JoVE: Science Education

Newborn Infant Physical Exam

--Manuscript Draft--

Manuscript Number:	10003
Full Title:	Newborn Infant Physical Exam
Article Type:	Manuscript
Section/Category:	Manuscript Submission
Corresponding Author:	Aimee C. Knorr UNITED STATES
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	
Corresponding Author's Secondary Institution:	
First Author:	Aimee C. Knorr
First Author Secondary Information:	
Order of Authors:	Aimee C. Knorr
	Elizabeth Doherty
Order of Authors Secondary Information:	

Authors Names

Aimee C. Knorr, MD and Elizabeth G. Doherty, MD

Department of Newborn Medicine, Boston Children's Hospital and Winchester Hospital.

Clinical Skills Education Title

Newborn Infant Physical Exam

Overview

The physical exam of a newborn infant is an important skill for the clinician to master. Detailed history taking including family, maternal, pregnancy, and perinatal information along with the infant's physical exam provides the first complete account of the infant's well-being. A careful examination soon after delivery allows the physician to detect anomalies or presence of distress, which may compromise a newborn's successful adaptation to extra-uterine life. After the infant has transitioned from fetal to neonatal life, another detailed physical exam should be performed. When feasible, parental presence during the exam is beneficial in order to allow the student or other health care providers to ask additional questions and to explain any findings that may provoke anxiety.

Procedure and representative findings

There is no exact ordered sequence to the newborn physical exam. However, it is most useful if certain parts of the exam are done while the infant is quiet (those include heart, lung and abdomen examination), while other parts of the exam are best performed while the infant is alert and active.

Comment [DM1]: Aaron, you asked the authors to specify which parts of the exam were best done in what state, and to divide the procedure section based on state of alertness. They've done so.

1. General examination:
1.1 Remove any clothing on the infant and perform the exam either on a warmer or in an open crib being mindful of the duration of the exam, as infants can easily get cold.
1.2 Obtain a full set of vital signs* (temperature, heart rate, respiratory rate, blood pressure, and oxygen saturation in room air) and growth parameters (weight, length, and head circumference, and percentiles on growth chart based on gestational age).
* Vital sign normal ranges

- Temperature: 36.1- 37^0 C
- Heart Rate: 120-160 beats per minute
- Respiratory Rate: 40-60 breaths per minute
- Blood Pressure: As a general guideline, normal mean BP approximates gestational age plus 2-5 mmHg.
- Saturations in room air: Refer to Neonatal Resuscitation Program guidelines for oxygen saturation parameters during first 5 minutes of life. Thereafter, saturations generally range in mid to high 90s.

1.3 Assess state (e.g. alert, active, sleeping, in no apparent distress or in distress).

1.4 Assess posture (e.g. flexion, extension, position). Infants in breech positioning in utero frequently demonstrate hip flexion/leg extension at birth.

1.5 Note color (e.g. pink, pallor, central cyanosis, mottled, acrocyanosis). Most infants will demonstrate acrocyanosis shortly after delivery. Acrocyanosis may persist for first few days of life. Central cyanosis is best visualized on the tongue and mucous membranes.

1.6 Note any overt dysmorphisms (e.g. stigmata of trisomy 21), deformations (e.g. metatarsus adductus), or malformations (e.g. cleft lip).

2. Heart examination

2.1 Observe precordial activity. Locate the point of maximal impact (PMI- where the cardiac impulse can be best palpated on the chest wall).

Comment [AK2]: Heart exam best when infant is at rest/asleep

2.2. Auscultate utilizing bell and diaphragm components of the stethoscope. The bell is most effective at transmitting lower frequency sounds, while the diaphragm is most effective at transmitting higher frequency sounds.

2.3 Assess rate, rhythm, and quality of heart sounds.

2.4 Note presence or absence of murmur. If present, describe quality (intensity, grade I-VI/location/radiation). Many newborn infants will have a benign transient murmur as the ductus arteriosus closes. This murmur is often described as “machinery-like” or harsh in quality and is appreciated under the clavicle with some radiation down left sternal border.

