# Visual Diagnosis in the Newborn

3

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## Introduction

Physical findings in the newborn are variable and often subjective. Some important disorders have subtle clinical signs, and some overt signs are inconsequential. This chapter will provide an overview of pertinent newborn physical findings which are apparent to the healthcare provider. The chapter is organized in the same fashion as a physical examination is often performed initially. Head shape and hair pattern and abnormalities of the mouth and neck are the first conditions discussed. Later in the chapter, anomalies of the umbilical cord, abdomen, back, and extremities are presented. As some of the potential material is addressed in other chapters, this chapter will not discuss newborn birth injuries (Chap. 2), dermatological conditions in the newborn (Chap. 4), the late preterm infant (Chap. 5), ambiguous genitalia and problems with sexual differentiation (Chap. 19), and common problems of the newborn eye (Chap. 20).

## Case Presentation

You are asked to evaluate a "funny looking baby" born at term gestation last evening. On examination the baby has multiple findings.

Which of the following is associated with significant genetic disease?

1. Unilateral (right hand) simian crease
2. Small preauricular pit
3. Low-set ears without posterior rotation
4. Stalked (extra) digits on each fifth finger
5. None of the above

Although each of the features is determined by various sites of the human genome, none of them signal clinically significant disease. Commonly they are familial and anticipated by parents who often have the same traits. Your next step is to speak with the parents and examine them if necessary. They or their previous children may have the same physical finding, and if they have developed normally, the parents can be reassured that it is very unlikely that their baby has clinically significant disease [1].

**Answer: 5**

Several basic principles are important to remember in evaluating the baby. There is a broad range of "normal." Attractive parents do not always have attractive children and vice versa.

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Abnormal symmetrical features are a hallmark of major syndromes. A child with trisomy 21 does not have unilateral abnormal eye findings. Asymmetric physical traits may be due to a local process (e.g., hemangioma) affecting limb development or due to intrauterine constriction.

There is great variability in size, shape, and position of the ears. The cartilage is soft and an edge of the ear may fold over. As the cartilage stiffens over the next few weeks, the ear will return to the expected shape. Approximately 1% of newborns have a small dimple (pit) in front of the ear. These pits rarely become infected. A low-set ear is defined as an entire ear that is below a straight line drawn from the inner canthus of the eye to the outer canthus and extended posteriorly. Alternatively, a low-set ear may be defined as one that the ear canal is below a line drawn from the outer canthus to the base of the occiput. Most clinicians prefer the former definition as it is easier to measure. Of much greater significance is the posterior rotation of the ear which is associated with many genetic syndromes including trisomies 18 and 13 [1]. Figure 3.1a, b illustrate a low-set ear with posterior rotation. This baby with Goldenhar syndrome also has a smaller anterior duplicate earlobe and an enlarged mouth. A unilateral simian crease is a common finding and of no clinical significance. Bilateral simian hand creases are less common, but in the absence of other physical findings in a baby who is not growth restricted, it is most likely benign.

Stalked (extra) digits on the fifth finger of each hand are a common familial trait. After consulting with the family, they may be removed. If there is a bony attachment, additional digits, or fused digits, the risk of significant genetic disease is increased [2].

## Case Presentation

After a brief trial of labor, a primigravid mother is found to have her fetus in a transverse lie. A C-section is performed and she delivers a large for gestational age boy. She is concerned about the shape of his head which seems excessively elongated with a ridge on top (Fig. 3.2).

You tell her which of the following:

1. Large babies always have funny shaped heads.
2. Prolonged labor commonly causes excess molding of the skull.
3. Abnormal fusion of one or more sutures may cause the ridge.
4. Her pelvic structure forced the head into the abnormal shape.

