)
- Careful inspection of all skin
  - Develop a pattern
  - Don’t overlook body parts

- Examine skin creases
  - Assymetrical creases on thighs
    - Possible hip dysplasia
  - Simian Line (hands & feet)
    - possible Down syndrome
Schamroth Technique

- Place nail surfaces of corresponding fingers together

  A. Normal: diamond shaped window
  B. Clubbed: angle between distal tips increases
Clubbing of the Nails

- Associated with:
  - Respiratory disease
  - Cardiovascular disease
  - Thyroid disease
  - Cirrhosis
  - Colitis
Skin Turgor

- Best evaluated by gently pinching a fold of the abdominal skin

“Tenting” indicates:
- Dehydration
- Malnutrition
Immune and Lymphatic
Lymph nodes in the neonate react quickly to any mild stimulus
  - especially cervical and postauricular chains

Theory: compensate for lack of antibodies by increased filtration and phagocytosis
  - Ability to produce antibodies is still immature at birth but lymphoid tissue is plentiful
Palatine Tonsils

- Much larger during early childhood than after puberty

- Enlargement of the tonsils in children is \textbf{not necessarily} an indication of a problem
  - may obstruct nasopharynx $\Rightarrow$ sleep apnea
Lymph Exam

*It is not uncommon to find enlarge lymph nodes that may even be visible from a distance…*

“Normal”
- Firm, discrete, moveable, <5mm
- Up to 1cm in cervical or inguinal regions

Investigate further if:
- Growing rapidly or suspiciously large (>2-3 cm)
- Fixed and immovable
Expected Regions of Lymph Node Enlargement

<table>
<thead>
<tr>
<th></th>
<th>&lt;1 year</th>
<th>&lt;2 years</th>
<th>&gt;2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>postauricular and occipital</td>
<td>common</td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td>cervical and submandibular</td>
<td>uncommon</td>
<td></td>
<td>common</td>
</tr>
</tbody>
</table>

*It is NEVER normal for supraclavicular lymph nodes to be enlarged!*
Common Conditions
Infectious Mononucleosis

Epstein-Barr virus

*May occur at any age (MC in teens)

- **Initial symptoms:**
  - Pharyngitis, fever, fatigue, malaise
- **Exam Findings:**
  - Enlarged anterior and posterior cervical chains
  - Splenomegaly, hepatomegaly, and/or a rash may be noted
Strep Pharyngitis

Symptoms:
- Sore throat and runny nose
- Headache, fatigue, & abdominal pain

Exam Findings:
- Palatal petichiae
- Enlarged anterior cervical nodes

*Throat culture needed to confirm
Head and Neck
Inspect the Head

- Scaling, crusting (seborheic dermatitis)
- Dilated veins (increased ICP)
- Excessive hair or unusual hairline
- Note symmetry of shape, bulging or swelling...
Cranial Molding

- During a vaginal birth the cranial bones shift and overlap
  - Expect the skull to resume a “normal” shape and size within 1 week
<table>
<thead>
<tr>
<th>Caput succedaneum</th>
<th>Cephalhematoma</th>
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</thead>
<tbody>
<tr>
<td>Subcutaneous edema</td>
<td>Subperiosteal bleed</td>
</tr>
<tr>
<td>Crosses suture lines</td>
<td>Does not cross sutures</td>
</tr>
<tr>
<td>MC occiput</td>
<td>MC parietal</td>
</tr>
<tr>
<td>Soft, poorly defined margins</td>
<td>Firm, well-defined edges</td>
</tr>
</tbody>
</table>
Unusual contour may be related to a variety of causes:

- Irregular closing of suture lines (craniosynostosis)
- Positional head deformity (PHD)
- Preterm infants: soft cranial bones flatten with the positioning and weight of the head
Inspect the Face

- Spacing of features
- Symmetry
- Skin color
- Texture
- Paralysis
Observe…

- Head control?
- Position?
- Movement?

- Note any:
  - Jerking
  - Tremors
  - Inability to move head in one direction
Palpate the Head

- Note any tenderness over the scalp
- Suture lines
  - slight groove up to 6 months
- Fontanels
  - should feel slightly depressed; some pulsation is expected

Post. fontanel closes ~2 months
Ant. fontanel closes by 24 months
Bulging?
  o  Infection
  o  Increased intracranial pressure
Depressed?
  o  Dehydration

Measure the Fontanels
- Anterior fontanel should not exceed 4-5 cm
  (<6 months)
Transilluminate

- Dark room
- Transilluminator firm against scalp
- Begin at the midline frontal region and inch over the entire head
- Observe the ring of illumination; note asymmetry
Inspect the Neck

- Symmetry, size, shape
- Edema
- Distended veins
- Pulsations
- Masses
- Webbing
- Excess skin
To inspect the newborn’s neck...

