

A Comprehensive Newborn Examination: Part II. Skin, Trunk, Extremities, Neurologic

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Skin findings are common during the newborn examination. Although these findings are often benign, it is important to visualize the entire skin surface to distinguish these findings and appropriately reassure parents. The chest should be observed for symmetric movement, pectus excavatum, pectus carinatum, prominent xiphoid, or breast tissue. The infant should be as relaxed as possible so that the physician can more easily detect any abdominal masses, which are often renal in origin. A single umbilical artery may be associated with another congenital abnormality, especially renal anomalies, and intrauterine growth restriction and prematurity. Signs of ambiguous genitalia include clitoromegaly and fused labia in girls, and bilateral undescended testes, a micropenis, or a bifid scrotum in boys. Sacral dimples do not warrant further evaluation if they are less than 0.5 cm in diameter, are located within 2.5 cm of the anal verge, and are not associated with cutaneous markers; dimples that do not fit these criteria require ultrasonography to evaluate for spinal dysraphism. Brachial plexus injuries are most common in newborns who are large for gestational age, and physical therapy may be required to achieve normal function. Patients with abnormal findings on Ortolani and Barlow maneuvers should be evaluated further for hip dysplasia. It is also important to assess newborns for tone and confirm the presence of normal primitive reflexes. (*Am Fam Physician*. 2014;90(5):297-302. Copyright © 2014 American Academy of Family Physicians.)

This is part II of a two-part article on the newborn examination. Part I, "General, Head and Neck, Cardiopulmonary," appears in this issue of *AFP* on page 289.

CME This clinical content conforms to AAFP criteria for continuing medical education (CME). See CME Quiz Questions on page 280.

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Part I of this two-part article discusses the assessment of general health, head and neck, heart, and lungs.¹ Part II focuses on assessing the newborn's skin, trunk and extremities, and neurologic function.

Skin

A variety of normal and abnormal lesions may be present on newborn skin (*Table 1*).²⁻⁶ Although these findings are often benign, it is important to visualize the entire skin surface to distinguish these findings and appropriately reassure parents.²⁻⁶ It is common to see bruising and petechiae, which typically resolve over time.

Jaundice, which may cause yellowing of the skin and eyes, is common and typically benign. However, very elevated bilirubin levels can lead to serious consequences, such as kernicterus and acute bilirubin encephalopathy. Thus, bilirubin levels should be evaluated carefully according to American Academy of Pediatrics guidelines.⁷

Chest

Chest movement should be symmetric. Asymmetry suggests an abnormality such as

pneumothorax, cystic malformation of the lung, or diaphragmatic hernia. The physician should also observe for pectus excavatum, pectus carinatum, prominent xiphoid, and breast tissue (may be present in girls or boys as a result of maternal hormone exposure), all of which are generally inconsequential findings but may pose cosmetic concerns. Supernumerary nipples can occur in the vertical line from the axilla to the pubic region (the milk line) and require no treatment.⁸ Widely spaced nipples may be a sign of Turner syndrome.⁹ A prominent precordium may indicate a congenital heart defect.

Abdomen

When examining the abdomen, it may be beneficial to use one hand to hold the legs with the hips and knees flexed to help relax the newborn, and use the other hand to palpate the abdomen. General observation of the abdomen may reveal a scaphoid abdomen, which can indicate a congenital diaphragmatic hernia, or a distended abdomen, which may indicate an intestinal obstruction. The presence of a gastroschisis (intestines protrude through the abdominal wall without a sac, usually to the right of the

