HEALTH SUPERVISION

Health Supervision, Case #1

Written by Sandy Sanguino

What topics are important to cover in a prenatal visit?

Definitions for Specific Terms:

Prenatal Visit- A visit with the pediatrician that occurs before the birth of the child.

Review of Important Concepts:

Clinical Reasoning

The purpose of this visit is multi-faceted. It is about establishing a relationship with the family. It also provides an opportunity to introduce the family to the practice, provide guidance and identify risk-factors. It is important to address any concerns the family might have. Additional priorities for this visit should include:

1. Family resources (family support systems, transition home [assistance after discharge], family resources, use of community resources)
2. Parental (maternal) well-being (physical, mental, and oral health; nutritional status; medication use; pregnancy risks)
3. Family history (specifically inherited diseases)
4. Breastfeeding decision (breastfeeding plans, breastfeeding concerns [past experiences, prescription or nonprescription medications/drugs, family support of breastfeeding], breastfeeding support systems, financial resources for infant feeding)
5. Safety (car safety seats, pets, alcohol/substance use [fetal effects, driving], environmental health risks [smoking, lead, mold], guns, fire/burns [water heater setting, smoke detectors], carbon monoxide detectors/alarms)
6. Newborn care (introduction to the practice, illness prevention, sleep [back to sleep crib safety, sleep location], newborn health risks [hand washing, outings]), discuss circumcision

Suggested Learning Activities:

- Have the students role play a prenatal visit.

Other Resources:

- http://brightfutures.aap.org/3rd_Edition_Guidelines_and_Pocket_Guide.html

Health Supervision, Case #3

Written by Penny Murata, M.D.

A twelve month-old child is seen for a health maintenance visit. He is due to receive his vaccines. On exam he has a temperature of 100.4°F and a runny nose. Should he still be immunized? What are the absolute contraindications to immunizations?

Definitions for Specific Terms:

Fever- What is a fever? Fever is defined as temperature ≥100.4°F

Health maintenance visit- What are the usual ages for health maintenance visits? (newborn follow-up; 2, 4, 6, 9, 12, 15, 18 months; 2 years and annually thereafter); What are the components of a health maintenance visit? (interval history of illness or injury since previous visit; parental concerns; nutrition; behavior; sleep habits; elimination habits; developmental milestones; growth; safety; anticipatory guidance; screening for lead and anemia; review of immunizations needed; recommendations for timing of next visit)

Absolute contraindications- Absolute contraindication refers to definite reasons for not administering the immunizations as opposed to "precautions", which indicate vaccines would most likely be deferred, but might be administered if the benefit outweighs the risk.

Review of Important Concepts:

Historical Points

1. Severity of current illness: Does the patient have additional symptoms of moderate or severe illness that are indications to delay vaccine administration? If a child has a severe illness (e.g. influenza, bronchiolitis, pneumonia etc) the vaccines should be delayed to avoid confusing a vaccine reaction with the illnesss, Mild illnesses, including upper respiratory infection, otitis media, diarrhea, and need for antibiotic use, are not contraindications to vaccination. There is no evidence that administering vaccine during mild illnesses decreases the effectiveness of the vaccine or increases the risk of adverse reactions to the vaccine.

2. History of adverse reaction to vaccine(s): Patients should be screened for previous serious reactions to vaccines (e.g. anaphylactic reaction to vaccine or vaccine component; Guillain-Barre Syndrome). Children with egg allergies can be given MMR without prior skin testing. Anaphylactic symptoms include hives, wheezing or difficulty breathing, circulatory collapse, and shock.

3. History of immunodeficiency: Leukemia, cancer, AIDS, and other immunocompromised conditions are usually contraindications for live virus vaccines. Which vaccines are live? (MMR, MMRV, varicella, rotavirus, and intranasal live attenuated influenza vaccine [LAIV]) MMR and varicella vaccines should be considered for HIV-infected children, depending on age-specific CD4+T-lymphocyte counts (≥15%).

4. History of chemotherapy or steroid therapy in the past 3 months: Chemotherapy or long-term high-dose steroid treatment is an indication to postpone live virus vaccines. Ask about the timing, duration, and dose of treatment.

5. History of blood product transfusion, immune globulin or antiviral drug use: Live virus vaccines might need to be postponed.

6. History of vaccinations in the past 4 weeks: The interval between LAIV or injectable live virus vaccine (MMR, MMRV, varicella, yellow fever) and similar vaccine is 28 days.

Physical Exam Findings

Moderate or severe illness: Examples include respiratory distress or dehydration.