- Place the infant supine
- Elevate the upper back and let the head fall back into extension
Palpate the Neck

- Sternocleidomastoid
  - Note tone; hematoma

- Trachea

- Thyroid
  - Difficult to palpate unless it’s enlarged

  Goiter
    - Intrauterine deprivation of thyroid hormone
    - May cause respiratory distress
Common Conditions
Torticollis (“Wry Neck”)

- Birth injury
  - Hematoma
    - May be palpated shortly after birth
    - Firm fibrous mass 2-3 weeks later

- Older children
  - Result of trauma, muscle spasm, viral infection, drug ingestion, ________
Craniosynostosis

- Premature union of cranial sutures
  - Small head circumference (microcephaly)
  - Rigid sutures
  - Misshapen skull
  - Usually not accompanied by mental retardation
Microcephaly

Related to:

- Craniostenosis
- Cerebral dysgenesis
  - Associated with mental retardation and failure of brain to develop normally
Hydrocephalus

- Enlarged head
- Bossing of the skull
- Widening of sutures and fontanels
- Lethargy, irritability, weakness
- Sclera visible above the iris
  - “Sunsetting sign”
Craniotabes

- Softening of the skull
- Demonstrated by pressing the bone along the suture line... bone pops in and out

Associated with:
- Rickets and hydrocephalus
- Can be a “normal” finding
  - up to 1/3 of all newborn infants
  - more common in premature infants
Bell’s palsy (facial palsy)

Asymmetry of facial features

- Eyelid will not close completely
- Drooping corner of mouth
- Loss of labonasial fold
Down Syndrome

- Depressed nasal bridge
- Epicanthal folds
- Mongolian slant of eyes
- Low set ears
- Large tongue
Eyes
By 2-3 months…
  - Voluntary control of eye muscles

By 8 months…
  - Can differentiate colors

By 9 months…
  - Eye muscles coordinate; a single image is perceived
Inspect External Eye

- Size of eyes (symmetry?)
- Distance between the eyes
  - Hypertelorism (widely spaced eyes)
    - may be associated with mental retardation
- Slant of palpebral fissures
- Epicanthal folds
  - Prominent in Asian populations, Down syndrome?
Inspect Eyelids

To detect the “Setting Sun Sign”…

- Rapidly lower the infant from upright to supine position
- Look for sclera above the iris

Differentials include:
- Expected variant in newborn
- Hydrocephalus
- Brainstem lesion
Clinical Note

Newborn…
- eyelids may be swollen or edematous, accompanied by conjunctival inflammation and drainage as a consequence of routinely administered antibiotics

Beyond the newborn period…
- redness, hemorrhage, discharge, granular appearance may indicate infection, allergy, or trauma
Inspect

- Sclera
- Pupil
- Iris
- Conjunctiva
Coloboma
aka “Keyhole pupil”

- Loss of functional pupil
- Often associated with other congenital abnormalities

Brushfield spots

- White specks in a linear pattern around the circumference of the iris
  - Suggests Down syndrome
Strabismus?

Exoptropic vs. Esotropic

Tests include:
- Corneal light reflex (Hirschberg’s Test)
- Cross-Cover Test
- Cover-Uncover Test
Infant Cranial Nerves (II, III, IV, VI)

1. Expect the infant to focus and track through 60 degrees

2. Optical blink reflex
   - Shine a bright light at the infant’s eyes
   - Note the quick closure of the eyes and dorsiflexion of the head

3. Corneal light reflex (Hirschberg’s)
Extraocular Movements - Child

- Six cardinal fields of gaze
- Peripheral vision
  - Parent may hold the child’s head still
  - Use a teddy bear or toy
  - Have child sit on parent’s lap
Visual Acuity

Infant
- Grossly examined by observing the infant’s preference for looking at certain objects

Younger Children
- Observe play with toys - stacking, building, or placing objects inside of others
  - If tasks are performed well, vision difficulties are unlikely
Snellen E Chart*

- Tested when a child can cooperate with the exam
  - Usually ~3 years of age

- Ask which way the “legs” are pointing

*Also available with different shapes
Remember:

- Test each eye separately
- With and without corrective lenses

20/25 +2

Means that they can read all on the 20/25 line and 2 from the 20/20 line
Anticipated Visual Activity

<table>
<thead>
<tr>
<th>Age</th>
<th>Visual Acuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 years</td>
<td>20/50</td>
</tr>
<tr>
<td>4 years</td>
<td>20/40</td>
</tr>
<tr>
<td>5 years</td>
<td>20/30</td>
</tr>
<tr>
<td>6 years</td>
<td>20/20</td>
</tr>
</tbody>
</table>
Red Reflex

*Performed from birth on… should be elicited in every newborn!

- Observe for opacities, dark spots, or white spots within the circle of red glow
  - Congenital cataracts
  - Retinoblastoma
Congenital Cataracts

- Requires a full metabolic, infectious, systemic, and genetic workup...