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>
Routine renal ultrasonography to look for renal anomalies in newborns with isolated cases of a single umbilical artery is not beneficial.	C	11, 12
Bilateral undescended testes, a micropenis, or a bifid scrotum should prompt investigation for ambiguous genitalia.	C	15
Newborns with a hypospadias should not be circumcised because the foreskin may be needed for repair.	C	19
A sacral dimple is simple if it is less than 0.5 cm in diameter, located within 2.5 cm of the anal verge, and not associated with cutaneous markers (discoloration or hypertrichosis). In the absence of these criteria, ultrasonography should be performed before three months of age to evaluate for spinal dysraphism.	C	22
Girls born in the breech position should receive imaging to evaluate for hip dysplasia. Imaging should be considered in newborns with a family history of developmental hip dysplasia and in newborn boys born in the breech position.	C	33, 34

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort>.

umbilicus) or omphalocele (abdominal contents protrude within a sac at the midline) is usually known before delivery and warrants emergent surgical consultation.¹⁰ Diastasis recti abdominis is caused by a relative weakness of the fascia between the two rectus abdominis muscles and usually resolves on its own over time. Linea nigra is a dark pigmented vertical line appearing from below the umbilicus to the pubic symphysis that is caused by maternal hormone exposure and disappears over time.

The umbilical cord should be inspected for signs of infection and bleeding. It should contain two arteries and one vein. A single umbilical artery may be associated with another congenital abnormality, especially renal anomalies, and intrauterine growth restriction and prematurity. In the past, renal ultrasonography was routinely performed in newborns with a single umbilical artery; however, routine renal imaging in isolated cases has not been proven beneficial.¹⁰⁻¹² Umbilical hernias, which are common in newborns, rarely become incarcerated or strangulated, and most resolve by the time the child reaches three years of age.

The abdomen should also be auscultated for bowel sounds in all four quadrants, and then palpated to feel for masses and organomegaly. It may be helpful to use the flats of the fingers rather than the tips. The liver is usually approximately 1 to 2 cm below the lower costal margin. About one-half of abdominal masses are renal in origin, such as multicystic dysplastic kidneys, Wilms tumor, hydronephrosis, renal vein thrombosis,

and ureteropelvic junction obstruction. Other masses include teratoma, neuroblastoma, ovarian torsion, ovarian cyst, and gastric duplication cyst.¹³

Genitourinary

Term female newborns have prominent labia majora, whereas preterm female newborns have prominent labia minora and clitoris. A white discharge or small amount of blood may be present and is a normal response to maternal estrogen withdrawal. Separating the labia minora allows evaluation for patency of the hymen. Signs of ambiguous genitalia include clitoromegaly and fused labia. A hymenal tag may be present and usually requires no intervention.

In male newborns, both testes should be descended into the scrotal sac. Retractable testes can be milked into the scrotum and do not require intervention. Bilateral undescended testes, a micropenis (penile length for a term newborn is 2.5 to 3.5 cm),¹⁴ or a bifid scrotum should prompt investigation for ambiguous genitalia. Findings suggestive of ambiguous genitalia should be addressed urgently, and consultation with endocrinology, genetics, and urology is indicated. Gender should not be assigned until all information is obtained.¹⁵

Evaluation of the scrotum may reveal an inguinal hernia or hydrocele (*Figure 1*). An inguinal hernia occurs when the processus vaginalis fails to close, which leaves an opening for bowel to pass through and leads to a bulge in the inguinal canal that may extend to the scrotum. The hernia can often be