Clinical Reasoning

1. Which immunizations are indicated for a 12 month-old child? MMR, varicella, hepatitis A (HAV), Pneumococcal, Haemophilus influenza type B (Hib), DTaP (if at least 6 month interval between DTaP#3 and today's DTaP#4), polio#3 if not yet received, hepatitis B (HBV)#3 if not yet received, and possibly influenza depending on the season.

2. What are absolute contraindications to immunizations? Anaphylactic reaction to vaccine or vaccine components (neomycin, streptomycin or polymyxin B-polio; alum and possibly 2-phenoxyethanol-HBV; neomycin or gelatin – MMR, varicella; egg-influenza); encephalopathy within 7 days of DTaP dose; moderate or severe acute illness.

3. What are precautions to vaccines? For DTaP, precautions include previous reaction to DTaP dose: seizure within 3 days, pale or limp episode or collapse within 48 hours, continous crying for ≥3 hours within 48 hours, fever of 105°F within 48 hours.

4. What are common reactions to the vaccines that are indicated? DTaP – fever, local inflammation, fussiness, tiredness, poor appetite, vomiting; Polio – local pain; Pneumococcal – fever, drowsiness, loss of appetite, local inflammation; Hib – fever, local inflammation; HAV – headache, loss of appetite, tiredness, local soreness; HBV – fever, local soreness; MMR – fever, mild rash usually within 7-12 days; varicella – local inflammation, fever, or mild rash up to a month after dose; influenza – local inflammation, hoarseness, sore/red/itchy eyes, cough, fever, aches

Diagnosis:

1. If the patient has no additional symptoms, how would you characterize the current acute illness?
   Mild (not moderate or severe)

2. Are there any vaccines that you would withhold or postpone?
   No, if the patient has no prior reactions to vaccines and given today's mild illness, the patient can receive all indicated vaccines.

Suggestions for Learning Activities:

- Have the students discuss the case in small groups of 2-3 students and refer to the Vaccine Information Statements (VIS) for contraindications and common reactions to the indicated vaccines.
- Ask the students to role play the scenario (in small groups or a select few students in front of the large group): the "parent" can express concerns about giving the vaccines when the child is ill and about the possible reactions; the "health care provider" can address the concerns.

Other Resources:

- AAP Red Book: Report of the Committee on Infectious Diseases
- American Academy of Pediatrics www.cispimmunize.org
- Centers for Disease Control www.cdc.gov
- National Network for Immunization www.immunizationinfo.org
- Parents of Kids with Infectious Diseases www.pkids.org

Health Supervision, Case #4

Written by Penny Murata, M.D.

A twelve month-old child has been taking 2 mg/kg/day of oral prednisone for the past three days for asthma. He is due for his routine immunizations. Would you modify his immunization schedule? What if he had been taking 2 mg/kg/day for the past three weeks?

Definitions for Specific Terms:

Prednisone- Prednisone is a synthetic corticosteroid with immunosuppressive and anti-inflammatory properties. What forms of steroids are available, in addition to the oral form? Intravenous, inhaled, intramuscular

Asthma- How is asthma diagnosed in young children? It might be difficult to make a definitive diagnosis of asthma in a twelve month-old child; the diagnosis could be supported by personal or family history of atopy and, over time, recurrent episodes of wheezing responsive to bronchodilator use and pulmonary function tests.

Review of Important Concepts:

Historical Points

1. What is the usual duration of prednisone treatment for acute asthma exacerbation?
   3-5 days, but sometimes up to 7 days or longer depending on patient's response
2. Is the current dose at the usual recommended dose?
   Yes, the usual dose of oral prednisone for asthma exacerbation in the outpatient setting is 1-2 mg/kg/day divided once a day or twice a day.
3. How severe is the patient's current illness?
   The patient has been on oral prednisone for the past 3 days, but might need a longer course depending on the response.

Physical Exam Findings

Respiratory symptoms: Moderate or severe illness, including respiratory distress, is a contraindication to vaccination. Assess for respiratory rate, shortness of breath, cyanosis, nasal flaring, retractions, and breath sounds.

Clinical Reasoning

1. Which immunizations are indicated for a 12 month-old child [see also Health Supervision #3]?
   MMR, varicella, hepatitis A (HAV), Pneumococcal, Haemophilus influenza type B (Hib), DTaP (if at least 6 month interval between DTaP#3 and today's DTaP#4), polio#3 if not yet received, hepatitis B (HBV)#3 if not yet received, and possibly influenza depending on the season.

2. How could predisone use affect the immunizations administered to this patient?
   Prednisone use could result in immunosuppression.