Common causes:
- Infectious diseases
  - Toxoplasmosis, Rubella (MC), Cytomegalovirus, & Herpes
- Hypoglycemia
- Trisomies
- Prematurity
- Etc.
Ears
Developmental Features

- External auditory canal – shorter, has an upward curve
  - Infant otoscopic exam – “pull downward”
- Eustachian tube – relatively wider, shorter and more horizontal
  - Reflux of nasopharyngeal secretions
- Growth of adenoids may occlude the eustachian tube
  - Interferes with aeration of the middle ear
Inspect the Ear

- Well formed
  - all landmarks present

- Flexible
  - should have instant recoil after bending

- Position
  - the tip of the auricle should cross an imaginary line between the outer canthus of the eye and the prominent portion of the occiput (EOP)

- No skin tags or preauricular pits should be present
Low or poorly shaped auricles... associated with renal disorders and congenital abnormalities
Palpate

- Lymph nodes
- Pinna
- Tragus
- Mastoid
  - Tenderness?
  - Warmth?

*If pain is noted with palpation of the mastoid, suspect mastoiditis…
Otoscopic Exam – Infant

1. Lay the infant supine/prone
2. Turn head to the side
3. Hold otoscope so that the ulnar surface of your hand rests against the infant’s head
   *Prevent trauma to auditory canal
4. Other hand stabilizes infant’s head
5. Pull auricle down to straighten the canal
Newborn Variants

You may note…

- Limited mobility
- Dullness and opacity of a pink or red tympanic membrane
- Light reflex may appear diffuse
  - Tympanic membrane is not conical for several months
- Auditory canal may be obstructed with vernix

*Otoscopic exam should be performed within the first few weeks of life*
Otoscopic Exam – Child

- Pull auricle either down and back OR up and back
  - best view of the tympanic membrane

- Postpone until the end of the visit
- Best done on parent’s lap
- Be prepared to use restraint if encouraging the child fails
  - Ask the parent to restrain the child
Restraining a Child - Otoscope

- Face the child sideways with one arm placed around parent’s waist
- Parent holds the child firmly against his/her trunk
  - One arm restrains the head
  - One arm restrains the body
- Doctor further stabilizes the child’s head while inserting the otoscope
Clinical Note

“Red reflex”

- If the child is crying or has recently cried vigorously… dilation of blood vessels in the tympanic membrane can cause redness

You cannot assume that redness of the membrane alone is a middle ear infection!
Pneumatic Otoscopy

- Assesses mobility of the tympanic membrane
  - needed to differentiate

| Crying – Red Reflex | Red
|---------------------|-----
| Moveable            |     |
| Infection           | Red
| No mobility         |     |
Common Conditions
Otitis Externa

- Infection of the auditory canal
  - History of trauma or moist environment
  - Itching in the ear canal
  - Intense pain with movement of pinna; chewing
  - Discharge may be watery at first, then purulent & thick mixed with pus and epithelial cells
    - Musty, foul-smelling
  - Conductive hearing loss (exudate and swelling)
  - Canal is red, edematous; tympanic membrane obscure
Bacterial Otitis Media

Infection of the middle ear

- MC infection in childhood
- Often follows or accompanies URTI

- Fever, feeling of blockage, tugging earlobe, anorexia, irritability, dizziness, vomiting & diarrhea
- Deep-seated earache
- Discharge if tympanic membrane ruptures or through tympanostomy tubes; foul-smelling
- Conductive hearing loss (fills with pus)
- Tympanic membrane may be red, thickened, bulging; full, limited, or no movement
Otitis Media with Effusion

- Collection of liquid (effusion) in the middle ear

Associated with:
- Allergies
- Enlarged lymph tissue
- Obstructed or dysfunctional eustachian tube
Otitis Media with Effusion

- Sticking or cracking sound on yawning or swallowing; no signs of acute infection
- Pain is uncommon; feeling of fullness
- Discharge is uncommon
- Conductive hearing loss as middle ear fills with fluid
- If chronic, may delay speech development temporarily
- Tympanic membrane is retracted, impaired mobility, yellowish; air fluid level and/or bubbles
Nose
Development

- Maxillary and ethmoid sinuses
  - present at birth, though very small

- Sphenoid sinus
  - tiny cavity at birth
  - not fully developed until puberty

- Frontal sinus
  - develops by 7-8 years
Inspection

- Symmetric appearance
- Positioned in the vertical midline on the face
- Only minimal movement of the nares with breathing should be apparent

Possible congenital abnormality if...
- Saddle-shaped nose with a low bridge and broad base
- Short small nose
- Large nose
“Adenoidal” or “Allergic Salute”

- Transverse crease at the juncture between the cartilage and the bone of the nose

- Children often wipe their noses with an upward sweep of the palm of the hand
  - If repeated often enough, causes a crease
Nasal Patency

Must be determined at the time of birth…

- Mouth closed, occlude one naris and then the other
- Observe the respiratory pattern
  - With total obstruction, the infant will not be able to inspire or expire through the noncompressed naris

dDx: Septal deviation, choanal atresia
Choanal Atresia

- Congenital nasal obstruction of the posterior nares
  - Junction between nasal cavity and nasopharynx

- Newborns may experience respiratory distress and difficulty feeding
  - Obligatory nose breathers

