

Viral Mini-Case History Studies for Courses Involving Medical Microbiology

Resource Type: Curriculum: Classroom

Publication Date: 10/19/2000

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Abstract

Twenty-six viral mini-case history studies are designed as problem solving exercises to allow students to test their powers of deduction in identifying and treating important human pathogens, using clear cut cases involving "at risk" individuals wherever possible.

Activity

Invitation for User Feedback. If you have used the activity and would like to provide feedback, please send an e-mail to MicrobeLibrary@asmusa.org. Feedback can include ideas which complement the activity and new approaches for implementing the activity. Your comments will be added to the activity under a separate section labeled "Feedback." Comments may be edited.

Editor's Note (2008): This Curriculum Resource was published prior to establishment of current criteria of submission, and as such, does not contain all criteria required of current publications. However, the Editorial Committee felt that the activity itself remained worthwhile and relevant, and encourages potential users to contact the authors for clarification as needed. If you do update this activity for use with your students, and are interested in updating the resource for distribution in the library, please contact ASM at MicrobeLibrary@asmusa.org.

INTRODUCTION

Background.

Mini-case history studies can be used as classroom exercises or given to students to work through as part of a written examination. In this activity, 26 mini-cases divided into two sections, DNA-containing viruses (13 cases) and RNA-containing viruses and unconventional virus-like agents (13 cases), are presented. Suggested answer content for each component of the mini-case histories is italicized next to the question itself.

To incorporate these mini-case history studies into the curriculum, begin by presenting them to the students as a classroom or laboratory exercise. Divide students into groups of two to four individuals, assign one mini-case history study to each group, and allow them 15 to 20 minutes to work through it. This gives adequate time to discuss the problem and determine answers to the questions.

Subsequently, when each new sub-section of virology is covered, use one or two mini-case histories to accompany the lectures as problem-based learning exercises. Assign the mini-case history studies once the sub-section has been completed and give the students a few days to prepare a paragraph, which shows their conclusions and method of arriving at each conclusion, for each mini-case history study.

[Note: My classes are usually a mixture of Physician Assistant, Biology/Pre-Med., and Environmental Science majors and between 80 and 90% of all types of students enjoy these "sleuthing" exercises. All mini-case histories here have also been a component of my students' examinations at some point (usually a maximum of two mini-case histories each for DNA- and RNA-containing viruses) and this has helped in ironing out any confusing descriptions or sayings.]

PROCEDURE

Materials.

[Viral Mini-Case History Studies for Courses Involving Medical Microbiology--Answer Key](#)

[Viral Mini-Case History Studies for Courses Involving Medical Microbiology](#)—A list of mini-cases provided for each classroom or laboratory exercise, grouped as DNA-containing viruses, RNA-containing viruses, and unusual virus-like agents.

Instructor version.

The mini-case history studies may be used in several ways.

A. Possible applications.

The mini-case histories included in this activity have been utilized successfully as classroom exercises, take home assignments, and examination material. The exercises tend to work best when a time limit is identified and when students are encouraged to try and work from memory rather than scanning through their notes.

Classroom exercise. The classroom exercise is useful, especially to the professor with a big class, since it encourages

students' participation and critical thinking without being overly time consuming. Groups of two to four students appear to operate the most effectively for this exercise; lone students may feel somewhat "swamped" by the information, while larger groups may encourage one or two individuals to analyze the mini-case history with the remainder of the group not becoming truly involved. A time limit of 15 to 20 minutes for each mini-case history has been found to be optimal, allowing students sufficient time to digest the data but not too long to make them doubt their conclusions or "over-analyze" the information (often the case with the very bright student). Varying the students within each group and the spokesperson for each group also adds challenge to the exercise.

Take home assignment. Once the students are familiar with the steps needed to work through a mini-case history, they are ready to tackle one on their own. The ability to do this outside class and without help or hindrance from other group members may encourage the quieter student to perform more efficiently. In addition, many students, especially foreign language students, may be more able to put their ideas into writing rather than into an oral presentation. This kind of assignment, unlike the classroom exercise, allows more time and imposes less pressure. Again, it is advisable to encourage students to set some kind of time limit to prevent over-analysis, and to try and work as much from memory as possible to encourage the development of microbiological algorithms.