In breech and elective cesarean deliveries where the head has not been engaged in the pel-

**Fig. 3.2** Head elongation

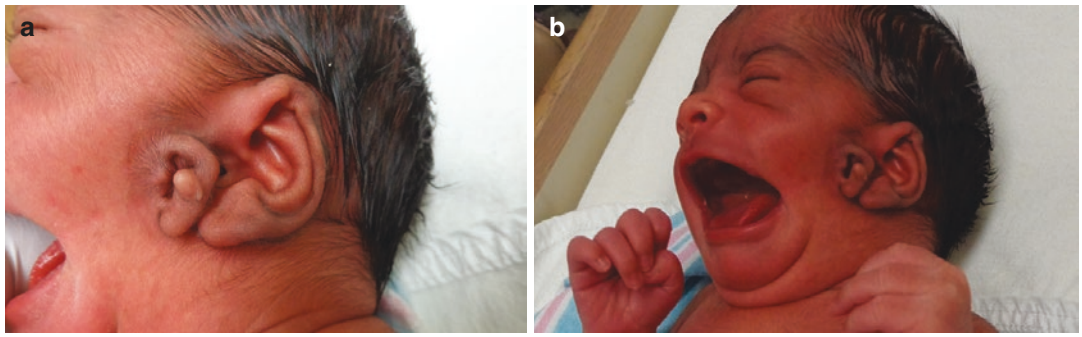


**Fig. 3.1** (**a**) Ears. (**b**) Ears and mouth

vis, the newborn's head should be spherical. The shape of a newborn's head should be approximately spherical [3]. Scalp edema is common [4].

At birth and for the first week, the edges of the parietal bones commonly overlap the frontal and occipital bones resulting in small anterior and posterior fontanelles [5]. The bones gradually separate and suture lines and fontanelles should be palpable by the first office visit.

Molding of the head occurs in virtually all term newborns who are born after labor and from a vertex position. The change in shape is more profound in firstborn infants and in babies whose heads were engaged in the pelvis for a prolonged time. The pressure of the pelvic ischial spines on the head during a vertex vaginal delivery causes flattening of the forehead with tapering of the parietal bones to a depressed occiput. In a face or brow presentation, there is a prominent forehead.

The baby, in the case above, has a ridge due to craniosynostosis of the sagittal suture. The head growth will be asymmetric and will be further distorted unless the suture is surgically reopened [6].

**Answer: 3**

Craniosynostosis results from the premature fusion of one or more cranial sutures. It may be due to a primary defect of ossification [7]. More commonly there is failure of brain growth which allows secondary fusion. The misshapen head results from restricted skull growth based on which sutures have fused. Maternal smoking increases the incidence [8]. Primary craniosynostosis is associated with many syndromes [9].

Variations of fused sutures are:

1. Scaphocephaly (sagittal) – flattened side to side
2. Brachycephaly (bilateral coronal) – flattened front to back
3. Plagiocephaly (anterior-coronal, posterior-lambdoid) – flattened top of the skull
4. Trigonocephaly (metopic) – triangle-shaped skull

## Case Presentation

A newborn has light-colored scalp hair over a depigmented area (Fig. 3.3a).

