The Usual Suspects: Common microorganisms causing infections in the respiratory tract

Bacteria
Gram-positive
Corynebacterium diphtheriae
Staphylococcus aureus
Streptococcus pneumoniae
Streptococcus pyogenes

Gram-negative
Bordetella pertussis
Chlamydia pneumoniae
Coxiella burnetii
Haemophilus influenzae
Legionella pneumophila
Mycobacterium tuberculosis
Mycoplasma pneumoniae
Yersinia pestis

Fungi
Aspergillus
Blastomyces dermatitidis
Coccidioides immitis
Cryptococcus neoformans
Histoplasma capsulatum

Viruses
Coronavirus
Epstein-Barr virus
Hantavirus
Influenza v'Irus
Parainfluenza virus
Respiratory syncytial virus
Rhinovirus

Protozoa
Uncommon

Case 4.1

You are a physician's assistant at a local pediatrician's office. Five-year-old Michael is brought to the office by his father. Michael is crying and complaining that his mouth hurts. His father has been at work and does not know whether the boy has had a fever during the day. Currently his temperature is 103^{o} F. The physician notices that Michael's breath smells rotten. Lymph nodes in his neck are swollen, and visual examination of the throat reveals a white packet adhering to the left tonsil. Much of the soft palate is red.

1. What laboratory tests are called for?

2. What types of infections are in the **differential diagnosis?**

3. Your practice has recently been overrun by sore throats and now, late in the evening, there are no supplies for performing the proper test. Should the physician prescribe antibiotics or not?

4. In deciding whether to prescribe antibiotics, should the physician be extra careful not to prescribe an unnecessary antibiotic, or be extra- careful not to let bacterial infection go untreated.

5. What are the possible sequelae of untreated, sore throats?

Case 4.2

You and your friend are driving to the mall; it is late October. A public announcement comes on the radio urging people to get their flu vaccinations. You are a second-year nursing student and you mention that the nursing staff at your university is holding vaccine clinic next week.

Your friend Susan says, "I'm not getting a flu shot! Last time I did, it gave me the flu." Others in the car agree with her. But Heather asked you if it's true that the vaccine can give you the flu.

1. What should your answer to Heather's question be?

2. Heather says that because she had a flu shot last year she's going to skip it this year. Respond, with an explanation.

3. What is the difference between **"antigenic** drift" and "antigenic shift?

4. What is different about the vaccine from year to year? Who decides what form it will take every year?

5. Susan wants to know why you don't have to get other vaccines annually.

6. Another friend, Dru, says that even though she had the flu shot last year she got terribly sick with the stomach flu over Thanksgiving break and missed most of her vacation. What is your explanation for this?

Case 4.3

Julie's husband has not been feeling well for the past 10 days. He has congestion in his lungs and has been very tired. She talked him into going to the doctor a week ago when his temperature was 101° F. The doctor gave him some oral amoxicillin, which he took faithfully until it was gone. But she still thinks he looks sick.

Julie, Doug, and their 3-year-old daughter have just moved to Ohio from Arizona. Doug is a park ranger and he loves his job, but for the past three days he has felt too sick to go to work. His respiratory symptoms have not improved. Julie makes an appointment for him with her doctor.

1. As the Physician's assistant in the office, you are the first to examine Doug. What is your tentative diagnosis, based on the history?

2. Which components of the history support your tentative diagnosis?

3. Doug's condition has not responded to the antibiotic. List two possible reasons for this finding.

4. What are some other conditions caused by this microorganism?

S. Should Julie worry that Doug can transmit the infection to her or to their daughter?

6. What precautions can be taken by other workers who may be regularly or heavily exposed to bat or bird droppings?

Case 4.4

It is mid-July. You are working as a **triage** nurse in the emergency department of a small suburban hospital in Arizona. A young, athletic-looking man in his early 20s is helped into your office by his girlfriend. He greets you and sits down, but is feverish and his breathing is labored. The girlfriend answers your questions for him. She says the symptoms began about 24 hours ago and seemed to worsen quickly. It looks like the flu to you, but the season is wrong. So you ask about the man's activities over the past week to 10 days. Nothing in this history points to an obvious **etiology** for the disease. And the girlfriend, rather defensively, adds that she is a “neat-freak" and is constantly cleaning and disinfecting the house they share. But of course, respiratory infections are very common and can be acquired anywhere. After listening to his chest you decide that it may be bronchitis or influenza. You decide to isolate him from the rest of the people in the waiting room until an examining room becomes free.

Forty-five minutes later the girlfriend comes barreling into your office. "I think he's choking!" she screams. You and the attending physician arrive at his bed where he indeed seems to be suffocating. His face is red and he is gripping his throat. The doctor calls out, **"acute** respiratory distress," and a team moves in to try to restore his breathing.

Later that evening, on your way out, you learn that the patient has died. Several days later the charge nurse tells you what the patient's lab work revealed. It identified an infection that he probably acquired a few weeks earlier while he and his girlfriend stayed in an isolated cabin his family owned but seldom used.

