Teaching Immunization for Medical Education (TIME)

MULTISTATION CLINICAL TEACHING SCENARIOS

Haemophilus Influenzae Type B (Hib) Prevention:

Facilitator's Answer Key

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SOURCES OF INFORMATION ON *HAEMOPHILUS INFLUENZAE* TYPE B (HIB) VACCINE

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3. Centers for Disease Control and Prevention. Haemophilus influenzae type b. In: Epidemiology and Prevention of Vaccine-Preventable Diseases. Atkinson W, Wolfe S, Hamborsky J, McIntyre L, eds. 11th ed. Washington DC: Public Health Foundation, 2009. This book may be viewed at http://www.cdc.gov/vaccines/pubs/pinkbook/default.htm and may be purchased from the Public Health Foundation by calling 1-800-418-7246.

4. Centers for Disease Control and Prevention. Current Recommended Immunization Schedule for Persons Aged 0 through 6 Years – United States. http://www.cdc.gov/vaccines/recs/schedules/child-schedule.htm#printable <http://www.cdc.gov/vaccines/recs/schedules/child-schedule.htm>

Answers to Questions for Learners – Scenario One

1. What is Vicky's diagnosis? What are the most common organisms causing this disease?

   Vicky has meningitis. On clinical examination, she has a positive Brudzinski's sign. In unimmunized populations, the most common bacterial causes of meningitis are *Haemophilus influenza* type b (Hib), *Neisseria meningitidis*, and *Streptococcus pneumoniae*. Less common causes include Group B streptococcus, *Listeria monocytogenes, Mycobacteria tuberculosis*, and enteric organisms.

2. Based on the Gram stain of Vicky's cerebrospinal fluid (Fig. 2), what organism is likely to be causing her illness?

   Vicky's cerebrospinal fluid shows gram-negative coccobacilli, consistent with *Haemophilus influenzae.*

3. What other illnesses are caused by this organism?

   In addition to meningitis, Hib can cause epiglottis, pneumonia, cellulitis, arthritis, osteomyelitis, and pericarditis.

4. Discuss the morbidity and morality associated with Vicky's illness.

   The mortality rate of Hib meningitis is 2% to 5%, even with prompt and appropriate treatment. Survivors have a 15% to 30% incidence of neurologic sequelae such as vision or hearing loss, hydrocephalus, and language disorders.

5. Was this disease preventable?
   Yes. Vaccination against Hib is highly effective in preventing meningitis and other serious infections due to Hib. If Vicky had received the recommended Hib vaccines, she probably would not have developed Hib meningitis.

Answers to Questions for Learners – Scenario Two

1. Do Vicky, Vanessa, Alex or Mary require Hib vaccination? Recommend appropriate vaccines and schedules.

   Although Vicky has Hib meningitis, Hib disease in children less than 2 years of age does not reliably induce immunity to further Hib infections. At convalescence, she should receive one dose of conjugate vaccine. She will need an additional dose 1 month later and a booster dose at 8 weeks after that, at the earliest, between 12 – 15 months of age.

   Vanessa has received three doses of conjugate Hib vaccine at 3, 6, and 9 months of age. She requires a single Hib booster of any licensed vaccine.

   Alex does not require Hib vaccination because he was fully vaccinated by 18 months of age. Even if he were unvaccinated, he is more than 5 years of age and would not normally be considered a candidate for Hib vaccination.

   Mary should receive 2 doses of Hib vaccine, separated by 4 weeks, with a booster Hib dose at 12 to 15 months of age. (If the provider is using Act HIB®, a third dose is recommended at 6-months.)

2. Who among Vicky's family and household contacts should receive rifampin chemoprophylaxis?

   Because Vanessa is incompletely vaccinated and less than 4 years old, everyone in her household, including adults and her sister Vicky, should receive rifampin. Also, Mary should receive rifampin, due to extensive household contact time.

Answers to Questions for Learners – Scenario Three

1. One parent asks: "My child is scheduled for a Hib vaccine tomorrow, but she is still on antibiotics for an ear infection diagnosed last week. Should I reschedule her appointment? Explain contraindications to Hib vaccination.

   Hib vaccination is contraindicated in children who have had an anaphylactic reaction to a previous dose of Hib vaccine. Vaccination of children who have moderate or severe acute illness should be delayed until the child is better. Mild illness, current antibiotic therapy, and convalescence from a recent illness are not contraindications to the use of Hib or any other routine childhood vaccine.

2. The father of a 3-month-old calls with questions about Hib vaccine. The baby has had no vaccinations because the parents have heard that vaccinations have dangerous side effects. What can you tell the father about the adverse reactions associated with Hib vaccine?