Examination material. The microbiological algorithms generated by the classroom and take home assignments may be tested as a component of the microbiology examination. Ideally, a student should be able to use the series of steps they have memorized to successfully analyze a mini-case history under examination conditions. However, many students, in the "heat of the moment" have trouble doing this, so a professor might want to allow the use of a limited amount of notes made by the student to be used in the examination (similar to formulae used in mathematics and physics examinations).

B. How I use these studies.

Since the process of working through a mini-case history is a novel skill, I usually begin with the classroom or laboratory exercise; at least 50 to 75% of the group grasp the procedure on the first occasion and can help teach the remaining class members. I give the students guidance as to how the process works by presenting two example mini-case histories and showing them each step taken to answer the associated questions. Each group of two to four students is then given the same two mini-case histories and asked to work through them for 15 to 20 minutes. They are asked to follow four steps:

1. Underline all components of the mini-case history that are important in reaching a diagnosis (e.g. laboratory data and risk factors such as vacations recently taken, occupations, or lifestyle practices).
2. Make a list of all appropriate species that fall into the category being studied and produce diseases of the kind presented in the mini-case history. For example, in the case of a gram-positive coccus causing a skin infection write a list of all gram-positive cocci capable of causing this condition.
3. Take the list and begin to eliminate candidates from it by using the information from the mini-case history. Discuss each candidate with your classmates until you reach a consensus.
4. Once you have identified the responsible organism, go on to determine a treatment strategy, other at-risk individuals, and methods of infection prevention, as appropriate.

I ask the students to use their notes as little as possible during this exercise to allow them to develop a "feel" for the subject and improve their critical thinking skills. They are not, however, prevented from using their notes at this point. Once they have seen the method for processing the mini-case history data, each group in the class is assigned a different, third mini-case history analysis and given 15 to 20 minutes to repeat the steps.

When the groups have finished deliberating, each member answers one of the questions associated with their mini-case history. This ensures that all students understand the process and could be assumed to be able to repeat it on their own. In addition, students are asked to comment on the ease with which they could identify the organism: Was the identity obvious? What pieces of information would they take away from the mini-case history to make it more difficult? How would they improve the mini-case history? Asking students to comment on the histories helps them focus on the concepts being demonstrated. Many brighter students generate ideas on the subject even during the first mini-case history session.

Once students understand how to proceed with a mini-case history, they can be encouraged to pursue them alone on a take home assignment. Students are asked to use a similar time limit as during class (15 to 20 minutes) to analyze the mini-case history and then write a paragraph explaining their method of reaching conclusions, any further thoughts they have about the condition the patient is suffering from and the "story" accompanying it. They are essentially asked to critique the mini-case, looking for loopholes, ascertaining the ease with which it could be solved, and sharing any ideas that might improve it.

By the time my students reach the examination stage, they have already processed many of these mini-case histories. For the microbiology course taught at this institution, four microbiology examinations are given each semester with the last two containing a maximum of two mini-case histories in any particular sub-section of microbiology. This has been successful in the past, since the combination of mini-case history analyses, short answer questions, fill-in-the-blank, and multiple matching in my examinations has allowed me to evaluate a wide variety of students' skills.

C. The concept of a mini-case history.

These mini-case histories were generated over a period of six weeks during the summer of 1998 using clinical and microbiological information gleaned from four separate microbiology textbooks. In making each mini-case, I initially focused on the symptoms and manifestation of the disease and the microscopic appearance of the organism causing it—information that the students gained in lectures and from the course textbook. By gradually adding pieces of information—such as the age of the patient, a risk factor, or a laboratory finding—other similar organisms were eliminated as potential causative agents so that the identity of the pathogen became obvious. The only difficulty was to balance how much information to give, so the answer wasn't totally obvious or completely obscure.