2.5 Assess peripheral pulses (femoral, brachial, and radial with noted amplitude and equality).

2.6 Assess peripheral perfusion (capillary refill time in seconds). To assess capillary refill time, the examiner holds pressure with their finger in the midline of the infant’s sternum for 5 seconds as the skin color under the finger becomes pale/white. After releasing the pressure, count the seconds elapsed for the baseline color to return (normal is ≤ 2 seconds).

3. Chest and lungs examination

Comment [AK3]: Best at rest or asleep

3.1 Assess symmetry of the chest (chest asymmetry may suggest tension pneumothorax).

3.2 Inspect the breast- assess the size, location, and symmetry of the breast buds and the development of the areola. Premature infants lack developed breast tissue. Full-term newborns (male and female) have raised areola with breast buds ranging from a few millimeters to 10 millimeters. Widely spaced nipples are suggestive of chromosomal anomaly (Turner syndrome).

3.3 Note pattern of breathing (regular respiratory rate, periodic breathing, or episodes of apnea can all be developmentally normal depending on infant’s gestational age).

3.4 Observe for presence of grunting, flaring, or retractions, which are signs of respiratory distress.

3.5 Auscultate breath sounds. Note quality (clear/rales/rhonchi/wheezes) and equality.

4 Abdominal examination

Comment [AK4]: Better when infant at rest or asleep

4.1 Observe for symmetry, notable organomegaly, and any intestinal movement.

4.2 Auscultate for bowel sound activity in all 4 quadrants.

4.3 Palpate abdomen starting from lower to upper quadrants. Flex knees and hips if needed to relax abdominal musculature.

4.4 Note the location of the liver and spleen in relation to the costal margins. In a normal newborn infant, the liver may be palpated 1-3 cm below the costal margin. The spleen is usually not palpable.

4.5 Inspect the umbilical cord (presence, absence, dry, moist, and number of vessels). The umbilical cord usually has 2 arteries and one vein. A single umbilical artery is seen in ~ 0.2-0.6 % of singleton births. A single umbilical artery is associated with increased rate of chromosomal or other congenital anomalies such as renal abnormalities. **[Figure 1]**

5. Examination of genitalia

5.1 Male infant

5.1.1 Observe for gross abnormalities in penile length, scrotal development, and location. Penile length is measured from pubic bone to tip (< 2 cm is defined as micropenis).

5.1.2 Palpate testes. Identify presence of both testes and location (in scrotal sac, at inguinal canal, not palpated). A nontender testicle with discoloration of the scrotum may indicate prenatal testicular torsion.

5.1.3 Inspect for any inguinal hernias.

5.1.4 Note phimosis, urethral meatus patency and position, hypospadias, and hydroceles. The most common abnormality of the position of the urethral meatus is hypospadias resulting in abnormal ventral placement of the urethral opening.

5.1.5 Observe placement and patency of the anus.

5.2 Female infant

5.2.1 Note size of the labia majora, labia minora, and clitoris. The labia minora and clitoris are prominent in preterm infants.

5.2.2. Observe for any discharge from the vagina (creamy white or on occasion bloody pseudomenses from maternal estrogen withdrawal).

5.2.3 Note any mucosal tags, cysts, or presence of imperforate hymen. Assess placement and patency of the anus.

6. Hips examination

6.1 Flex hips and knees 90 degrees. Place middle finger on greater trochanter and thumb on medial thigh to assess for developmental dysplasia of the hip (DDH). Risk factors for DDH include: female gender, breech positioning in utero, and positive family history.

6.2 Perform Barlow exam: Apply posterior pressure. If a hip is dislocatable, it will snap out of the acetabulum with a click or clunk.