Table 1. Common Skin Findings in Newborns

<i>Finding</i>	<i>Characteristics</i>	<i>Location</i>
Salmon patch (nevus simplex)	Macular pink-red capillary dilations, often bilateral, fades over time	Forehead, upper eyelid, nape of the neck (stork bite)
Port-wine stain (nevus flammeus)	Dark purple or red, capillary malformation, generally does not fade, ophthalmology referral needed if near the eye	Nonspecific location Sturge-Weber syndrome: over the trigeminal nerve (associated with seizures, glaucoma) Klippel-Trénaunay-Weber syndrome: extremity
Hemangioma	Benign vascular tumor, caused by increased growth of endothelial cells on blood vessels Often benign and self-involutes, management depends on size and location	Nonspecific
Erythema toxicum	Flesh-colored papules with erythematous base, contains eosinophils, resolves in first week	Diffuse (face and trunk)
Pustular melanosis	Pustules without erythema, contain neutrophils, rupture and leave hyperpigmented macules that may persist for months	Diffuse (forehead, chin, neck, back)
Milia	White papules, consist of epidermal cysts with keratinous material, spontaneous rupture within first few weeks of life	Nose
Mongolian spots (dermal melanocytosis)	Blue-gray macules, up to 10-cm diameter, more common in black, Native American, and Hispanic populations; usually fade by four years of age, but can be confused with abuse and should be documented	Common in sacral region
Café au lait spots	Light-brown macule, likely benign but may be an early sign of neurofibromatosis or McCune-Albright syndrome	Nonspecific
Cutis marmorata	Reticular mottling of the skin caused by vascular response to cold, typically resolves with warmth	Usually localized to the lower limbs

Information from references 2 through 6.

reduced with pressure, and bowel sounds are sometimes auscultated.^{16,17} Inguinal hernias may incarcerate and strangulate, and thus should be surgically repaired. A hydrocele occurs when the failed closure allows only fluid to pass through and usually transilluminates with light. Hydroceles often resolve within the first one to two years of life.^{16,17}

An American Academy of Pediatrics policy statement asserts that the health benefits of male circumcision (e.g., prevention of urinary tract infections, penile cancer, and transmission of some sexually transmitted infections) outweigh the risks; however, the procedure should be performed only if the parents choose it.¹⁸ Hypospadias is the abnormal ventral placement of the urethral opening, which may be within the glans, the shaft of the penis, or scrotum (*Figure 2*). Newborns with hypospadias should not be circumcised because the foreskin may be used for repair.¹⁹ Chordee is a ventral curvature of the penis. It is a contraindication to circumcision and warrants referral to

urology for correction. A buried penis (a penis that retracts into a fat pad) should not be circumcised if the head is not exposed during rest because it could become trapped in the fat pad with postoperative swelling.^{20,21}

Anus/Rectum

The rectum should be examined for normal placement and patency. A sacral dimple is considered simple if it is less than 0.5 cm in diameter, is located within 2.5 cm of the anal verge, and is not associated with cutaneous stigmata (e.g., hairy patches, hemangiomas). Classically, sacral dimples that do not fit these criteria have prompted ultrasonography before three months of age to evaluate for spinal dysraphism.^{22,23} Recent information has shown that this may not be the best criteria for ultrasonography because evaluation for complex dimples without associated nonneurologic congenital abnormalities is unlikely to reveal an abnormality requiring surgical intervention. However, ultrasonography is a simple, noninvasive procedure and a good detector