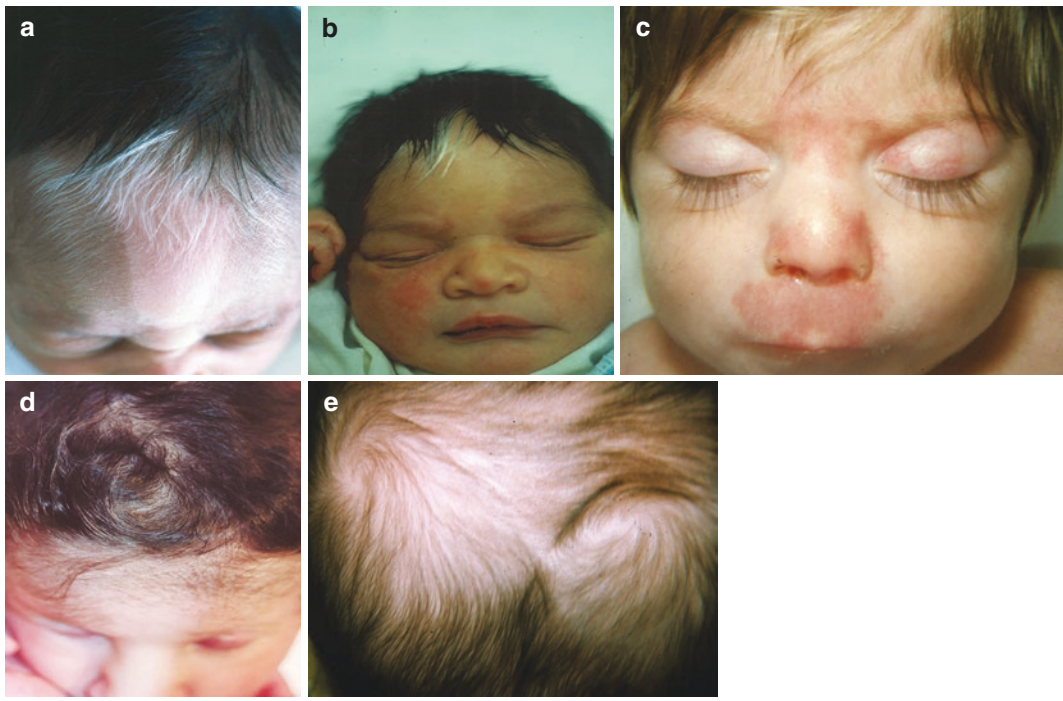


**Fig. 3.3** (**a**) Piebaldism. (**b**) Waardenburg syndrome. (**c**) Hypertrichosis, long eyelashes. Cornelia de Lange syndrome. (**d**) Scalp hair anterior. (**e**) Scalp hair – double whorl

He is at greatest risk for:

1. Hearing loss
2. Melanoma
3. Discordant hair growth
4. Childhood alopecia
5. None of the above

Scalp hair is variable in volume, consistency, and pattern. Hair color expresses the pigmentation of the skin beneath it. Hair over a patch of light-pigmented skin will be light also but has no association with answers 1–4 above. Conversely, hair growing over a scalp melanoma will often be darker than surrounding scalp hair.

**Answer: 5**

A "white" forelock over a patch or normally pigmented skin is a classic sign of Waardenburg syndrome which often has associated progressive hearing loss (Fig. 3.3b). Decreased hair pigmentation is a prominent feature of albinism and untreated phenylketonuria [10].

The scalp hair should be distributed symmetrically with a visible neck, a break in hair between the hair of the scalp and the lateral eyebrow, a break between the eyebrows, and a single posterior hair whorl [11].

A low posterior hairline and short neck are associated with many syndromes including Turner syndrome (45X) fetal hydantoin syndrome, Cornelia de Lange syndrome, and Noonan syndromes. All of them are associated with developmental delay [1].

Hypertrichosis overlying the temple and melding into the eyebrow is a classic sign of both the Treacher Collins and Fraser syndromes.

Synophrys (unibrow) often with a low frontal hairline and luxuriant eyelashes is common in Cornelia de Lange syndrome, trisomy 18, fetal hydantoin syndrome, and Fanconi syndrome (Fig. 3.3c).

The majority of newborns have a single posterior scalp hair whorl. The expected location is posterior with 14% midline, 56% slightly to the left of midline, and 30% to the right of midline. Hair whorls in front of the ears, very lateral on the scalp, and just above the forehead are unusual variants seen in multiple syndromes with developmental delay [11] (Fig. 3.3d).

A double hair whorl is unusual and often familial. In the absence of any family member with a double hair whorl, the hair whorl which is derived from the ectoderm germ layer may be associated with an underlying brain underdevelopment (Fig. 3.3e).

## Case Presentation

A mother complains that breastfeeding is painful. You examine the baby's mouth and find a tooth in the midline gum line of the mandible (Fig. 3.4a).

Your first step should be:

1. Consult a pediatric dentist.
2. Obtain an X-ray of the mandible.
3. Extract the tooth yourself.
4. Assure the mother that it will fall out by itself within the next week.

A natal tooth is a rare finding. Approximately 10% are a "false" tooth with no root structure. This calcified cap may be shed and possibly aspirated. The other 90% are normal primary teeth that have erupted early. An X-ray should be obtained to differentiate the two. A dentist should remove the tooth to allow comfortable breastfeeding. If the tooth has a root, it is a primary tooth, and the eruption and spacing of other primary teeth may be affected. It may be associated with various syndromes, including Ellis-van Creveld, Hallermann-Streiff, Pierre Robin, and Sotos [12].

**Answer: 2**

Other findings in the mouth include:

1. Bohn nodules – Remnants of salivary gland tissue as a result of cystic degeneration. They are found along the lingual and buccal ridges and at the junction of the hard and soft palate. These are <3 mm in size and are filled with keratin and resolve spontaneously (Fig. 3.4b).