6.3 Perform Ortolani exam: Apply pressure and abduct the hips. If the head of the femur is already dislocated, a clunk or click will be appreciated as the femur head slips anteriorly into the acetabulum.

7. Extremities examination

7.1 Appreciate muscle bulk and tone of the upper and lower extremities.

7.2 Observe for polydactyly, clinodactyly, and syndactyly.

7.3 Note symmetry, range of motion, and position of the hands and feet (foot deformities from in utero positioning can usually be placed to neutral position with ease).

7.4 Open both hands to assess palmar creases. A single unilateral palmar crease occurs in 5-10 % of normal population and is more common in newborn with trisomy 21.

8. Spine examination

Inspect for scoliosis, sinus tracts, midline swelling, or dimples. If a dimple is present, note whether the base can be seen (floor of dimple covered with skin) or whether a tuft of hair is present. If the dimple base cannot be visualized and/or a tuft of hair is seen, further work-up is warranted. Any of these abnormal findings can be associated with occult spinal dysraphism.

9. Head examination

9.1 Assess shape and size of head.

9.2 Inspect for molding (over-riding of cranial bones), caput succedaneum, and cephalohematoma. **[Figure 2]**

9.3 Inspect scalp for lacerations, presence/pattern of hair or scalp defects, bruises, and erosions.

9.4 Palpate anterior fontanelle (variable diameter based on gestational age and ethnicity; term ~ 2cm) and posterior fontanelle (posterior fontanelle may only be a fingertip in diameter).

Sunken fontanelle may reflect dehydration while a bulging fontanelle may represent increased intracranial pressure (e.g. with meningitis or intraventricular fluid/ blood).

9.5 Palpate the sutures of the skull (sagittal, coronal, lambdoid, and metopic). An asymmetric skull that persists for longer than two to three days after birth or a persistent palpable ridge along the suture line may indicate craniosynostosis, a premature fusion of cranial sutures.

10. Eye examination
10.1 Inspect shape and interpupillary distance.

10.2 Check for red reflex with ophthalmoscope. The red reflex is performed by holding an ophthalmoscope at about 1 foot from the infant's eye in a dimly lit room. The transmission of light travels through the normally transparent parts of the infant's eye and then reflects reddish-orange color from back of the infant's eye (retina). An abnormal red reflex may indicate the presence of congenital cataracts or retinoblastoma.

10.3 Assess extra-ocular movements and pupillary reaction to light.

10.4 Assess palpebral fissures. Upward slanting from the inner canthus may be seen in infants with trisomy 21.

11. Ear examination
11.1 Note position, size, and shape.

11.2 Inspect for the presence of auditory canals. Check for preauricular sinus, pits, or skin tags.

12. Neck examination
12.1 Check for goiter, thyroglossal duct cyst, or branchial arch sinus tract.

12.2 Palpate clavicles and assess for any tenderness or crepitance, which could be due to clavicle fracture.

13. Nose and mouth examination
13.1 Check for patency by listening with the stethoscope over each nare. If unable to confirm patency, consider passing a nasogastric tube on one side, then remove and repeat on the opposite side.

13.2 Inspect the lips, gum line, palate, and uvula.

13.3 Using a gloved finger, palpate the gum line, and hard and soft palate.

13.4 Observe for any clefts, teeth, or cysts.
13.5 Assess the lingular frenulum (a band of soft tissue that connects the floor of the mouth to the tongue). An unusually short lingular frenulum is known as ankyloglossia.

13.6 Note the presence of sucking on a gloved finger.

Skin
14.1 Observe color (pallor, jaundice, or ruddy complexion).

14.2 If an exam is performed at delivery, note the presence of vernix caseosa (a cheesy white biofilm that covers the skin during the last trimester of pregnancy).
Check for common abnormalities. **[Table 1]**

Neurologic
15.1 Assess level of alertness, spontaneous motor activity, tone, muscle strength, and primitive reflexes.