3. Which of the above indicated immunizations are generally contraindicated in an immunosuppressed patient?
   Live vaccines (MMR, varicella, live attenuated influenza vaccine)

4. What amount and duration of systemic steroids are considered unlikely to induce immunosuppression?
   Short term (<14 days); low to moderate dose (<20 mg prednisone/day); long-term, alternate day treatment with short-acting steroids; maintenance physiologic doses for replacement therapy; or topical, inhaled, or intraarticular, bursal, or tendon injection.

5. What amount and duration of systemic steroids might induce immunosuppression?
   ≥2 mg/kg of body weight or ≥20 mg./day of prednisone or equivalent for persons who weigh >10 kg for ≥14 days

Diagnosis:

1. For the patient taking 2 mg/kg/day of oral prednisone for the past three days, would you consider the patient to be immunosuppressed, and if so, how would you alter the immunization administration?
   No.

2. For the patient taking 2 mg/kg/day of oral prednisone for the past three weeks, would you consider the patient to be immunosuppressed, and if so, how would you alter the immunization administration?
   Yes. It is recommended to postpone live virus vaccinations for at least one month after discontinuing the corticosteroid therapy.

Suggestions for Learning Activities:

- Have the students refer to the Advisory Committee on Immunization Practices (ACIP) General Recommendations on Immunization and drug reference information (e.g. Epocrates or PDR online)
- Modify the case to allow the students to calculate the patient's steroid dose based on the patient's weight and dose of steroid (rather than stating the dose as "2 mg/kg/day")

Other Resources:

- AAP Red Book: Report of the Committee on Infectious Diseases
- American Academy of Pediatrics www.cispimmunize.org
- Centers for Disease Control www.cdc.gov
- Advisory Committee on Immunization Practices (ACIP) General Recommendations on Immunization
- Epocrates www.epocrates.com

Health Supervision, Case #5

Written by Julia Belkowitz, M.D. and Leticia Oliveros, M.D.

In the nursery, parents are informed that blood needs to be drawn from their newborn for "screening tests". Describe to the parents what these are and why they are performed. What tests are routinely performed in your state? How are the results transmitted to the parents?

Definitions for Specific Terms:

Screening tests- A diagnostic test used to identify disease in patient not yet showing symptoms.

Newborn screening test- A set of tests administered to all newborns in order to identify serious health conditions prior to the onset of symptoms. All states require universal testing; however the individual tests performed vary state by state.

Review of Important Concepts:

Historical Points

The test is performed on all newborns regardless of the patient's history. However, some important components of the history to include when interpreting the results include the following:

1. Timing of when the specimen was drawn
2. Birth/ neonatal history: Important factors that could affect the newborn screen results include preterm birth, feeding history, previous medical treatments including blood transfusions or parenteral nutrition
3. Family history can be used to try to identify other family members affected.
4. Feeding history: When feeds were initiated (has it been 24 hours), type of milk/ formula, any feeding difficulties/ interruptions

Physical Exam Findings

Most cases do not show any physical signs at the time of testing

Clinical Reasoning

1. Why is newborn screening done?
   Newborn screening tests are done to identify serious, disabling or life threatening conditions that present after birth. Most conditions identified have a very low prevalence. Most states also include a hearing test as a part of the newborn screening program.

2. How many tests are included in the screen?
   The American College of Medical Genetics recommends that each state test for a core panel of 29 disorders and an additional 25 secondary conditions to be included in the testing. Each state varies in its panel, however. Students can refer to the state health department to identify the panel used in individual states.

3. What types of conditions are tested for in newborn screening?
   a. Amino acid metabolism disorders (e.g. Phenylketonuria, maple syrup urine disease, homocystinuria)
   b. Organic acid metabolism disorders (problems breaking down chemicals like amino acids, lipids, sugars, and steroids, e.g. isovaleric acidemia, multiple carboxylase deficiency)
   c. Fatty acid oxidation disorders (e.g. carnitine uptake defect)
   d. Hemoglobinopathies (e.g. sickle cell anemia, Hb S/beta-thalassemia, Hb S/C disease)
   e. Others (e.g. hypothyroidism, cystic fibrosis, congenital adrenal hyperplasia, galactosemia, biotinidase deficiency)

4. What are the benefits of universal screening?
   a. Benefits of testing include that clinical manifestations can be reduced or eliminated because of early identification and intervention.
   b. It can also potentially identify other family members at risk.

5. What are the risks of the test?
   a. Risks and limitations of the test include the false negative and false positive associated with the testing.
   b. A screen does not rule in or rule out disease. This can lead to additional testing and the associated financial and social costs (including stress to families).
   c. There also may be affected children not identified.