*Will breathe when crying*
Sinuses

Infant
- Maxillary and ethmod sinuses are small
- Few problems arise in these areas and examination is generally unnecessary

Child
- Maxillary sinuses should be palpated
- Few sinus problems occur since the sinuses are still developing

There is wide variation however... do not rule out sinusitis simply on the basis of age!
Sinusitis

- Infection of one or more paranasal sinuses
  - May be a complication of a viral URTI, dental infection, allergies, or a structural defect of the nose

Signs in children include:
- upper respiratory symptoms
- nasal discharge
- low-grade fever
- daytime cough
- malodorous breath
- cervical adenopathy
- intermittent painless morning eye swelling
- NO facial pain or headache
Developmental Features

- Salivation increases by 3 months
- Infant drools until swallowing is learned

Teeth
- 20 deciduous teeth appear (6-24 months)
- Eruption of permanent teeth begins about 6 years of age and is completed by 14-15 yrs
- 3rd molar ("wisdom tooth") ~18 years old
Inspection

- **Tongue**
  - should fit well in the floor of the mouth
  - protrude beyond the alveolar ridge

- **Frenulum**
  - usually attaches midway between the ventral surface of the tongue and its tip
Macroglossia
(abnormally large tongue)
- Congenital hypothyroidism
- Congenital abnormalities
- Down Syndrome

Short Frenulum
- Feeding problems
- Speech difficulties
- Gums
  - smooth; serrated edge along the buccal margins

- Teeth
  - count deciduous teeth
  - note any unusual sequence of eruption
Natal Teeth
- Teeth or tooth buds in a newborn
- Potential for aspiration
- May be removed

Retention Cysts
(aka Epstein Pearls)
- Appear along the buccal margins of the gums
- Pearl-like retention cysts
- Disappear in 1-2 months
Baby bottle syndrome
- Multiple brown caries on upper and lower incisors
d/t bedtime bottle of juice/milk

Black or grey colored teeth
- Pulp decay
d/t oral iron therapy

Mottled or pitted teeth
- Enamel dysplasia
d/t tetracycline treatment during tooth development

Flattened edges on the teeth
- Bruxism – unconscious grinding of the teeth
- Buccal mucosa
  - Should be pink and moist, no lesions
  - Scrape any white patches with a tongue blade

Nonadherent = milk deposits
Adherent = candidiasis (thrush)
- Palate
  - Should be well-formed with no cleft

Infant
  - Narrow, flat palate roof or a high, arched palate?
    - may result in feeding and speech problems
    - associated with congenital anomalies

Child
  - Highly arched palate?
    - seen in chronic mouth breathers
Cleft Lip and Palate

- Congenital malformation
- Fissure in the upper lip and/or palate
  - Complete cleft – extends through the lip and hard and soft palates to the nasal cavity
  - Partial Cleft – any of the tissues

Long term issues:
- feeding problems
- speech difficulties
- improper tooth development and alignment
- chronic otitis media
- hearing loss
Tonsils

- Should blend with the color of the pharynx
- Peak size between 2 - 6 years
- Should retain unobstructed passage

Graded to describe their size

1+ visible
2+ halfway between tonsillar pillars and the uvula
3+ nearly touching the uvula
4+ touching each other
Tonsillitis

- Inflammation or infection of the tonsils
  - Frequently caused by streptococci
    - Sore throat, referred pain to the ears, dysphagia, fever, fetid breath, and malaise
    - Tonsils appear red and swollen; purulent exudate
      - yellow follicles are associated with strep.
    - Anterior cervical lymph nodes enlarged
Peritonsillar Abscess

- Infection of the tissue between the tonsil and pharynx
  - Complication of tonsillitis
  - Dyphagia, drooling, severe sore throat with pain radiating to the ear, muffled voice, fever
  - Tonsil, tonsillar pillar and adjacent soft palate become red and swollen
  - Tonsil may appear pushed forward or backward, possibly displacing the uvula
Drooling
  - Normal in infancy

If it persists past 12 months…
  - consider a neurologic disorder

If acute…
  - consider epiglotitis
Tips – Infant Mouth Exam

- Crying provides an opportunity to examine the mouth
- Avoid depressing the tongue
  - Stimulates the “Tongue Thrust Reflex”
  - Makes visualization of the mouth difficult
Tips – Child Mouth Exam

- To reduce fear, let the child hold and manipulate the tongue blade and light.
- Start by asking to see their teeth.
  - Usually not threatening.
- Ask the child to protrude the tongue and say “ah”, a tongue blade is often unnecessary.
- To raise the palate, ask the child to pant “like a puppy”.
If child refuses to open mouth…

- Insert a tongue blade through the lips to the back molars
- Gently but firmly insert the tongue blade between the back molars and press the blade to the tongue
- This should stimulate the gag reflex
  - Gives you a brief view of the mouth and oropharynx
Chest and Lungs
Newborn Apgar Score

Subjective qualitative evaluation

- done at 1 and 5 minutes
- determine “survivability” of the newborn by observing the level of function of 5 components