Summary

Examination of a newborn infant is a core clinical skill to be attained by a medical professional caring for infants. A complete examination of the newborn infant includes a comprehensive history (maternal, perinatal, delivery, neonatal), observation of the infant, attainment of vital signs, and direct hands-on examination. Throughout the exam, the physician should point out reassuring normal findings as well as any abnormalities with qualification as to whether additional testing or follow-up may be warranted. The sequence of the exam should be followed to maximize the information gathered. Parts of the exam that require an infant to be quiet should be performed first. The infant will continue to have multiple physical exams throughout the first year of life but the examination during the first 24 hours of life is crucial to ensure early detection of any abnormalities and to establish a baseline for subsequent examinations.

Figures and legends

Table 1: Common Skin Abnormalities of the Newborn
Types and description of common skin abnormalities that can be observed in a newborn infant.

Figure 1: Umbilical cord
A schematic showing the vessels of infant umbilical cord. (redraw)

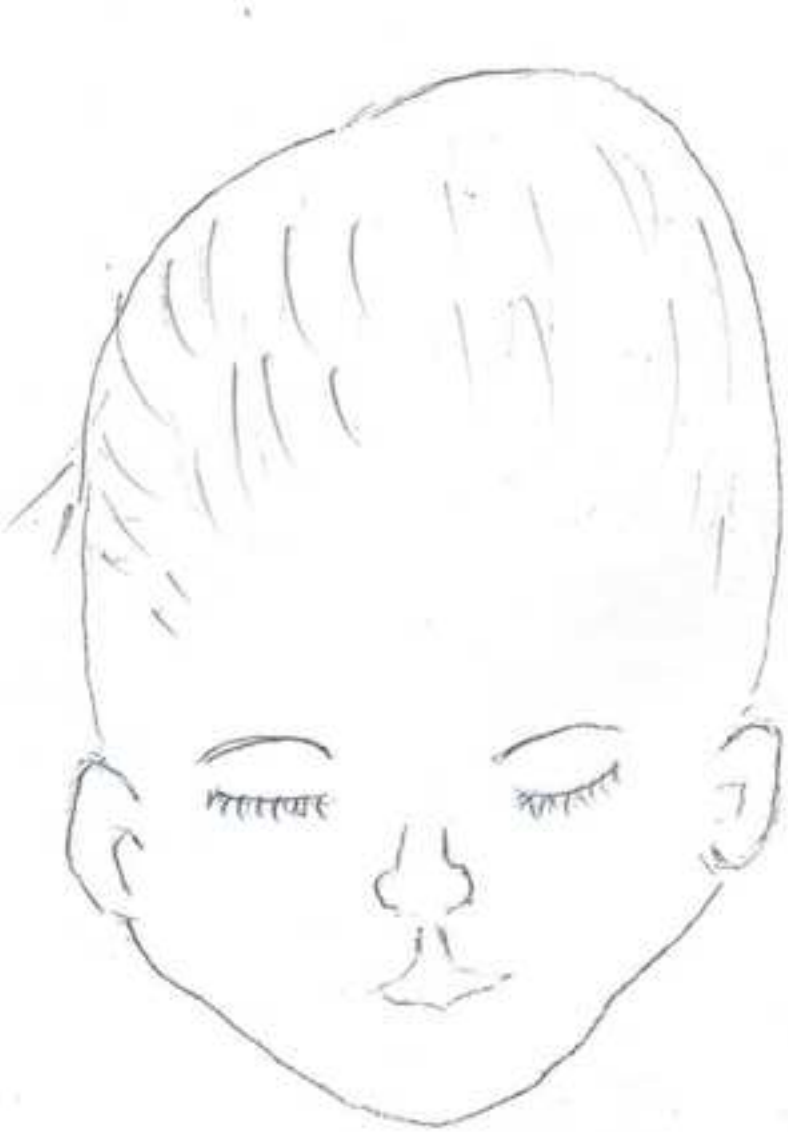
Figure 2: Caput succedaneum versus Cephalohematoma (redraw)