6. How is the testing done?
   The process by which newborn screening is done varies state by state. Typically the lab is drawn after 24 hours of age/ protein feedings via a heel stick. A drop of blood is placed into each of the specimen areas on special filter paper and sent to the lab for analysis via tandem mass spectrometry and other techniques.

7. How are the results transmitted to patients?
   The testing laboratory has the responsibility of communicating test results to the hospital of birth and/ or physician of record for the newborn. For abnormal results, most states have systems in place to notify the family in need of immediate medical care and/ or follow up by a specialist. In some states, the primary care provider for the newborn is responsible for communicating the results to the parents.

Suggestions for Learning Activities:

- Students can role play the interaction with the parents.
- Students can look up what screening tests are done in their state and learn about the processes in place for an abnormal result. The ACT sheets from the American College of Medical Genetics are a helpful resource.
- Students can discuss the complexities of a system required for management of one individual child with an abnormal test, including the coordination required at all levels of the system from the state laws, lab draw and testing, notification system to medical provider, challenges with contacting the individual family, and having them access the confirmatory testing, including potential therapy.
- Students can discuss the benefits and costs (psychological and financial) of newborn screening to the individual and society.

- Students can discuss the ethical implication of screening programs and/ or the concept of screening for late onset diseases.

Other Resources:

- ACMG ACT Sheets and Confirmatory Algorithms. American College of Medical Genetics; http://www.acmg.net/AM/Template.cfm?Section=ACT_Sheets_and_Confirmatory_Algorithms&Template=/CM/HTMLDisplay.cfm&ContentID=5127. Accessed July 28, 2011.
- Kaye CI M.D. and Committee on Genetics. Technical Report: Introduction to the Newborn Screening Fact Sheets. Pediatrics. 2006; 118(3):1304-1312.
- March of Dimes. www.marchofdimes.com
- National Newborn Screening and Genetics Resource Center. www.genes-r-us.uthscsa.edu
- Newborn Screening Overview. National Center for Medical Home Resources. http://www.medicalhomeinfo.org/how/clinical_care/newborn_screening.aspx. Accessed July 28, 2011.

Health Supervision, Case #7

Written by Julia Belkowitz, M.D.

A four-month old boy is seen for a well child examination. Following his first set of immunizations he had a temperature of 103° for 12 hours and was extremely irritable. The parents are concerned about giving the next set of immunizations. How would you address their concerns?

Definitions for Specific Terms:

Vaccine contraindication- A condition that increases the risk for a serious adverse reaction.

Vaccine Precaution- A condition that might increase the risk for a serious adverse reaction or that might compromise the ability of the vaccine to produce immunity. In general a vaccine should be held in a patient with a precaution unless the benefits outweigh the risks (i.e. community outbreak of infectious disease).

Review of Important Concepts:

Historical Points

- Associated symptoms with episode above- seizure, inconsolable crying, neurologic changes or altered consciousness
- Past medical history- progressive neurological illness
- Return to baseline after 12 hour period

Physical Exam Findings

Complete physical exam

Clinical Reasoning

1. Physician must differentiate a common, expected vaccine reaction from an event that would indicate a precaution or contraindication from administering the next vaccinations.
   What are the expected reactions to vaccines? Common vaccine reactions can be
   a. Local (such as pain or redness at the site)
   b. Systemic (such as fever)

2. What are the contraindications for vaccination?
   Absolute contraindications are few and include an anaphylactic reaction to a previous vaccine or encephalopathy (e.g., coma, decreased level of consciousness, or prolonged seizures) within 7 days of previous administration of DTP/ DTaP. Vaccines using the whole cell pertussis (DTP) vaccines are no longer used in the US as they have been replaced with the acellular form (DTaP), associated with fewer adverse effects, since licensed in 1991.

3. What are the vaccination precautions?
   Precautions include moderate or severe acute illness with or without fever, progressive neurologic disorder, including infantile spasms, uncontrolled epilepsy, progressive encephalopathy or reactions

to previous vaccines including temperature of ≥105°F (≥40.5°C), collapse or shock-like state (i.e., hypotonic hyporesponsive episode), persistent, inconsolable crying lasting ≥3 hours, Guillain-Barre syndrome <6 weeks after previous dose of tetanus toxoid--containing vaccine.

4. Can a child receive vaccinations if they have a fever after vaccinations?
   Conditions commonly misperceived as contraindications can lead to missed opportunities for vaccinations. Vaccines may be given during mild acute illness with or without fever or current antimicrobial therapy; after mild to moderate local reaction or low-grade or moderate fever after previous vaccine (less than 105 degrees); recent exposure to an infectious disease; family history of seizures, SIDS, or adverse vaccine event.