- Muscle tone
- Heart rate
- Reflex irritability
- Color
- Respiratory rate

\[ \text{Activity} \]
\[ \text{Pulse} \]
\[ \text{Grimace} \]
\[ \text{Appearance} \]
\[ \text{Respirations} \]
## Apgar Score

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate</td>
<td>Absent</td>
<td>&lt;100</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Respiratory effort</td>
<td>Absent</td>
<td>Slow/irregular</td>
<td>Easy; Good crying</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Limp</td>
<td>Some flexion of extremities</td>
<td>Active motion</td>
</tr>
<tr>
<td>Reflex irritability</td>
<td>No response</td>
<td>Grimace, slow</td>
<td>Lusty cry</td>
</tr>
<tr>
<td>Color</td>
<td>Blue/pale</td>
<td>Acrocyanosis</td>
<td>Pink</td>
</tr>
</tbody>
</table>
Depressed Respiration

- Maternal environment during labor
  - Sedatives
  - Compromised blood supply to the child
- Mechanical obstruction by mucus
- Neurological damage (birth trauma)?
  - Infants rely primarily on the diaphragm for respiratory effort (C3,4,5…)
Development

- Bony structure is more prominent than the adult due to a relatively thin chest wall.

- More cartilaginous and yielding
  - How will this affect the adjustment?

- Xiphoid process is often more prominent and a bit more movable.
Inspection

- Chest is generally round
  - A-P diameter approximately the same as the transverse

If the “roundness” of a child’s chest persists past the 2nd year, suspect a possible chronic obstructive pulmonary problem…
Nipples

- Symmetry in size
- Swelling
- Discharge
- Supernumerary

Breast development in a newborn d/t hormonal influences

Measure distance between the nipples
  - Should be ¼ chest circumference
Respiratory Rate

- Count for 1 minute
  - Average: 40-60 rpm (80 rpm is not uncommon)

If room temp is very warm or cool, variation in the rate occurs

- Most often tachypnea
- Sometimes bradypnea
Respiratory Rhythm

- Note regularity of respiration
  - Premature infants are more likely to have irregular respiratory patterns

Periodic breathing
- sequence of relatively vigorous respiratory efforts followed by apnea of as long as 10-15 seconds
Periodic Breathing

Cause for concern if …
- Apneic episodes tend to be prolonged
- Baby becomes centrally cyanotic

- In the term infant periodic breathing should wane a few hours after birth
- Persistence in preterm infants is relative to gestational age
  - Apneic periods should diminish in frequency as they approach term status
Observe Chest Expansion

- If asymmetric, suspect inability to fill one of the lungs
  - Pneumothorax
    - Presence of air/gas in the pleural cavity
  - Diaphragmatic hernia
    - May hear “clicks & gurgles”
Palpate

- Rib cage and sternum
  - Loss of symmetry
  - Unusual masses
  - Crepitus
    - Fractured clavicle (birth trauma)
      - May show no evidence of pain

- Xiphoid
  - Mobile and prominent
Auscultation – Infant

- Localization of breath sounds is difficult
  - Breath sounds are easily transmitted from one segment to another

*Difficult to detect absence of breath sounds in any given area*
Auscultation – Child

- May not be able to give enough of an expiration to satisfy you (<5 years old)
  - Especially with subtle wheezing
  - Ask them to “blow out” your penlight
  - Ask them to blow away a bit of tissue in your hand
  - Listen after they run up and down the hallway
Chest wall is thinner and more resonant than adult’s

- Breath sounds may sound louder, harsher, and more bronchial
- Hyperresonance is common
  - Easy to miss the dullness of underlying consolidation (percussion)

“If you sense some loss of resonance, give it as much importance as you would give frank dullness in the adult.”
Tips – Lung Exam

- Percussion is usually unreliable in the infant
  - Examiner’s fingers may be too large

- A sob is frequently followed by a deep breath
  - Allows the evaluation of vocal resonance
  - Feel for tactile fremitus
    - Whole hand, palm and fingers
Crackles and Ronchi

- Not uncommon immediately after birth (fluid has not completely cleared)
  - If asymmetric, a problem should be suspected…
    - dDx: aspiration of meconium

Respiratory Grunting

- Infant tries to expel trapped air or fetal lung fluid while trying to retain air and increase oxygen levels
  - If persistent, cause for concern
Stridor

- High pitched, piercing sound
  - Cannot be dismissed as inconsequential… especially when inspiration is longer than expiration

✓ Floppy epiglottis
✓ Congenital defects
✓ Croup

✓ Edematous response
  - Infection
  - Allergen
  - Smoke
  - Chemicals
  - Aspirated foreign body
Increased Respiratory Effort

- Retraction at the supraclavicular notch
- Contraction of the SCM’s
- Flaring of the nostrils
- Obvious intercostal exertion (retractions)
- Tachypnea

“See-saw” respirations
Does a loss of synchrony between L and R occur during the respiratory effort? Is there a lag in movement of the chest on one side? Atelectasis? Diaphragmatic hernia?