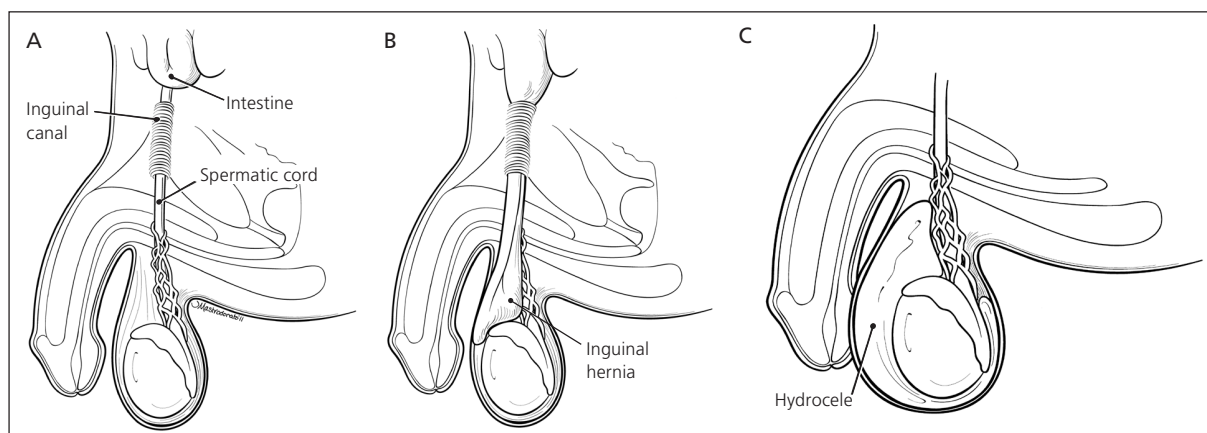


Figure 1. (A) Normal testis in the newborn examination. (B) An inguinal hernia occurs when the processus vaginalis fails to close, which leaves an opening for bowel to pass through and leads to a bulge in the inguinal canal that may extend to the scrotum. (C) A hydrocele occurs when the failed closure allows only fluid to pass through.

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of a tethered cord, if present.²⁴ An imperforate anus may be a sign of a syndrome or may be an isolated finding. A VACTERL association includes vertebral/vascular, anorectal, cardiac, tracheoesophageal, radial/renal, and limb anomalies. It is also commonly seen with trisomies 18 and 21.

Extremities

The hands and feet should be inspected for syndactyly and polydactyly. Supernumerary

digits arise from the lateral surface of a digit, most commonly on the ulnar aspect of the little finger, and vary from a complete digit with a nail bed and cartilage to a small amount of pedunculated skin. These digits are usually benign but are removed for cosmetic reasons. Supernumerary digits without bone involvement usually can be tied off at the base, whereas digits with bone often need surgery, which should be performed by a skilled plastic surgeon. Polydactyly may be an isolated abnormality but warrants a careful physical examination to investigate for other genetic abnormalities.²⁵ A single palmar crease may be a sign of trisomy 21 syndrome, but also occurs in 3% to 10% of persons without the syndrome.^{26,27} Clinodactyly (curvature of the fifth digit) may be hereditary or a sign of a variety of syndromes, including Turner syndrome and trisomy 21 syndrome.^{28,29}

Various palsies may occur in association with brachial plexus injury. These injuries are more common in newborns who are large for gestational age, especially those with shoulder dystocia or a prolonged delivery. An Erb palsy results from a traction injury to the C5 to C7 spinal nerve roots and may cause the newborn to hold his or her arm medially rotated to the side with the hand pronated (“waiter’s tip”). A Klumpke palsy involving lower segments of C8 and T1 results in paralysis of the entire arm with absent reflexes. A variant of Klumpke palsy, known as Klumpke paralysis, produces a claw hand, in which the forearm is supinated and the wrist and fingers are flexed. Palsies may require physical therapy.³⁰

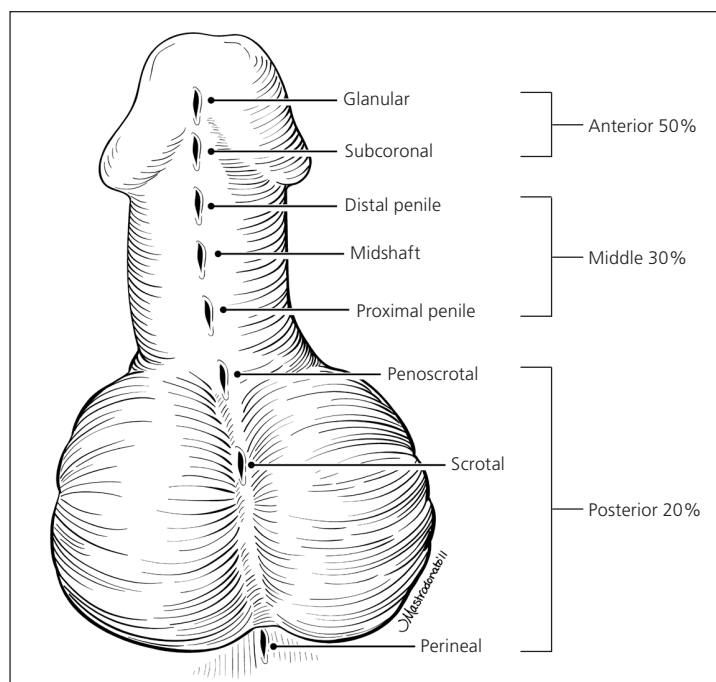


Figure 2. Possible location of the urethral meatus in newborns with hypospadias.