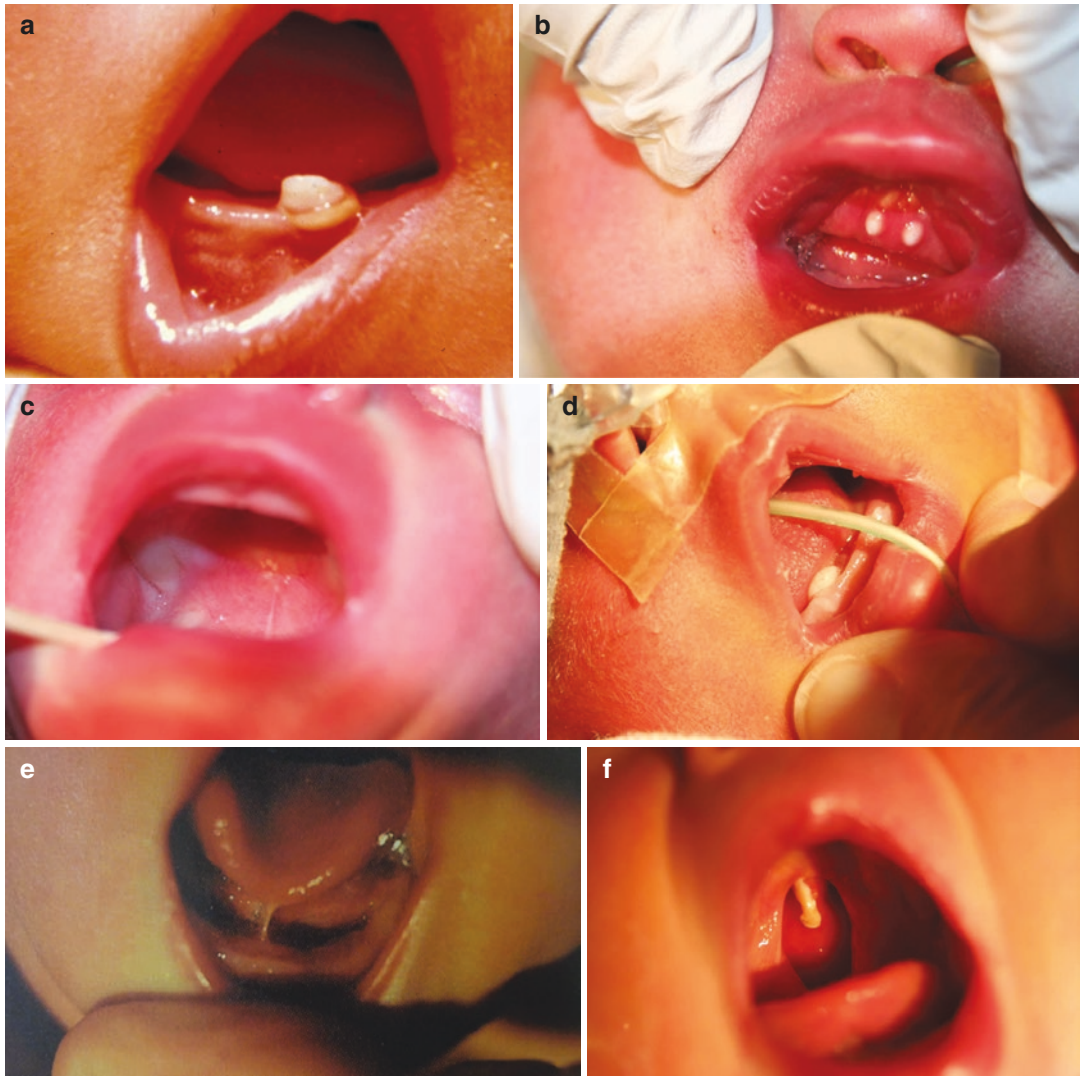


**Fig. 3.4** (**a**) Neonatal tooth. (**b**) Bohn nodules. (**c**) Epstein pearls. (**d**) Ranula. (**e**) Ankyloglossia. (**f**) Absent uvula – submucous cleft palate