In formulating the mini-cases, I used risk factors including lifestyle, vacations, and age as much as possible to try and instill in the students a sense that these could provide real pointers as to the identity of a microorganism in a sick patient. I felt it was important to make the situations as realistic as possible so that patients used "everyday" language. In addition, I tried to show that diagnostic mistakes are made, e.g. that conditions which appeared to be child abuse, irritable bowel disease,

or lactose intolerance may actually be microbial in origin and that all information, no matter how apparently trite, may be important. Finally, the idea of the mini-case history was that it really would appear as a kind of "detective story" with a "plot," so students would enjoy "sleuthing" out the "culprit"—and learn new skills in the process.

Sample Student Instructions.

1. Classroom Exercise: You have been given a mini-case history in the area of _____, which was covered in your lecture sections during the past week(s). You have been assigned to a group of four students and, as a group, you need to work through mini-case history number ____ from the list given, during the next 15 to 20 minutes. Use the following strategy to diagnose the mini-case. First, underline all components of the mini-case history that you think are important in reaching a diagnosis. Second, make a list of all viruses that fall into the designated category and produce diseases of the kind described in the mini-case history. Third, eliminate organisms from your list by using the additional information presented in the mini-case history. Once you have identified the organism involved, go on to determine treatment strategy, other at-risk individuals, and methods of infection prevention, as appropriate. Once you have completed the mini-case history, please raise your hand. As a group, you will be asked to present to the class your list of "suspect" organisms, and explain how you eliminated each one and arrived at the answers to the questions.
2. Homework Exercise: You have been given a mini-case history in the area of _____, which was covered in your lecture sections during the past week(s). Use the following strategy to diagnose the mini-case. First, underline all components of the mini-case history that you think are important in reaching a diagnosis. Second, make a list of all viruses that fall into the designated category and produce diseases of the kind described in the mini-case history. Third, eliminate organisms from your list by using the additional information presented in the mini-case history. Once you have identified the organism involved, go on to determine treatment strategy, other at-risk individuals, and methods of infection prevention, as appropriate. Present, in paragraph form, your list of "suspect" organisms, and explain how you eliminated each one and arrived at the answers to the questions.

Safety Issues. Not applicable.

SUPPLEMENTARY MATERIALS

Possible Modifications.

In my course, bacteria, fungi, protozoa, and viruses are taught as separate and sequential subjects in a similar fashion to the way they are set-out in most microbiology textbooks. The mini-case histories are therefore presented in a similar, sequential way and are somewhat easier to diagnose since they are associated with each sub-section. Mini-case history studies could also be assigned at the end of a course as a method of outcome assessment to see how good the students are at going back and identifying the organisms, when presented with a whole series of them.

Reference textbooks used to generate mini-case history studies

1. **Black, J. G.** 1999. Microbiology principles and explorations, 4th ed., Prentice-Hall Inc., Englewood Cliffs, N.J.
2. **Jensen, M. J. and D. N. Wright.** 1997. Microbiology for the health sciences, 4th ed., Prentice-Hall Inc., Englewood Cliffs, N.J.
3. **Prescott, L. M., J. P. Harley, and D. A. Klein.** 1999. Microbiology, 4th ed., McGraw-Hill Book Co., New York.
4. **Talaro, K. and A. Talaro.** 1999. Foundations in microbiology, 3rd ed., McGraw-Hill Book Co., New York.