   Adverse reactions to conjugate Hib vaccines are uncommon. Local reactions of swelling, redness, and/or pain at the injection site are the most commonly reported events and occur in 5% to 30% of Hib vaccine recipients. These local reactions usually resolve in 12 to 24 hours. Systemic reactions to Hib vaccine, such as fever and irritability, are rare.

3. A reporter from the local paper calls for information for a story she is writing. She asks you:
    a. How is Hib spread?
    b. Who should receive Hib vaccination?

    Hib is spread by contact with infected respiratory secretions. Hib colonizes the mucus membranes of the nasopharynx. It may be rapidly eliminated from the body, remain for several months without causing disease, or invade the bloodstream, causing disease at distant sites.

    All children under the age of 5 years old should receive Hib vaccination. For previously unvaccinated children 5 years and older, with a special risk factor such as sickle cell anemia, leukemia, HIV, or splenectomy, Hib vaccination may be indicated. Ideally, Hib vaccination should be given at 2, 4, and 6 months (6 month vaccination is not required with PRP-OMP), so that protective antibody from the vaccine is present by the time maternally-acquired antibody levels have waned. A booster dose after the first birthday helps to continue immune protection. Children less than 6 weeks of age should not receive Hib vaccine.

Answers to Questions for Learners – Scenario Four

1. What are possible diagnoses for Joshua's illness? What microorganism might be responsible?

   Epiglottitis, parapharyngeal abscess or cellulitis, croup, and foreign body are the most common considerations in the differential diagnosis. Angioedema, thermal or caustic injury, and expanding congenital anomaly (e.g., a cyst) are less likely possibilities.

   Epiglottitis is the most likely diagnosis for Joshua. In the past, it was almost universally caused by Hib. In vaccinated populations, other organisms, such as Group A beta-hemolytic streptococcus, *Staphylococcus aureus, Streptococcus pneumonia*, and *Candida albicans* are becoming more common causes of epiglottitis.

2. What steps should you take immediately to evaluate and treat Joshua?

   Joshua is obviously very ill, with stridor, tachypnea, and the inability to swallow his own saliva. He needs emergency laryngoscopy and intubation, preferably by an experienced specialist. While waiting for the equipment and personnel required for this, Joshua should be kept calm and allowed to maintain any posture he chooses. Sitting on or near a parent who holds a source of supplemental oxygen near his face, if this does not upset him, is the best option while he is still able to breathe on his own. Intravenous lines, blood draws, and other potentially upsetting procedures should be avoided until Joshua's airway is protected from sudden obstruction. Once Joshua has been intubated, blood and epiglottis cultures may be obtained, and antibiotic therapy with a third generation cephalosporin can be started.

   If Joshua were only mildly ill, a lateral neck film performed in the emergency department might be helpful in looking for the "thumb sign" of a swollen epiglottis.

Whether or not it is safe to insert a tongue blade to attempt to see the epiglottis in a stable, cooperative older child is controversial.

3. How has the widespread use of Hib vaccine affected the incidence of invasive Hib diseases?

   Invasive Hib disease is becoming much less common. Surveillance has shown a 99% decline in rates of Hib disease after the introduction of Hib conjugate vaccine.

Answers to Questions for Learners – Scenario Five

1. How many doses of Hib vaccine will each child need to complete the series?

   Jenny will require two more doses (separated by at least 4 weeks) to complete her primary series, and then a booster dose at 12 to 15 months of age.

   Joey will require 2 doses of vaccine if the provider continues the series with Pedvax HIB®, one now and a booster at 12 to 15 months (with this booster being at least 8 weeks after dose 2).

   MaryBeth will only require one dose of vaccine, because she is older than 15 months.

   Maggie, as a healthy 6 year old, does not require vaccination against Hib.

2. Which vaccine would you use for each child?

   Jenny and Joey need to complete the primary Hib series. Single antigen vaccines approved for this include PRP-T (ActHIB®), and PRP-OMP (PedvaxHIB®). If their records indicate that they also require other vaccine antigens (such as Hepatitis B, Pertussis, etc.), combination vaccines such as DTaP-IPV/Hib (Pentacel®), or HepB-Hib (Comvax®) can be used to bring their immunizations up to date with fewer injections. Hiberix® PRP-T is not currently approved for use in children younger than 15 months of age, but would be an appropriate choice for booster doses for both children at 15 months of age.

   Mary Beth can receive PRP-T (ActHIB®) or PRP-OMP (PedvaxHIB®). PRP-T (Hiberix®) is licensed for children 15 to 60 months of age who have completed a primary Hib series, so this would not technically be a correct choice for her

immunization. She may also benefit from combination vaccines if her other immunizations are not up to date.