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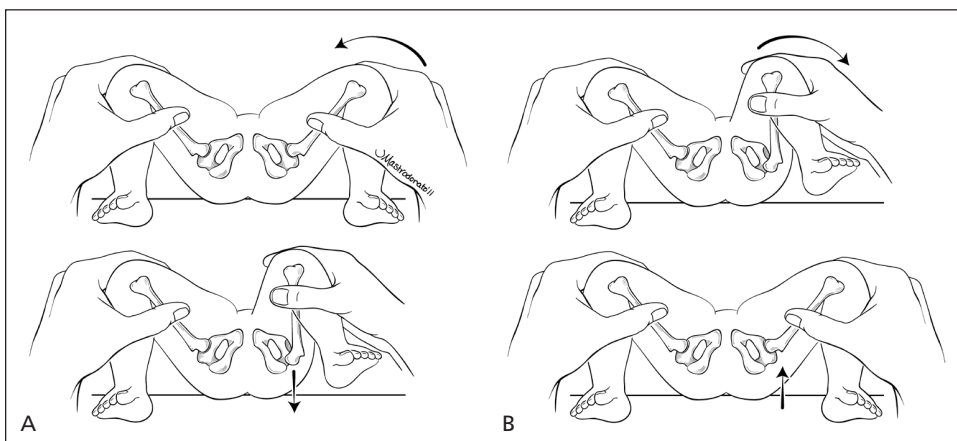


Figure 3. Techniques to evaluate for hip dysplasia in newborns. (A) The Barlow maneuver involves adducting the hip while pushing the thigh posteriorly to see if can be dislocated. (B) The Ortolani maneuver involves abducting the hips while pushing the thigh anteriorly and relocates reducible hips dislocated by the Barlow maneuver creating a clunk.

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Talipes equinovarus, or clubfoot, is a common orthopedic abnormality impacting one per 1,000 births. This abnormality results in the inversion and adduction of the forefoot, inversion of the heel and hindfoot, limited extension of the ankle and subtalar joint, and internal rotation of the leg. The examiner should first determine if this is merely a positional deformity that is easily corrected with manipulation and requiring no further management, or if it is truly talipes equinovarus necessitating an orthopedic consultation and usually casting.³¹ Pedal edema in the newborn may indicate Turner syndrome.³²

When evaluating the hips for dysplasia, each hip should be examined separately with the other hand stabilizing the pelvis (Figure 3). The Barlow maneuver involves adducting the hip while pushing the thigh posteriorly to see if it can be dislocated. The Ortolani procedure tests for posterior dislocation of the hips and is considered positive if a clunk is heard when the femoral head relocates anteriorly into the acetabulum. If the results of the newborn hip examination are equivocally positive (i.e., a soft click and mild asymmetry without an Ortolani or a Barlow sign), a follow-up hip examination two weeks later by the child's physician is recommended. A previous article in *American Family Physician* includes a full description of the assessment for hip dysplasia.³³

Girls born in a breech position (risk of dysplasia in this population is 120 per 1,000) should receive imaging (ultrasonography at six weeks of age or plain radiography at four

months of age). Imaging should be considered in newborns with a family history of developmental hip dysplasia (risk of 44 per 1,000 in girls and 9.4 per 1,000 in boys) and in boys born in a breech position (risk of 26 per 1,000).³⁴