5. Can this child receive vaccinations again?
   The child in this case appears to have an expected vaccine reaction and the parents should be counseled to continue with vaccinations according to the recommended schedule.

6. How should a physician communicate with a parent concerned about or reluctant to vaccinate their child?
   Open, effective communication is vital during discussions of concerns related to immunizations. The provider should ask directly what the parent's specific concerns are (as well as the source of the information) in order to adequately address the concern.

7. What are cooling measures that can be used in case of fever following future vaccinations?
   a. Infant acetaminophen at appropriate weight-based dose
   b. Remove child's clothing
   c. Tepid bath

8. What information should be given to parents about vaccination?
   In order to reduce concerns with parents about vaccination reactions, parents should be educated about the possible vaccine reactions prior to immunization through discussions with the provider and provision of Vaccine Information Sheets (VIS).
9. Is it ok to delay vaccination of a child?
   Delay of vaccinations constitutes a missed opportunity and leads to incomplete vaccination and subsequent increased risk for preventable illnesses in the child and the community.

10. What should a physician do if there is an adverse event after vaccination?
    In the case of a clinically significant adverse reaction, it should be reported to the Vaccine Adverse Event Reporting System (VAERS). This system helps monitor such outcomes and maintain the safety of vaccines.

Suggestions for Learning Activities:

- Role play the counseling session with the family
- Students can search for individual vaccine contraindications and precautions.
- Students can practice searching for VIS for specific vaccines in specific languages.
- Students can discuss other common concerns they have heard from friends/ family and the media about vaccinations and discuss how to address these misperceptions (i.e. mercury in vaccines, link with autism, etc.) on a community level.

Other Resources:

- American Academy of Pediatrics. Active and Passive Vaccination. In: Pickering LK, Baker CJ, Kimberlin DW. Long SS, eds. Report of the Committee on Infectious Diseases. 28th ed. Elk Grove, IL: American Academy of Pediatrics; 2009: 1-9, 40-43.
- American Academy of Pediatrics. Immunizations: Communicating with Families. http://www.aap.org/immunization/pediatricians/communicating.html. Accessed July 28, 2011.
- Centers for Disease Control www.cdc.gov (vaccine information statements)
- Kroger AT, Sumaya CV, Pickering LK, Atkinson WL. General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP). (January 28, 2011) MMWR: Morbidity and Mortality Weekly Report. 60; 1-60. Retrieved from http://www.cdc.gov/mmwr.

Health Supervision, Case #8

Written by Julia Belkowitz, M.D. and Fred Malkin, M.D.

The parents of a previously healthy nine-month-old girl want to know why a hemoglobin was checked. How would you answer their concern? What are the common etiologies of anemia at this age? How would you evaluate an abnormal hemoglobin level?

Definitions for Specific Terms:

Hemoglobin (Hgb or Hb)- Is the concentration of red blood cell (RBC) pigment in whole blood
Anemia is defined as a low Hgb concentration or red blood cell (RBCmass compared with age-specific norms.
Normal Hgb levels vary by age:

Age	Hgb	MCV
Birth	13.5-24	95-121
<1 mo	10.0-20	
1-2 months	10-18	
2-6 months	9.5-14	
6 months-2 yrs	10.5-13.5	70-86
2-6 yrs	11.5-13.5	
6-12 yrs	11.5-15.5	

Iron deficiency anemia is the final stage of iron depletion [iron depletion→ iron deficiency→ iron deficiency anemia].

Review of Important Concepts:

Historical Points

- Birth history – jaundice/phototherapy
- Nutritional history- type and quantity of milk/ formula, cow's milk, heme rich foods
- Family history of anemia, elevated lead levels
- Developmental history
- Symptoms of anemia such as pica, irritability, fatigue, exercise intolerance, dark colored urine due to hemolysis, dark stools or hematuria due to blood loss
- Exposure to drugs or toxins (e.g. lead)
- Children with iron deficiency anemia are often asymptomatic)

Physical Exam Findings

Often none but look for pallor, tachycardia, icteric sclera, jaundice, cardiac dilatation, systolic murmurs, splenomegaly, koilonychia, angular stomatitis

Clinical Reasoning

1. Why screen for anemia?
   a. Iron deficiency anemia is the most common cause of anemia worldwide and in U.S. Fourteen percent of 1-2 year olds are iron deficient (http://www.cdc.gov/nchs/fastats/anemia.htm).
   b. Anemia can have potential effects on development and behavior.
   c. Screening is recommended for all infants between ages 9- 12 months (and again 6 months later in high risk communities) to diagnose and treat early.
   d. Primary prevention, through dietary education, is crucial to prevent iron deficiency.