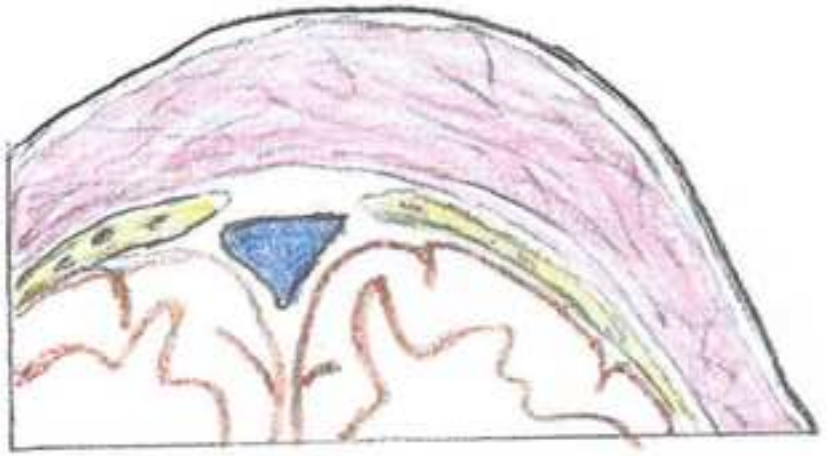
A: Caput succedaneum: Area of edema over the presenting part of the head. Crosses suture lines. Resolves within a few days of life.
B: Cephalohematoma: Area of subperiosteal collection of blood. Evolves after birth forming a fluctuant mass that does not cross the suture line. Resolves over weeks or months.

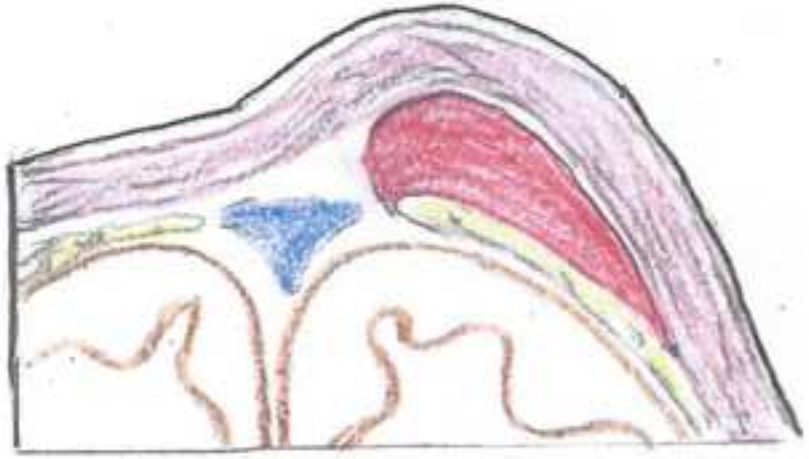
Table 1: Common Skin Abnormalities of the Newborn

Skin Finding	Description
Milia	Cysts filled with keratin
Erythema toxicum	Benign papular lesions with an erythematous base
Benign pustular melanosis	superficial pustules overlying hyperpigmented macules occurring mostly in African-American newborns
Mongolian spots	Also known as congenital dermal melanocytosis; blue/grey/brown skin discoloration frequently on lower back, or buttocks
Hemangioma	Sometimes referred to strawberry mark; birthmark that most commonly appears as a rubbery, red nodule of extra blood vessels in the skin
Nevus flammeus	Also known as port wine stain; a capillary malformation that can occur anywhere on the body
Nevus simplex	Often called macular stain, stork bite, or angel kiss; a pink-red capillary malformation that may occur on the upper eyelids, upper lip, middle of the forehead, or the nape of the neck

Click here to download high resolution image







Click here to download high resolution image