2. Epstein pearls – Also called gingival cysts, this is a white vesicle (<3 mm) lined with thin epithelium often on the center of the palate. They resolve spontaneously (Fig. 3.4c).
3. Ranula – Mucous retention cysts (mucoceles) on the floor of the mouth. They can be simple or more complex. These are usually disorders of the salivary glands. Surgical removal or marsupialization is sometimes required (Fig. 3.4d).
4. Tongue-tie (ankyloglossia) – Is a congenital oral anomaly where there is usually a short lingual frenulum connecting the underside of the tongue to the floor of the mouth. These almost always stretch soon after birth. Feeding difficulties are variable and there have been reports of elocution defects later on in childhood. Surgical intervention is may be warranted (Fig. 3.4e).
5. Uvula – A projection from the posterior end of the soft palate is composed of connective tissue, glandular tissue and some muscle fibers. It occasionally is bifurcated (bifid) especially if a cleft palate is present. A uvula may also be absent. Swallowing and feeding should be observed carefully (Fig. 3.4f).

In the vicinity, the nose has a relatively simple external structure which in the early embryo fuses in the midline. Delayed or failed fusion is rarely limited to the nose and often includes cleft lip and palate, common features of trisomy 13 Syndrome.

## Case Presentation

A term newborn is reportedly breastfeeding poorly. The nurses have discovered a "lump" on the side of the baby's neck. You observe the baby feeding and note tachypnea as well as some difficulty swallowing. The neck mass is in the lateral neck, is soft and fluid filled, and is non-tender with a bluish hue (Fig. 3.5).

These findings suggest the mass is:

1. A thyroglossal duct cyst
2. A thyroid mass
3. A pneumomediastinum herniating into the neck
4. A cyst derived from lymphoid tissue

The first three clinical findings are midline or between the sternocleidomastoid muscles. This presentation is classic for a cystic malformation. The mass is derived from lymphoid tissue and often dissects into the posterior mediastinum [13]. The most common form is lymphangioma [14]. It may compress the esophagus (difficulty swallowing) and encompass the trachea resulting in a limited airway and tachypnea [15]. A cystic hygroma may be associated with Turner syndrome or Noonan syndrome. The more prominent masses are often discovered by prenatal ultrasonography.

**Answer: 4**

The treatment options currently include surgical resection, but there is a small chance of recurrence [16]. If the baby is stable, other options include sclerosing agents such as bleomycin, doxycycline, ethanol, picibanil, and sodium tetradecyl sulfate [17–19].

Most neck masses are midline or nearly so. Thyroid hyperplasia and thyroglossal duct cysts are usually firm and are very rare. A pneumomediastinum may dissect into the midline neck or further. These babies are usually very sick given the extent and pressure of the mediastinum in the chest.

## Case Presentation

You attend the delivery of a poorly controlled diabetic who is delivered by C-section at 38 -week gestation due to fetal macrosomia and poor fetal heart rate reactivity. There was spontaneous rupture of the membranes 26 h prior to delivery. The baby boy weighs 4.4 kg, is covered with vernix (Fig. 3.6), and although initially depressed responds well to tactile stimulation and drying. Resuscitation is not necessary.

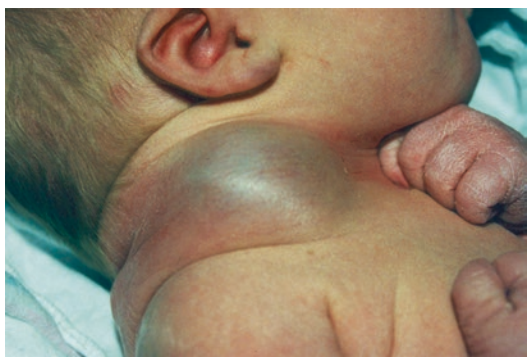

**Fig. 3.5** Cystic hygroma

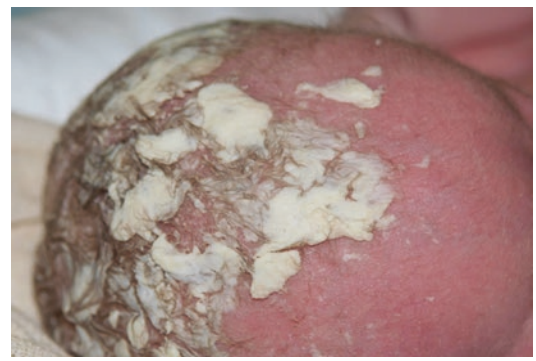

**Fig. 3.6** Vernix

He is at greatest risk for which of the following?