3. Is there a problem with using different Hib vaccine types to complete the series?

No; the number and timing of the vaccine doses is more important than the type of conjugate vaccine that is used. But keep in mind that the brand or type of vaccine may determine how many doses are needed.

4. You are concerned that these children have not yet been vaccinated in a more timely fashion. You perform a chart audit of the children in your new practice, and discover that only 60% have received adequate Hib vaccination. Can you suggest ways to improve the vaccination rate?

Performing the chart audit was an important first step in addressing this problem. You may wish to institute a reminder system in your new practice to notify parents when children are due for vaccinations. You should train your staff to review each child's vaccination record at each visit so that no opportunities for vaccination are missed.

Educational material for families might help them understand the importance of seeking vaccinations for their children. Checking your office policies regarding scheduling and payment may reveal barriers to vaccination that you can correct.

Use each opportunity to vaccinate. Sick visits for minor illnesses are often good times to catch up on vaccinations. Give every vaccine for which the child is eligible at that visit.

Keep vaccines in stock, so that families will not have to return at a later time for vaccination. If there are vaccine shortages, such as the 2008-2010 unavailability of PRP-OMP containing Hib vaccines, follow professional guidelines regarding the best

use of available vaccine, and keep a registry of children with deferred vaccinations to facilitate recall when vaccine supplies improve. Educate yourself and your staff about the true contraindications to vaccination and the misconceptions that often lead a provider to incorrectly withhold a vaccine dose. Take full advantage of every opportunity to vaccinate.

HIB SAMPLE TEST

1. Historically, the most common form of invasive Hib disease is
   a. Epiglottitis.
   b. Diarrheal illness.
   c. Sinusitis.
   d. Meningitis.
   e. Cellulitis.

2. The most likely person to develop invasive Hib disease is
   a. A 7-year-old child with no Hib vaccinations.
   b. A 6-month-old baby with no Hib vaccinations.
   c. A 25-year-old child-care worker.
   d. A 2-month-old baby with no Hib vaccinations.
   e. A 2-year-old child with one Hib vaccination at 15 months of age.

3. Who should receive Hib vaccine?
   a. A 16-month-old child who just recovered from Hib meningitis.
   b. A 2-month-old child who was born 7 weeks prematurely.
   c. A 4-month-old child how has a mild viral upper respiratory tract infection.
   d. A unvaccinated 7-month-old with phenylketonuria.
   e. All should receive Hib vaccination.

4. Which of the following statements is true regarding adverse reactions associated with Hib vaccination?
   a. Adverse events are uncommon.
   b. Most children will experience fever and irritability.
   c. Local reactions occur in up to 30% of recipients, and take 1 week to resolve.
   d. Side effects from Hib vaccine are most severe if it is administered at the same time as hepatitis B vaccine.
   e. A diffuse maculopapular rash develops in 15% of recipients.

5. Which of the following is not true about the spead of Hib?
   a. Hib is usually spread by those with symptomatic Hib disease.
   b. Hib is spread more easily in crowded conditions, such as day-care settings.
   c. Adults can spread Hib disease, though most are immune to it.
   d. Hib is found in respiratory secretions.
   e. In most cases, Hib colonizes the nasopharynx without causing disease.

6. Which of the following is not acceptable to complete the Hib vaccination for a 14-month-old child who has received three PRP-T vaccinations at 2,5, and 7 months of age?
   a. PRP-OMP (PedvaxHIB®).
   b. PRP-T (ActHIB®).
   c. Both are acceptable.
   d. None are acceptable.

7. Most Hib-containing vaccines are recommended for administration at the following ages:
   a. Birth, 1 month, 6 months.
   b. 2,4,6, 9, and 12 months.
   c. 2,4,6, and 12 to 15 months.
   d. 6,12, and 18 months.
   e. 2,4,6, 12 to 15 months, and 4 to 6 years.

8. Factors that decrease Hib vaccination rates might include
   a. Administering vaccinations only at scheduled well-child visits.
   b. Deferring vaccinations until the next visit because a child has a mild upper respiratory tract infection and a temperature of 101°F (38.3°C).
   c. Requiring a full physical examination before each vaccination to rule out contraindications.
   d. All the above.
   e. None of the above.

9. Which of the following is true regarding the multiple Hib vaccines available?
   a. The entire vaccination series must be completed with the same Hib vaccine or the series must be started over.
   b. The primary series (during the first year of life) must be completed with the same vaccine, but the booster dose may be a different vaccine.
   c. Combination of the licensed vaccines is allowable, as long as the proper number of doses is administered.
   d. None of the above.

HIB TEST ANSWER KEY

1. D
2. B
3. E
4. A
5. A
6. C
7. C
8. D
9. C