Neurologic

The neurologic examination should assess the primitive reflexes, which include the suck, grasp, root, primitive stepping, and Moro reflexes. The Babinski reflex should cause dorsiflexion of the great toe on stimulation of the sole of the foot. In general, these reflexes become increasingly difficult to elicit beyond six months of life, as the central nervous system matures and begins to allow voluntary motor activity. The newborn's muscular tone should be evaluated by placing him or her in vertical suspension. When examining a newborn with hypotonia, it will feel as if the newborn is slipping through the examiner's hands due to weakness in the shoulder girdle and legs. The newborn will also feel rigid when moving the extremities and will stay extended for a prolonged period while in vertical suspension.³⁵

Data Sources: A PubMed search was completed using the terms infant, newborn, developmental delay, developmental disturbance, and physical examination. The search included meta-analyses, randomized controlled trials, clinical trials, and reviews. We also searched POEMs (patient-oriented evidence that matters), Clinical Evidence, the Cochrane database, and Essential Evidence Plus. Search dates: January 1, 2012, and May 2, 2014.

The opinions and assertions contained herein are the private views of the author and are not to be construed as

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official or as reflecting the views of the U.S. Army Medical Department or the U.S. Army Service at large.

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REFERENCES

1. Lewis ML. A comprehensive newborn examination: part I. General, head and neck, cardiopulmonary. *Am Fam Physician*. 2014;90(5):289-296.
2. Merlob P, Metzker A, Reisner SH. Transient neonatal pustular melanosis. *Am J Dis Child*. 1982;136(6):521-522.
3. Berg FJ, Solomon LM. Erythema neonatorum toxicum. *Arch Dis Child*. 1987;62(4):327-328.
4. O'Connor NR, McLaughlin MR, Ham P. Newborn skin: part I. Common rashes. *Am Fam Physician*. 2008;77(1):47-52.
5. Metry DW, Hebert AA. Benign cutaneous vascular tumors of infancy: when to worry, what to do. *Arch Dermatol*. 2000;136(7):905-914.
6. Comi AM. Update on Sturge-Weber syndrome: diagnosis, treatment, quantitative measures, and controversies. *Lymphat Res Biol*. 2007;5(4):257-264.
7. American Academy of Pediatrics Subcommittee on Hyperbilirubinemia. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation [published correction appears in *Pediatrics*. 2004;114(4):1138]. *Pediatrics*. 2004;114(1):297-316.
8. Brown J, Schwartz RA. Supernumerary nipples: an overview. *Cutis*. 2003;71(5):344-346.
9. Pinsker JE. Clinical review: Turner syndrome: updating the paradigm of clinical care. *J Clin Endocrinol Metab*. 2012;97(6):E994-E1003.
10. Christison-Lagay ER, Kelleher CM, Langer JC. Neonatal abdominal wall defects. *Semin Fetal Neonatal Med*. 2011;16(3):164-172.
11. Martínez-Frías ML, Bermejo E, Rodríguez-Pinilla E, Prieto D; ECEMC Working Group. Does single umbilical artery (SUA) predict any type of congenital defect? Clinical-epidemiological analysis of a large consecutive series of malformed infants. *Am J Med Genet A*. 2008;146A(1):15-25.
12. Deshpande SA, Jog S, Watson H, Gornall A. Do babies with isolated single umbilical artery need routine postnatal renal ultrasonography? *Arch Dis Child Fetal Neonatal Ed*. 2009;94(4):F265-F267.