Related Activities

[Bacterial Mini-Case History Studies for Courses Involving Medical Microbiology](#)

[Fungal and Protozoal Mini-Case History Studies for Courses Involving Medical Microbiology](#)

Viral Mini-Case History Studies for Courses Involving Medical Microbiology-- Answer Key

DNA viruses

1. A 22-year-old physician assistant (PA) presents at her primary care physician with a painful abscess on the tip of her right middle finger. A tissue sample from the abscess reveals the presence of syncytial cells with some inclusions. The patient has just begun work as a PA and wonders whether she might have "picked something up" from one of her patients. (6 points)

What DNA viruses can cause skin lesions? (3 points) *Herpes simplex virus (HSV) 1 and 2, vaccinia, and parvoviruses.*

What is wrong with this patient? *Herpetic Whitlows.*

How did she contract the infection? *Touching someone who has oral/genital herpes without wearing gloves.*

What treatment would you prescribe for the patient? *Acyclovir (topical).*

2. A 2-week-old baby is taken to the primary care physician with severe ulcerations covering the skin of his entire body. The physician first suspects child abuse since it appears that the baby has been burnt all over with cigarettes. Human embryonic fibroblast tissue culture of the double-stranded enveloped viral agent responsible results in the production of giant cells (syncytia) with multiple inclusions. (5 points)

What is wrong with the baby? How did he contract this infection? (2 points) *Herpes of the newborn; neonatal infection.*

What DNA virus or viruses can produce this infection? *Herpes simplex virus (HSV) 1 and 2.*

What is the outlook for this baby? *30% of infected babies die.*

What further action would you take? *Counsel his mother that she is infected and has transmitted it to her child.*

3. An 18-month-old child presents to her primary care physician with fever and diffuse vesiculopustular lesions over her entire body. Two days ago, she developed a rash on her scalp, face, and trunk. On examination, the child has a mild fever and rapid heart rate and is in some distress because the lesions are "itchy." Her family physician tells the child's parents to take her home and prescribes ointments to alleviate the skin lesions. In addition he says that they should, under *no circumstances*, give her aspirin to alleviate the discomfort. In caring for her child, the mother also comes down with the same condition. Both patients recover from her infection but some of the skin lesions do heal leaving a tiny pit or scar. (5 points)

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What is wrong with this child? *Chicken pox (Varicella-zoster virus).*

Should her condition have been prevented? How? *Yes; vaccine to all children over 12 months.*

Why did her physician negate use of aspirin? In what other condition is the use of aspirin prohibited? (2 points) *Reye's syndrome. Influenza.*

Is this child likely to get the virus again? *No, usually once in a lifetime.*

4. A 17-year-old high school student presents at her primary care physician with an asymmetrical vesiculopapular rash on her chest and back which is tender and painful. The rash is unusual in that it does not cross the mid-line of her body. The patient's history is unremarkable except for recent surgery to remove a benign tumor from her lower back. The physician's diagnosis is that the rash is caused by a double-stranded DNA-containing virus belonging to the herpesvirus group. (5 points)

What is wrong with this patient? *Shingles.*

How did she get this illness? (2 points) *Surgery/X ray treatment caused re-activation of latent chickenpox virus.*

What is the outlook for the patient? (2 points) *Several months of illness with no recurrence.*

5. A baby was born with hepatosplenomegaly, jaundice, and microcephaly. Analysis of his spleen tissue reveals the presence of enveloped double-stranded DNA viruses and giant cells. (5 points)

What has happened to this baby? (2 points) *Cytomegalovirus (CMV) exposure on passage down birth canal. Occurs in 20% of babies where mother has concurrent infection.*

Is his condition common? *Up to 5,000 babies are born with this condition each year in the U.S.*

Name another group of individuals for whom this virus causes problems. *Immunocompromised and AIDS-infected individuals.*

Name another mode of transmission of this virus. *Sex, saliva, and secretions are possible modes of transmission.*

6. A college student presents to his primary care physician with a sore throat, high fever, and skin rash. On examination, his pharynx is noted to have a gray-white exudate and his distended abdomen results from an enlarged spleen and liver. Blood work demonstrates lymphocytes containing abnormally large nuclei perforated with holes, a hallmark symptom of this condition. (6 points)

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What is the patient suffering from? What components of the case history are clues to the diagnosis? (3 points) *Epstein-Barr virus. Clues: college student, swollen throat and abdomen, plus abnormal lymphocytes.*

How may he have contracted it? *Also known as "kissing disease" so is contracted by contact with secretions.*