1. Neonatal diabetes
2. Surfactant deficiency
3. Sepsis
4. Malrotation of the intestines
5. None of the above

Neonatal diabetes is a rare condition and the neonates are severely growth retarded. Some of the components of vernix are antibacterial, and there is no association with excess vernix and sepsis or intestinal malrotation.

This large for gestational age baby is at risk for numerous metabolic problems including hypoglycemia and hypocalcemia. The excess fetal growth is due to fetal hyperglycemia provoking an excess of fetal insulin, which stimulates somatic growth. At birth the baby's transplacental glucose source abruptly stops and the insulin provokes the hypoglycemia.

**Answer: 2**

The primary component of vernix is:

1. Water
2. Carbohydrates
3. Complex lipids
4. Proteins

The excess vernix is associated with surfactant deficiency. Vernix caseosa is a complex biofilm that protects the developing fetal skin from the changing composition of the amniotic fluid. It is a biofilm composed of water (81%), lipid (9%), and proteins (10%). It includes shed periderm and sebaceous secretions [20]. Lipids include cholesterol, ceramides, triglycerides, phospholipids, and sterol esters. There are 41 different proteins in vernix; 25 are unique and found nowhere else in the body. Some of these proteins are anti-infectious – defensins, lactoferrin, calprotectin, lysozyme, and neutrophil lipocalin to name a few. It begins to shed at ~34-week gestation in response to increasing surfactant shed from maturing fetal lung into the amniotic fluid [21]. Amniotic fluid aspirated at term produces more lung inflammation because of the lipids originating from the vernix.

**Answer: 1**

LGA babies born to diabetic mothers are at increased risk for malformations, primarily cardiac, central nervous system, limb anomalies, intestinal obstruction, and situs inversus, not malrotation of the intestines.

## Case Presentation

A 1-week-old baby girl born at term returns to your office at 21 days with a persistent umbilical cord (Fig. 3.7).

The most appropriate treatment is:

1. Exploration and then excision with a sterile scalpel
2. Cautery with silver nitrate
3. Referral for evaluation by a surgeon
4. Oral antibiotics

A persistent cord commonly has a blood supply. A surgeon may need to explore it for an intra-abdominal component. The umbilical cord is composed of a glycoprotein matrix (Wharton's

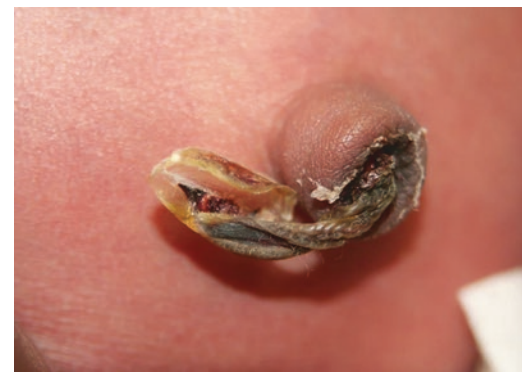

**Fig. 3.7** Delayed cord shedding – 16 days

jelly) suspended in 90% water. There are three vessels, a vein and two arteries arising from each of the iliac arteries. The arteries coil around the vein in a counterclockwise rotation thought to be derived from the rotation of the bowel entering the abdomen from the coelomic cavity. Lack of rotation may be associated with malrotation of the intestines.

The cord dries rapidly in less than 4 days and is colonized with bacteria which attract neutrophils which in turn release chemokines (e.g. lysozyme) cleaving the dried cord by 8–10 days [22]. Neutropenia, leukocyte adhesion deficiency, and interleukin kinase deficiency are possibilities. Failure of neutrophils to respond and therefore a persistent cord is a prominent feature of a very rare x-linked syndrome exclusive to males and not pertinent to this female baby. Enthusiastic cleansing of the cord with alcohol delays colonization and thwarts ingress of neutrophils, delaying the shedding of the dried cord. Almost all other persistent cords are due to a continued blood supply. Surgical exploration has found peritoneum, omphalocele with or without intestine, a patent urachus, a urachal cyst, hemangiomas, AV malformation, and redundant skin [23].