Is there stridor? Croup? Epiglottitis?

Is there retraction at the suprasternal notch, intercostally, or at the xiphoid process?

Do the nares dilate and flare with respiratory effort? Is pneumonia present?

Is there an audible expiratory grunt? Is it audible with the stethoscope only or without? Is there lower airway obstruction? Focal atelectasis?

Is there paradoxic breathing?
| INSPECTION                     | Tachypnea  
|                               | Shallow breathing  
|                               | Flaring of nostrils  
|                               | Occasional cyanosis  
|                               | Limited movement; splinting  
| PALPATION                     | Increased fremitus (consolidation)  
| PERCUSSION                    | Dullness (consolidation)  
| AUSCULTATION                  | Variety of crackles  
|                               | Occasional rhochi  
|                               | Bronchial breath sounds  
|                               | Egophony, bronchophony, whispered pectoriloquy  |
| INSPECTION                  | Occasional tachypnea  
|                            | Occasional shallow breathing  
|                            | Often no deviation from expected findings  |
| PALPATION                  | Tactile fremitus undiminished  |
| PERCUSSION                 | Resonance  |
| AUSCULTATION               | Breath sounds may be prolonged  
|                            | Occasional crackles  
<p>|                            | Occasional expiratory wheezes  |</p>
<table>
<thead>
<tr>
<th>Method</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSPECTION</td>
<td>Tachypnea</td>
</tr>
<tr>
<td></td>
<td>Dyspnea</td>
</tr>
<tr>
<td>PALPATION</td>
<td>Tachycardia</td>
</tr>
<tr>
<td></td>
<td>Diminished fremitus</td>
</tr>
<tr>
<td>PERCUSSION</td>
<td>Hyper-resonance</td>
</tr>
<tr>
<td></td>
<td>Limited diaphragmatic descent; lower diaphragmatic level</td>
</tr>
<tr>
<td>AUSCULTATION</td>
<td>Prolonged expiration</td>
</tr>
<tr>
<td></td>
<td>Wheezes</td>
</tr>
<tr>
<td></td>
<td>Diminished lung sounds</td>
</tr>
</tbody>
</table>
Heart
Fetal Circulation

- Compensates for the non-functional fetal lung
  - Blood passes directly from the R to L atrium through the foramen ovale
  - Right ventricle pumps blood through the ductus arteriosus

- At birth... functional closure of foramen ovale and the ductus arteriosus closes within 24-48 hours
Patent Ductus Arteriosus

- Blood flows through the ductus during systole and diastole
  - Increases pressure in the pulmonary circulation
  - Increased workload for the right ventricle

Small shunt: may be asymptomatic
Large shunt: may have dyspnea on exertion

“Machinery murmer”
- Harsh, loud, continuous murmur
- 1st - 3rd intercostal spaces & lower sternal border
- Usually unaltered by postural changes
Patent Foramen Ovale

- Allows blood to flow between the right and left atria
  - Usually asymptomatic
  - May exhibit cyanosis with exertion (especially if other congenital heart defects are present)
Heart Exam

- Examine within the first 24 hours and again at 2-3 days of age
  - Changes from fetal to systemic and pulmonary circulation

- Complete evaluation of heart function includes skin, lungs, & liver…
  - Congestive heart failure in the infant may present with a large, firm liver (hepatomegaly)
    - Unlike adults, this finding may be noted before pulmonary crackles
Inspection

- Color: should be “pink”

Purplish?
  dDx: polycythemia

Ashy, white?
  dDx: shock

Central cyanosis?
  dDx: congenital heart disease

Distribution & intensity of discoloration.
Extent of change after exertion.
Capillary Refill

- Capillary refill time is very rapid up to 2 yrs
  - < 1 second (normal)

- Prolonged capillary refill time (> 2 seconds)
  dDx:
  - Significant dehydration
  - Hypovolemic shock
Apical Impulse

- 4th - 5th left intercostal space, medial to the midclavicular line
  - Apex of the heart is higher, heart lies more horizontal

*Adult heart position is reached by age 7
Enlargement? Position?

- **Pneumothorax**
  - Shifts apical pulse away from the area of pneumothorax

- **Diaphragmatic hernia**
  - MC on the left side
  - Shifts the heart to the right

- **Dextrocardia**
  - Apical impulse on the right
Dextrocardia & Sinus Invertus

- **Dextrocardia**
  - Right thoracic heart & normally placed stomach and liver
  - May be associated with other anomalies

- **Sinus Invertus**
  - Heart and stomach are on the right, liver on the left
  - Not very common
Pulses

- Brachial, radial, and femoral pulses are palpable

Weak or thin pulse dDx:
- Decreased cardiac output
- Peripheral vasoconstriction

Bounding pulse dDx:
- L to R shunt; PDA (patent ductus arteriosus)

Difference in pulse amplitude between femoral and radial pulses dDx:
- Coarctation of the Aorta
Heart Rate