What treatment would you recommend? *Supportive care.*

What is the prognosis of the disease? *Recovery and antibody production.*

7. A 19-year-old, HIV-negative female college student presents to her ENT clinic with hoarseness and difficulty in swallowing. She has a 1-week history of sore throat, fever, tiredness, and myalgia. On examination, she has grossly swollen tonsils with an exudate present. Her cervical lymph nodes are enlarged, as is her spleen. Blood work demonstrates a normal hematocrit and white cell count, but an altered lymphocyte component of 28% normal and 12% atypical lymphocytes. (6 points)

What is wrong with this patient? What led you to this diagnosis? (3 points) *Mononucleosis (mono)*. Clues: *Epstein-Barr virus (EBV), atypical lymphocytes, symptoms, age*.

Name two complications of this condition that could occur in otherwise normal hosts. (2 points) *Guellain-Barre (GB) syndrome, hepatitis, aplastic anemia, Burkitt's lymphoma*.

Where did the patient contract this virus? *"Kissing disease," so contact with secretions*.

8. James, a 5-year-old African-American boy, has just returned from a 3-month summer vacation with his family to visit his grandparents in Nigeria. While there, he was sick with what his mother termed "really bad tonsillitis" and a fever which lasted for about 2 weeks. After his recovery, the child had a 3-week bout of malaria, which was successfully treated with mepacrine and chloroquine. On his return, his mother noticed that his right jaw and cheek were somewhat enlarged and thought he might have "mumps." On examination, the child is found to have a grossly swollen right jaw and cheek. The left side is normal. A biopsy sample taken from the right jaw reveals a B-cell carcinoma. (4 points)

What is wrong with James? Explain the sequence of events. (3 points) *Burkitt's lymphoma*. He had *Epstein-Barr virus (EBV)* followed by *malaria*, which predisposes to the development of this condition.

What is the significance, if any, of his being sick in Africa? (2 points) *He must have had EBV followed by malaria to get this condition and malaria is endemic to Africa*.

In which group of patients is this condition most common? *Most common in African-American children aged 4 to 8 years*.

9. A young woman presents to her primary care physician with malaise, fever, arthritis, abdominal discomfort, and a body rash. Blood work demonstrates leukopenia and the agent is isolated in the form of a Dane particle. Confirmation of the diagnosis is made by positive serology (presence of antibody) to both early antigen and to core antigen. The young woman is very agitated since she received a needle stick injury during her operating room technician job about 2 weeks ago and did not mention it to anyone. She has no history of intravenous drug use (IVDU) and is not currently sexually active. (5 points)

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What disease is the patient suffering from? *Hepatitis B*.

What is the prognosis? *Recovery and no loss of liver function*.

How could this infection have been prevented? *Vaccination, especially as she is a health care worker*.

Do you anticipate any long-term problems? *Increased chance (200x) of contracting liver cancer*.

What is unusual about this infectious agent? *It has single- and double-stranded DNA in its*

genome.

10. A 22-year-old college student presents to his primary care physician with malaise, fever, arthritis, abdominal discomfort, and a body rash. Blood work demonstrates leukopenia and the agent is isolated in the form of a Dane particle. Confirmation of the diagnosis is made by serology in which anti-HBsAg, IgM anti-HBc, and total anti-HBc were all found to be highly elevated. The patient admits to several homosexual encounters and is currently sexually active. He has no history of intravenous drug use (IVDU) or recent blood transfusions. (6 points)

What is wrong with this patient? *Hepatitis B.*

Name another virus he is at risk from because of his lifestyle, apart from HIV. *Herpes, papilloma, hepatitis C.*

Could his condition have been prevented? *Yes, there is a vaccine.*

Do you anticipate any long-term problems resulting from his infection? *Yes, increased risk (200x) of developing liver cancer.*

What is unusual about this infectious agent? *It has single- and double-stranded DNA in its genome.*

Do you anticipate any long-term problems resulting from his infection? *That he was the recipient of a hepatitis B vaccine which had produced a good immune response.*