**Answer: 3**

## Case Presentation

A full-term infant is born to a mother with no prenatal care. Labor is protracted and a cesarean section is performed. At delivery, the healthcare providers note shiny intestines to the right of the umbilicus. There is no covering membrane over the intestines.

The above scenario is most compatible with:

1. Gastroschisis
2. Omphalocele

Major abdominal defects are often discovered prenatally. A gastroschisis is an abdominal wall defect almost always positioned to the right of but not involving the umbilical cord. The intestine is exposed to amniotic fluid which beyond 34-week gestation contains solubilized vernix and other compounds which induce intestinal adhesions and serosal inflammation. Although both defects are managed by similar surgical repairs, the inflamed intestine of a baby with a gastroschisis (Fig. 3.8a) is more likely to have motility problems.

An omphalocele results from a failure of the midgut to return from the yolk sac to the abdomen. It involves the umbilical cord and is usually enclosed in a sack protecting the bowel from

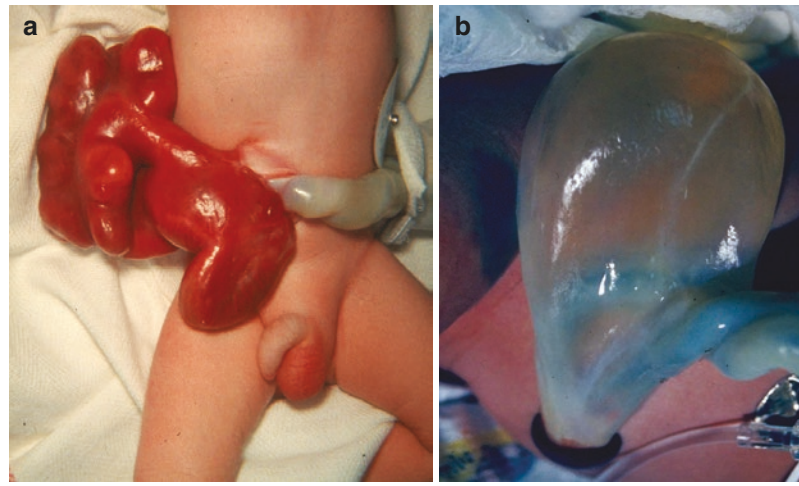


**Fig. 3.8** (**a**) Gastroschisis. (**b**) Omphalocele

exposure to amniotic fluid (Fig. 3.8b). They are commonly associated with genetic defects especially the trisomy syndromes [1].

## Case Presentation

Shortly after entering the room to examine a baby boy in the presence of his mother, she removes the baby's sock from the right foot. The mother asks "where is my baby's right great toe" (Fig. 3.9)?

Which is your most appropriate response?

1. It is a common variation of development of the foot.
2. It is an inherited congenital anomaly.
3. It was accidentally removed during delivery by C-section.
4. It was amputated by an amniotic band.

Most anomalies of limbs associated with syndromes are bilateral [24]. Numerous syndromes have focused on specific chromosomal or gene abnormalities that have associated limb defects. The anomalies include arachnodactyly, fractures, short limbs, limb reduction, brachydactyly, clinodactyly of the fifth finger, thumb hypoplasia or a triphalangeal thumb, radius aplasia, metacarpal and metatarsal hypoplasia, polydactyly, syndactyly, elbow dysplasia, and patella dysplasia. Newborns with any of these limb anomalies often have other physical findings that should trigger a genetic evaluation for the myriad of autosomal recessive disorders.

Small strips of amnion may project into the amniotic fluid especially with oligohydramnios. They wrap around rapidly growing small body parts, primarily limbs, and constrict blood flow. Deformities, unusual fusions, and less commonly amputations occur.

**Answer: 4**

## Case Presentation

A newborn has multiple areas of darker pigmentation in a line below the normal nipple and extending into the axilla on both sides (Fig. 3.10).

You council the mother that:

1. They are normal variants.
2. They will fade over time.
3. All but the normally located nipple need to be surgically removed.
4. Only the axillary accessory nipples may need to be removed.

Supernumerary nipples may be found up to seven pairs. They result from the incomplete regression of the embryonic mammary ridge (milk line). The true nipples are usually normal. The distal nipples are progressively less pigmented and rarely have underlying tissue [25].