- Heart rate is more variable
  - Infants: eating, sleeping, and waking
  - Children: exercise, tension, fever
    - ↑ HR 10-20 beats for each degree temp. ↑

Sinus arrhythmia is common in children
- Rate varies in a cyclical pattern
  - Faster on inspiration
  - Slower on expiration

Fixed tachycardia may indicate difficulty
# Heart Rate

<table>
<thead>
<tr>
<th>Age</th>
<th>Beats per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>120-170</td>
</tr>
<tr>
<td>1 year</td>
<td>80-160</td>
</tr>
<tr>
<td>3 years</td>
<td>80-120</td>
</tr>
<tr>
<td>6 years</td>
<td>75-115</td>
</tr>
<tr>
<td>10 years</td>
<td>70-110</td>
</tr>
</tbody>
</table>
Murmurs
- Relatively frequent in the first 48 hours
- Most are innocent; transition from fetal to pulmonic circulation

“Innocent murmurs”
- Disappear within 2-3 days (“short”)
- Grade I or II intensity (“soft”)
- Systolic
- Unaccompanied by other signs and symptoms
A murmur is usually NOT a significant congenital anomaly. Paradoxically, a significant congenital anomaly may be unaccompanied by a murmur…

- Must investigate if…
  - persists beyond 2nd or 3rd day of life
  - is intense
  - fills systole
  - occupies diastole to any extent
    - almost always significant
  - radiates widely
Venous hum

Caused by turbulence of blood flow in the internal jugular vein
- Continuous low-pitched sound
- Louder during diastole
- Common in children
- Usually has no pathologic significance

Ask child to sit with head turned away & tilted slightly upward
- Auscultate supraclavicular space
Blood Pressure

- Flush Technique (Infant)
  - Place cuff on upper arm (or leg)
  - Elevate and wrap the arm firmly with an elastic bandage from fingers to antecubital space
    - Empty veins and capillaries
  - Inflate cuff to a pressure above the systolic reading you expect
  - Lower the arm and remove the bandage
    - Arm will be pale
  - Diminish pressure gradually until you see a sudden “flush” and return to usual color
Blood Pressure

- Blood pressure is measured the same as in the adult after 2 years

- To facilitate the exam...
  - Explain the process
  - Let them explore the sphygmomanometer

- Make sure to use the correct cuff size!
  - Cover 2/3 of arm
Hypertension – Infant

- A sustained increase in BP is almost always significant in the newborn
  - Stenosis of renal artery
  - Coarctation of the aorta
  - Cystic disease of the kidney
  - Neuroblastoma
  - Wilms tumor
  - Hydronephrosis
  - Adrenal hyperplasia
  - CNS disease
Hypertension – Child

- Do not make the diagnosis of hypertension based on one reading
- An elevated systolic but normal diastolic may be d/t transient anxiety

<table>
<thead>
<tr>
<th>Significant</th>
<th>90th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe</td>
<td>95th percentile</td>
</tr>
</tbody>
</table>

*If consistently above the 95th percentile, dDx include:
  - Kidney disease
  - Renal arterial disease
  - Coarctation of the aorta
If there’s known heart disease…

Take careful note of:
- Weight gain (or loss)
- Developmental delay
- Cyanosis
  - Congenital heart defects that impede oxygenation
- Clubbing
  - fingers and toes
Abdomen
Tips – Abdomen Exam

- Relaxation and quiet
  - Bottle/pacifier/nursing
  - On parent’s lap
    - Dr. sits facing the parent, knees touching

- Use the respiratory cycle
  - Abdomen should be soft during inspiration
  - If abdomen remains hard during both inspiration and expiration, suspect peritoneal irritation
Ticklish?
- Firm touch
- Place the child’s hand under your palm leaving your fingers free to palpate

Tenderness and pain can be difficult to detect and localize
- Distract the child with a toy
- Start away from the area suspected
- Observe for changes... as you move to identify the area of greatest pain
  - Change in pitch of crying
  - Rejection of the opportunity to suck
  - Drawing the knees to the abdomen
  - Facial expression
  - Constriction of pupils
Inspection

- Movement with respiration
- Shape
- Contour
- Pulsations
  - Pulsations: common in infants
  - Distended veins dDx: vascular obstruction, abdominal distension or abdominal obstruction
  - Spider nevi dDx: liver disease
Infant…

- Abdomen should be rounded and dome shaped
  - Distended abdomen?
    - Feces, mass, organ enlargement
  - Scaphoid abdomen?
    - Abdominal contents are displaced

- Abdominal and chest movements should be synchronous
  - slight bulge of the abdomen at the beginning of respiration
Toddler

- Abdomen protrudes slightly “pot-bellied”

After age 5…

- Abdomen may become concave when laying supine

- Respirations continue to be abdominal until 6-7 years of age
  - In young children, restricted abdominal respiration may be related to peritoneal irritation
Umbilical stump

- should be dry and odorless

Inspect all skin folds for:

- Discharge
- Redness
- Induration
- Skin warmth
- Granulomatous tissue
Granuloma