2. Who is especially at risk?
   High risk factors include:
   a. WIC eligibility
   b. Children of migrant workers
   c. Recently arrived refugees
   d. Early introduction of whole cow's milk (before 1 year of age)
   e. Consumption of greater than 24 oz of whole cow milk per day (after the first year of life)
   f. Preterm birth or low-birth weight
   g. Intake of noniron-fortified infant formula
   h. Breastfeeding but receiving inadequate dietary iron after age 6 months

3. Why are children this age at risk?
   a. Babies are born with sufficient iron stores, but rapid growth decreases iron stores by 6 months of age.
   b. Adequate dietary intake is required to meet high demands of growth.

Diagnosis:

1. What screening test should be used?
   a. Typically only a hemoglobin or hematocrit is ordered as the initial test.
   b. If the screen shows low hemoglobin or hematocrit and dietary history is consistent, empiric treatment for iron deficiency anemia is begun with education on proper diet and supplementation with 3- 6 mg/kg elemental iron per day. Parents should be instructed that iron is absorbed better with an empty stomach/ juice and inhibited by calcium.

2. How do you confirm the diagnosis?
   Hemoglobin should be rechecked in 1 month. If the hemoglobin has increased by at least 1 g/dL, a diagnosis of iron-deficiency anemia can be made. Treatment is continued for 2- 3 months (at least one month after hemoglobin returns to normal levels) to replace iron stores.

3. What if it is not iron deficiency anemia?
   If the initial screen shows a low hemoglobin in the setting of an iron rich diet or if the patient does not respond as above to iron therapy, other sources for anemia, including occult blood loss, should be investigated.

4. Which tests should be used for further evaluation?
   a. Additional laboratory analysis includes a complete blood count and peripheral smear, serum ferritin, serum iron, total iron binding capacity, and reticulocyte count.
   b. Findings consistent with iron-deficiency anemia are decreased mean corpuscular volume (MCV), decreased mean corpuscular hemoglobin concentration (MCHC), low serum ferritin, increased red cell distribution width (RDW), low serum iron, and high total iron binding capacity (TIBC).
   c. The reticulocyte is expected to increase in response to oral iron supplementation within 7 days.

5. What are other causes for anemia in a child this age?
   a. Other causes of microcytic anemia include thalassemia, lead poisoning,chronic disease, sideroblastic anemia, aluminum toxicity, copper deficiency, and Hb C disorders.
   b. Normocytic anemias include acute blood loss, chronic disease, malignancy, hemolysis, hemoglobinopathies, membrane defects and enzymopathies.
   c. Macrocytic anemias include folate deficiency, vitamin B12 deficiency, hypothyroidism, liver disease, aplastic anemia, Diamond-Blackfan or Fanconi's anemia, and drug effects.
   d. The reticulocyte count is a useful tool to help differentiate.

Suggestions for Learning Activities:

- Students can review the Bright Futures guidelines for other recommended screening in children.
- Given a set of lab results, students may discuss the potential etiology of anemia for an individual child (for example: anemia, low MCV, normal RDW→ thalassemia trait); different sets of results can be given to small groups of students.
- Students can look up the dietary recommendations for infants and children including those that are breastfeeding, formula feeding and taking solid foods.
- Students can calculate the dose of iron supplementation and possible side effects of iron supplementation (e.g. dark stools, staining of teeth, constipation).
- Incorporate images of red blood cell morphology

Other Resources:

- American Academy of Pediatrics. Bright Futures 3rd Edition Guidelines, Pocket Guide, Tool and Resource Kit. http://brightfutures.aap.org/3rd_Edition_Guidelines_and_Pocket_Guide.html. Accessed July 28, 2011.
- American Academy of Pediatrics Committee on Nutrition. Diagnosis and Prevention of Iron Deficiency and Iron-deficiency Anemia in Infants and Young Children (0-3 years of age). Pediatrics. Nov 2010;126(5):1040-1050.
- Kleinman RE. Pediatric Nutrition Handbook. 6th Edition. Elk Grove, IL, American Academy of Pediatrics; 2009:410-419.
- Oski, F. Iron deficiency in infancy and childhood. N England J Med. 1993; 329:190-193.
- Wu AC, Lesperance L, Bernstein H. Screening for Iron Deficiency. Pediatrics in Review. 2002;23:171-178.