**Fig. 3.9** Absent great toe, amniotic band

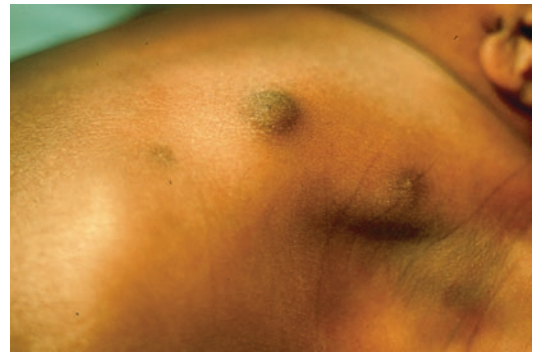

**Fig. 3.10** Supernumerary nipples

There is a very rare association with various kidney and urinary tract malformations [26]. The axillary nipples tend to be more pigmented and often have breast tissue. This tissue may hypertrophy at puberty and may produce small amounts of milk postpartum. Given the sheltered location and excess heat, there is malignant potential. For these reasons, early surgical removal of axillary accessory nipples may be appropriate.

## Case Presentation

A nurse in the regular nursery notes a "bump" on a baby's back when changing a diaper.

You examine the baby and find a midline closed skin-covered lesion in the lumbosacral region (Fig. 3.11a).

What is the most appropriate next step?

1. MRI/CT scan of the lower back
2. Neurosurgery consultation
3. Pediatric oncology consultation
4. Initiate antibiotics

Midline defects on the back, especially in the lumbar region, almost always involve a defect in the spine and often a significant defect of the spinal cord [27]. Neural tube defects are commonly affecting approximately 1500 babies each year in the United States. This incidence has decreased in the last 15 years due to supplemental folate administered to pregnant women especially prenatally and in the early first trimester [28, 29]. Although neural tube defects include anencephaly, encephalocele, and other anomalies of the head, this discussion will be limited to lesions of the lower back.

This case is a common presentation for a sacrococcygeal teratoma. It must be differentiated from a neural tube defect by proper imaging.

**Answer: 1**

Some defects are exposed to the level of nerve tissue. Others have minimal covering. Nearly all have a significant risk of infection. Careful sterile technique should allow protection of the defect and allow prompt imaging (MRI, CT) to determine the extent of the defect. A pediatric neurologist and pediatric neurosurgeon should be consulted promptly. All of the defects of the lower back have a high prevalence of lower extremity motor dysfunction, commonly with bladder and anal dysfunction in addition.

The variations include:

1. Spina bifida – spinal dysraphism, usually without neurologic sequelae
2. Meningoschisis – Exposed nerve tissue.
3. Meningocele – Spinal cord with a fluid-filled cover.
4. Meningomyelocele – The fluid filled sac contains nerve tissue.
5. Lipomeningomyelocele – Fat tissue is included in the defect.
6. Hemangio-meningocoele – Nerve tissue embedded in a midline hemangioma.


**Fig. 3.11** (**a**) SC teratoma. (**b**) Anterior sacrococcygeal teratoma

A sacrococcygeal teratoma (Fig. 3.11b) is a unique tumor of the lower lumbar-sacral spine and coccyx which contains a mixture of tissue from all three embryonic germ lines. Rarely the tumor can be anterior filling the pelvis and extending into the gonads. This tumor may be massive and lethal and is often very difficult to resect.

**Clinical Pearls**

1. Any abnormal physical finding may be familial. Examine the parents.
2. Symmetrical abnormalities are more commonly associated with a significant genetic abnormality; e.g., a unilateral simian palm crease is common and not associated with serious genetic disease.
3. Although low-set ears may be clinically significant, if the ears are also posteriorly rotated, a syndrome is likely.
4. Vernix is a very complex lipid and protein biofilm that protects the fetal skin from the changing composition of amniotic fluid.
5. Increasing amniotic fluid surfactant in the last 6 weeks of gestation facilitates fetal shedding of vernix.
6. Abnormal hair on the head associated with syndromes includes synophrys and more than one scalp whorl.
7. If there is no root on a neonatal tooth, it should be extracted.
8. A dried umbilical cord that has not been shed by 2 weeks almost always has a persistent blood supply and may warrant evaluation by a pediatric surgeon.

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