- Serous or serosanguinuous discharge once the stump has separated
- No other signs of infection
- Umbilicus is usually inverted
  - Often everts with increased abdominal pressure

- Note any protrusion through the umbilicus or rectus abdominus muscle
  - Hernia
  - Diastasis recti
Umbilical Hernia

- Protrusion of omentum and intestine through the umbilical opening

- Common in infants
  - Reach maximum size by 1 month
  - Generally close spontaneously by 1-2 years

- To determine size, measure the diameter of the opening (not the protruding contents)

- Should “reduce” with light pressure
Diastasis Recti

- Midline separation (1-4 cm) of the rectus abdominus
  - between the xiphoid and umbilicus
- No need to repair in most cases
  - herniation through the rectus abdominus does require surgery
- Usually resolves by 6 years of age
Peristaltic Waves

- Use tangential lighting
- Observe abdomen at eye level

Usually not visible
- Sometimes seen in thin, malnourished babies
- Suggests intestinal obstruction
Auscultation

- Peristalsis ("metallic tinkling")
  - Heard every 10-30 seconds
  - Bowel sounds should be present 1-2 hours after birth

- No bruits or venous hum should be detected
Light Palpation

- Knees flexed
- Place your hand gently on the abdomen
  - Thumb at the right upper quadrant
  - Index finger at the left upper quadrant
- Press very gently at first, only gradually increasing pressure
- Identify the spleen, liver, and masses close to the surface
Spleen

- Palpable 1-2 cm below the left costal margin for the first few weeks after birth

- A detectable spleen tip is common in well infants but increase in spleen size may indicate:
  - blood dyscrasias
  - septicemia
Liver (lower border)
- Newborn: just below the right costal margin
- Infants & toddlers: 1-3cm below
- Children: 1-2cm below

Hepatomegaly: lower border >3 cm below the right costal margin
- Infection
- Cardiac failure
- Liver disease
Deep Palpation

- Palpate all quadrants for masses
  - Location
  - Size
  - Shape
  - Tenderness
  - Consistency

Transillumination can be used to distinguish cystic from solid masses...
- Fixed masses should be investigated with special studies if...
  - Laterally mobile
  - Pulsatile
    - Palpate the aorta for signs of enlargement
  - Located along vertebral column

If any suspicion of neoplasm exists, limit palpation of the mass
  - May cause injury or spread of malignancy!
Nephroblastoma (Wilms Tumor)

- MC intraabdominal tumor of childhood (2-3 years of age)
- Malignant
  - Firm, non-tender mass deep within the flank
  - Only slightly moveable
  - Not usually crossing the midline; sometimes bilateral
  - Possibly:
    - Low-grade fever
    - Hypertension
Neuroblastoma

- Frequently appears as a mass in the adrenal medulla
- Malignancy in early childhood
  - Firm, fixed, non-tender, irregular and nodular abdominal mass
  - Malaise
  - Loss of appetite
  - Weight loss
  - Protrusion of eye(s)
  - Other symptoms may occur with:
    - compression of the mass or
    - metastasis to adjacent organs
Percussion

- May be more tympanic (vs. adults)
  - Swallow air when feeding & crying

  Tympany with distended abdomen?
  - Gas

  Dullness with distended abdomen?
  - Fluid, solid mass
Examine the Bladder

- Palpate and percuss over the suprapubic area
- Determine size
- Distention?
Rebound Tenderness

- Observe child’s facial expression and pupils
- Be cautious...

Once a child has experienced palpation that is too intense, a subsequent examiner has little chance for easy access to the abdomen
Intussusception

- Prolapse of one segment of intestine into another resulting in intestinal obstruction
- MC 3-12 months old; cause is unknown
  - Acute intermittent abdominal pain
  - Abdominal distention
  - Vomiting
  - Stools mixed with blood and mucus
    - Red current jelly appearance
  - Sausage-shaped mass in R or L upper quadrant
  - R lower quadrant feels empty (Dance sign)
Intussusception – “ABCDEF”

A bdominal or anal “sausage”
B lood from the rectum
C olic: babies draw up their legs
D istention, dehydration, and shock
E mesis
F ace pale
What if you find…?

- Olive-shaped mass in the right upper quadrant (deep palpation) immediately after the infant vomits
  …Pyloric stenosis
Pyloric Stenosis

- Hypertrophy of the circular muscle of the pylorus or obstruction of the pyloric sphincter
  - Regurgitation ~> projectile vomiting
  - Feeding eagerly (even after vomiting)
  - Failure to gain weight
  - Signs of dehydration
  - Small, rounded mass palpable in the R upper quadrant
    - especially after the child vomits
Gastroesophageal Reflux (GER)

- Relaxation or incompetence of the lower esophagus persisting beyond the newborn period
  - Regurgitation and vomiting
  - Weight loss and failure to thrive
  - Respiratory problems
    - aspiration
  - Bleeding from esophagitis
Omphalocele

- Intestine present in the umbilical cord or protruding from the umbilical area
  - Visible through a thick transparent membrane