1. What is the diagnosis?

2. What connection does the diagnosis have with the cabin?

3. You overhear the charge nurse say to herself: "I knew there was a good reason not to clean my house." To what could she have been referring?

4. This case is from Arizona. These infections were first seen in the United States in May of 1993 in the Four Corners area of the Southwest, which includes Arizona, Colorado, New Mexico, and Utah. Can we assume that this disease is only found in the Southwest? What factors determine the places this virus might be present?

Case 4.5.

Your son's best friend, Josh, has infectious mononucleosis; he hasn't been in school for two weeks. Your son and three of his friends come over after basketball practice looking for snacks, but they also was want to talk to you about Josh's infection because they know you are a physician's assistant. They are all afraid to visit Josh, but they want to know when they can expect him back at practice. One of the boys asks you what causes "mono." Another one of the boys says he heard it was a form of herpes. All of the boys cringe at that one. Can you help these guys out with some information?

1. What causes mono, or infectious mononucleosis? What do you know about this agent?

2. What are the symptoms?

3, How long will Josh be out of school? Is it okay to visit him?

4. You tease the boys by saying, "Besides, by the time you're adults, all of you will have it anyway." Before they recover from that shock you add, "and some of you have it right now!" Are you just playing around with them, or are these statements true? Explain your answers.

5. Sam, the point guard on the team, says his aunt has **chronic** fatigue syndrome. "Isn't that caused by the same virus?" he asks. Is it?

Case 4.6

When you left for school this morning your 3-month-old son was wheezing a bit and he had a slight fever of 99.8^{o} F. Your mother is watching him while you come to school to take your anatomy and physiology exam. Your pager goes off halfway through the exam. The baby's fever is rising and he is having more trouble breathing. Your mother says she is taking him to the emergency room. You rush over to the hospital. When you get there, he is in an examining room and the doctor is signing papers to admit him to intensive care. She says she suspects some kind of pneumonia. She mentions the type of pneumonia but you don't recognize the name and you are too worried about your son to pin her down at this moment. You do note that she mentions that the hospital has seen a dozen pediatric cases of this same type of pneumonia in the past week and a half.

The doctor swabs your son's nose but says the results won't be back for several days. In the meantime, they will give him supportive therapy, including an inhaled spray, but no antibacterial drugs. The doctor says that she feels sure that the child will recover, since the infection was caught very early. Nonetheless, after she leaves, your mother is frantic and indignant. She fires off the following questions to you.

1. What kind of pneumonia is it?

2. Why aren't they giving him antibacterial drugs?

3. How can the doctor be sure what's causing the pneumonia if she doesn't yet have test results?

4. What about your other child, who is 3-years old? Has she been exposed to the infection by being around the baby? Should the baby remain isolated when he comes home? Can the 3-year-old be vaccinated?

Case 4.7

One autumn in the late 1990s, a number of people became ill after working at a single building at an industrial plant in a neighborhood of Baltimore, Maryland. Their symptoms ranged from simple coughing and other respiratory symptoms to pneumonia. At least one of the 70 people reporting symptoms died.

The company voluntarily closed the building upon the recommendation of the Maryland Department of Health and Mental Hygiene. After all of the water systems at the plant were evaluated and disinfected, it reopened and no new cases were reported.

1. Health departments often have even less information than this when they have to start hypothesizing about the causative organism and its source. What is your first guess?

2. Describe the transmission characteristics of the suspected bacterium,

3. Is there a risk for a continuing community outbreak from these initial infections? Why or why not?

4. Would the health department be likely to identify this bacterium by performing routine water-screening procedures, such as serial dilution or filter collection followed by incubating on eosin methylene blue (EMB) or nutrient agar? Explain.

Case 4.8

You have just been accepted into the nursing school at a local medical center. The program requires that you have a physical, which includes a tuberculosis (TB) test as well as the hepatitis B **recombinant** vaccine series. The nurse administering the TB skin test explains that if significant swelling occurs around the injection site, you will probably have to have a chest X-ray to determine if you are infected with *Mycobacterium tuberculosis*. One and a half days later

you wake up and look at your arm, which appears swollen in an area about the size of a quarter around the skin test. It is red and tender to the touch. You're alarmed; could you have TB?

1. Why does the reaction take 36-48 hours to show up?

2. If you have a tuberculosis infection, why doesn't the whole body, or at least the respiratory tract, react when the **antigen** is injected during this diagnostic test?

3. You are referred for a chest X-ray, but the results are inconclusive. The clinic doctor prescribes a six-month course of isoniazid (abbreviated INH).You take the medicine according, to the pharmacist's instructions. Six months later you are talking a medical microbiology course as part of your nursing curriculum. On the day you study tuberculosis, you suddenly realize why you had a positive skin test. It has nothing to do with a true infection, but with the fact that you were born in the Netherlands. Your family moved to United States when you were 4 years old. What do you suppose is going on here? Discuss as fully as you can.

4. You have a friend in your hometown who is HIV positive. When you told her about your TB scare, she said that her specialist can't use the TB skin test, even though HIV-positive are at a higher risk than the healthy population for TB. Why is the skin test not recommended for HIV-positive people?