Health Supervision, Case #9

Written by Mary E. Brown, M.D., M.S.

The parents of a previously healthy three-year-old boy would like their son tested for tuberculosis. What are the indications for tuberculosis testing? What are the measurements of a positive PPD? How do you interpret a positive PPD in children who had a BCG vaccine?

Definitions for Specific Terms:

Tuberculin skin test (TST)- Skin test containing purified protein derivative (PPD) which causes a delayed hypersensitivity reaction in people who have had exposure to or infection with TB.

Latent tuberculosis infection (LTBI)- An infection with M. tuberculosis without symptoms of TB disease and without evidence of TB disease on chest x-ray.

TB Exposure- A person who has a history of contact with a person with confirmed or suspected TB, but who has a negative TST and no evidence of TB disease on physical exam or chest x-ray themselves.

BCG vaccine- Attenuated M. bovis vaccine given to people in areas in which TB is more prevalent or endemic.

High-risk countries- Countries other than the United States, Australia, New Zealand, or Western European countries.

Review of Important Concepts:

Historical Points

- What are the risk factors for exposure to or infection with TB?
  - Family history – family member or close contact with TB disease? Family member with a positive PPD?
  - Travel history – travel for >1 week to a high-risk country?
  - Birth history – born in a high risk country?
  - Immunization history – received BCG vaccine?

- What are the symptoms of TB disease?
  - Fever, night sweats, cough, hemoptysis, shortness of breath.
  - Children with LTBI will not present with any symptoms of active TB disease

Physical Exam Findings

1. LTBI: Children will have no signs of TB disease on exam.

2. Pulmonary TB disease: Lung exam may demonstrate rales, wheezing, and/or decreased breath sounds.

Clinical Reasoning

1. What are the indications for TST in children?
   a. Children who have risk factors for exposure to or infection with TB as noted in Historical points above.
   b. Annual TST is also indicated for children with HIV infection and incarcerated adolescents.
   c. Before starting immunosuppressive therapies

2. What is a positive PPD?
   Measured by diameter of induration, not erythema, between 48-72 hours after placement.
   A positive PPD varies depending on the child's risk factors for having LTBI and progressing to active TB disease.
   a. ≥ 5mm induration –
      - close contact with person with known or suspected TB disease
      - children on immunosuppressive therapies or with immunodeficiency
   b. ≥ 10 mm induration –
      - Increased risk of progression from LTBI to active TB disease
        - children < 4 years old
        - children with chronic diseases
      - Increased risk of exposure to TB disease
        - Children born in areas with a high prevalence of TB
        - Children with exposure to adults who have HIV, are homeless, drug users, incarcerated
   c. ≥ 15 mm induration –
      - Children ≥ 4 years old with no risk factors

3. How do you interpret a positive PPD in children who received BCG vaccine?
   A PPD is interpreted with the above criteria, regardless of whether a child has received BCG vaccine.
   Children who receive BCG vaccine are generally at increased risk for infection with TB (i.e. children living in areas where TB is more prevalent).

Suggestions for Learning Activities:

- Discuss the management of a child with a positive PPD.
- Review a chest x-ray of a child with pulmonary tuberculosis.

Other Resources:

- Cruz AT, Starke JR. Pediatric Tuberculosis. Pediatrics in Review. 2010;31(1):13-26.
- Tuberculosis. In: Pickering LK, Baker CJ, Kimberlin DW, Long SS, eds. Red Book: 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2009: 680-701.

Health Supervision, Case #11

Written by Penny Murata, M.D.

The mother of a twelve month-old girl, living in a house built four years ago, wants to know why her daughter should undergo lead testing. How would you respond to her concerns? What are the risk factors for lead poisoning? How do you treat an elevated lead level?

Definitions for Specific Terms:

Elevated blood lead level (EBLL)- EBLL is defined as 5 µg/dL or higher.

Review of Important Concepts:

Historical Points

1. Risk factors for EBLL: What are risk factors for lead exposure?
   a. Lead-based paint (banned in 1978) or lead-contaminated dust (created through deterioration of lead-based paint)
   b. Folk medication (greta, azarcon, ghasard, Ba-baw-san, Daw Tway, Pay-loo-ah, litargirio, surma, ayurvedic medicine)
   c. Artificial turf
   d. Candy imported from Mexico
   e. Certain cosmetics (kohl)
   f. Toy jewelry
   g. Toys
   h. Tap water
   i. Cookware
   j. Ceramics
   k. Lozeena spice
   l. Caregivers who work with lead-based products
   m. Sibling or playmate with EBLL
   n. Recent immigrant, refugee, or foreign adoptee;
   o. Low socioeconomic status

2. Symptoms of EBLL: What are possible symptoms of EBLL?
   a. Cognitive development is adversely affected by blood lead levels <10 µg/dL
   b. Most children with EBLL <40 µg/dL are asymptomatic, however at higher levels of blood lead, symptoms include headache, abdominal pain, vomiting, constipation, loss of appetite, constipation, clumsiness, somnolence, and irritability.