13. Schwartz MZ, Shaul DB. Abdominal masses in the newborn. *Pediatr Rev*. 1989;11(6):172-179.
14. Tschudy MM, Arcara KM; Johns Hopkins Hospital. *The Harriet Lane Handbook*. 19th ed. Philadelphia, Pa.: Mosby Elsevier; 2012.
15. Murphy C, Allen L, Jamieson MA. Ambiguous genitalia in the newborn: an overview and teaching tool. *J Pediatr Adolesc Gynecol*. 2011;24(5):236-250.
16. Nakayama DK, Rowe MI. Inguinal hernia and the acute scrotum in infants and children. *Pediatr Rev*. 1989;11(3):87-93.
17. Lao OB, Fitzgibbons RJ Jr, Cusick RA. Pediatric inguinal hernias, hydroceles, and undescended testicles. *Surg Clin North Am*. 2012;92(3):487-504, vii.
18. American Academy of Pediatrics Task Force on Circumcision. Circumcision policy statement. *Pediatrics*. 2012;130(3):585-586.
19. Baskin LS, Ebberts MB. Hypospadias: anatomy, etiology, and technique. *J Pediatr Surg*. 2006;41(3):463-472.
20. Alter GJ, Horton CE, Horton CE Jr. Buried penis as a contraindication for circumcision [published correction in *J Am Coll Surg*. 1994;178(6):636]. *J Am Coll Surg*. 1994;178(5):487-490.
21. Peleg D, Steiner A. The Gomco circumcision: common problems and solutions. *Am Fam Physician*. 1998;58(4):891-898.
22. Kriss VM, Desai NS. Occult spinal dysraphism in neonates: assessment of high-risk cutaneous stigmata on sonography. *AJR Am J Roentgenol*. 1998;171(6):1687-1692.
23. Ben-Sira L, Ponger P, Miller E, Beni-Adani L, Constantini S. Low-risk lumbar skin stigmata in infants: the role of ultrasound screening. *J Pediatr*. 2009;155(6):864-869.
24. Chem JJ, Kirkman JL, Shannon CN, et al. Use of lumbar ultrasonography to detect occult spinal dysraphism. *J Neurosurg Pediatr*. 2012;9(3):274-279.
25. Christensen JC, Leff FB, Lepow GM, et al. Congenital polydactyly and polymetatarsalia: classification, genetics, and surgical correction. 1981. *J Foot Ankle Surg*. 2011;50(3):336-339.
26. U.S. National Library of Medicine. National Institutes of Health. Plus. Simian crease. May 10, 2013. <http://www.nlm.nih.gov/medlineplus/ency/article/003290.htm>. Accessed June 4, 2014.
27. Davies PA, Smallpeice V. The single transverse palmar crease in infants and children. *Dev Med Child Neurol*. 1963;25:491-496.
28. Jones KL, Smith DW. Down syndrome. In: *Smith's Recognizable Patterns of Human Malformation*. 6th ed. Philadelphia, Pa.: Elsevier Saunders; 2006.
29. Sureshbabu R, Kumari R, Ranugha S, Sathyamoorthy R, Udayashankar C, Oudeacoumar P. Phenotypic and dermatological manifestations in Down Syndrome. *Dermatol Online J*. 2011;17(2):3.
30. Jennett RJ, Tarby TJ, Krauss RL. Erb's palsy contrasted with Klumpke's and total palsy: different mechanisms are involved. *Am J Obstet Gynecol*. 2002;186(6):1219-1220.
31. Bridgens J, Kiely N. Current management of clubfoot (congenital talipes equinovarus). *BMJ*. 2010;340:c355.
32. Säwendahl L, Davenport ML. Delayed diagnoses of Turner's syndrome: proposed guidelines for change. *J Pediatr*. 2000;137(4):455-459.
33. French LM, Dietz FR. Screening for developmental dysplasia of the hip. *Am Fam Physician*. 1999;60(1):177-184, 187-188.
34. Committee on Quality Improvement, Subcommittee on Developmental Dysplasia of the Hip, American Academy of Pediatrics. Clinical practice guideline: early detection of developmental dysplasia of the hip. *Pediatrics*. 2000;105(4 pt 1):896-905.
35. Zafeiriou DI. Primitive reflexes and postural reactions in the neurodevelopmental examination. *Pediatr Neurol*. 2004;31(1):1-8.