3. Age-associated risk: What ages are most at risk of lead poisoning and why?
   Children less than age 72 months (peak at about 24 months old) are at higher risk for EBLL due to the period of rapid growth and greater likelihood of putting their hands and other objects in their mouths. (Frequent hand washing might be useful in lowering EBLL, but there is no supporting data.)

Physical Exam Findings

1. Encephalopathy: lead level threshold is 70 μg/dL, but usually linked with higher lead levels

2. At-risk behaviors: pica, hand-to-mouth activity

3. Neurodevelopmental or behavioral disorders: distractibility, aggression, speech delay, or cognitive delay

Clinical Reasoning

1. Universal vs targeted screening: What are the advantages and disadvantages of universal screening vs targeted screening? (consider cost of testing, decreasing prevalence of EBLL, population at risk of EBLL, clinical manifestations and cost of EBLL)

2. What are the recommendations for lead screening? For children enrolled in Medicaid or an assistance program, lead screening is recommended at ages 12 and 24 months and if not previously screened, at age 36 to 72 months. For children not eligible for Medicaid or assistance program, the guidelines are not clear.

Diagnosis:

1. Method of testing:
   Venous blood lead level is the only reliable test.
   Lead toxicity: The degree of lead toxicity is indicated by the blood lead level category (μg/dL): 5-44; 45-69; >70.

2. What laboratory tests in addition to lead level would be helpful?
   Hemoglobin or hematocrit is recommended because anemia is linked with EBLL (peripheral smear is not useful as basophilic stippling is not specific for EBLL); inhibition of heme synthesis can cause excess porphyrins (free erythrocyte protoporphyrin [FEP] or zinc protoporphyrin [ZPP]) which are useful to follow cases of EBLL >25 μg/dL

3. What radiological studies might be useful?
   Abdominal x-ray can detect ingestion of lead-contaminated non-food items.

4. Tests that are not recommended:
   Searching for gingival lead lines; testing hair, teeth, or nails for lead; neurophysiologic function testing; renal function testing except during chelation with EDTA; imaging of long bones for lead lines; X-ray fluorescence of long bones to estimated lead in bones

5. The lead level determines management:

Blood lead level (µg/dL)	Management
<5	Dietary and environmental education Assess for lead exposure
5-44	Add to above: Confirm within 1-3 months and follow up lead levels Complete history and physical exam Labs-iron status, consider hemoglobin or hematocrit Environment assessment to remove lead exposure Neurodevelopmental monitoring Consider abdominal X-ray if indicated
45-69	Add to above: Confirm within 48 hours Labs-hemoglobin or hematocrit, FEP Abdominal X-ray Oral chelation (hospital if indicated)
>70	Add to above: Confirm urgently Hospitalization for chelation

Suggestions for Learning Activities:

- Ask the students to determine the management based on different scenarios with various lead level results
- Present a case of EBLL and have the students (in large group or small groups) ask the history to determine the most likely source of lead
- Ask the students to find items recently recalled because of high lead content (available through CDC website)
- Each student investigates home remedies used in own family and whether the home remedy has been linked with lead exposure
- Have students determine whether their state or local county program has recommendation for lead screening

Other Resources:

- American Academy of Pediatrics Committee on Environmental Health. Policy statement: Lead Exposure in Children: Prevention, Detection, and Management. Pediatrics. October 2005: 116(4): 1036-1046. (statement of reaffirmation published May 1, 2009).
- Centers for Disease Control National Center for Environmental Health www.cdc.gov/nceh/lead
- CDC Advisory Committee on Childhood Lead Poisoning Prevention. Interpreting and managing blood lead levels <10 µg/dL in children and reducing childhood exposures to lead. MMWR. Nov 2, 2007:56(RR08);1-14;16
- CDC Advisory Committee on Childhood Lead Poisoning Prevention. Low level lead exposure harms children: a renewed call for primary prevention. Jan 4, 2012:1-65.
- Local health care agency or public health department
- Pediatric Environmental Specialty Health Unit (PESHU) – regional resource
- U.S. Environmental Protection Agency www.epa.gov/lead