11. A 10-year-old boy presents at his primary care physician with dysuria and increased frequency of urination. Urine samples are negative for bacteria, but contain >50 white cells and up to 10 red cells/high power microscope field. The agent causing the boy's disease is a naked, double-stranded DNA-containing virus. (5 points)

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What is wrong with this patient? Is his age significant? (2 points) *Adenovirus, acute hemorrhagic cystitis. Yes, most infections by age 15.*

Can this condition be prevented? (2 points) *Although there is a vaccine, it is not commonly given, being administered primarily to military personnel.*

How would you treat the patient's infection? *The disease is usually self-limiting, so supportive care is mostly what is needed.*

12. An 18-year-old teenager, who is sexually active, presents to her gynecologist for a routine Pap smear. Her physician notices that the patient has 4 tiny, flat, painless genital warts on her labial area and asks her about them. The patient has apparently never noticed them and is unsure when they appeared. Her Pap smear shows no abnormalities. The patient's condition is being caused by a naked, double-stranded DNA virus. (4 points)

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How commonly is this condition seen in this age group? *Approximately 1 in 5 teenagers are serologically positive for human papilloma virus (HPV).*

Are genital warts a cause for concern? Why? (2 points) *Yes, two kinds have been linked with cervical cancer (serotypes 16 and 18).*

How common are they? *Up to 15% of population.*

13. A 7-year-old child presents to his primary care physician with a red rash on his cheeks and a low-grade fever. His mother was worried initially that the child might have been hit by another child at pre-school and paid little attention, since the boy was always "getting into mischief." The agent causing the infection is a small, non-enveloped single-stranded DNA virus. (5 points)

What is wrong with this child? *Erythema contagiosum.*

Name two groups of individuals in which this condition might be cause for concern. (2 points) *Pregnant women, immunocompromised children, and those with sickle cell anemia.*

Name a disease that this virus can cause in other mammals. *Distemper in cats, enteric disease in dogs, and a fatal cardiac infection in puppies.*

RNA viruses and unconventional virus-like agents

1. A patient presents to his primary care physician with muscle weakness and numbness in his lower limbs. After exhaustive testing he is found to have Guillain-Barre syndrome. This is thought to be the result of an adverse reaction to being vaccinated with a particular RNA virus.(4 points)

Which virus was this patient vaccinated with? *Influenza.*

How frequently does this condition result from such a vaccination? *Approximately 1 in 100,000 people have an adverse reaction to the influenza vaccine, so it is a rare side effect and occurs only in young people.*

What is likely to happen to this patient? *Most people recover total neurological function.*

How effective is the RNA-virus vaccine at preventing this particular viral infection? *70% if correct serotype is administered.*

2. A 35-year-old physician living in Boston was in his usual state of health until he developed an abrupt onset of headache, fever, and body aches during the month of October. He subsequently developed a sore throat and non-productive cough. Diagnosis of an RNA-containing virus was confirmed through rapid antigen detection using an enzyme immunosorbent assay (EIA). Culture and typing was also performed by a sentinel lab, which monitors the strains of this virus causing infections. (5 points)

What pulmonary complications may this patient encounter? Are these common? (2 points) *Bacterial superinfections with *Streptococcus pneumoniae* or *Haemophilus influenzae* are common.*

What non-pulmonary complications may the patient encounter? Are these common? (2 points) *Less common is the development of Guillain-Barre syndrome, myocarditis, or Reye's syndrome.*

Name a group of people at risk for developing severe infections with this virus. *Pregnant women, the elderly, chronic care and nursing home residents, and health care providers.*

3. A 12-year-old California boy presents to his primary care physician feeling "hot and tired" and with periumbilical pain, cough, sore throat, fever, and myalgia. His physician diagnoses the flu and sends him home. Four hours later, the boy is admitted to the emergency room vomiting and short of breath. A chest X-ray shows pulmonary edema and blood work demonstrates significantly

reduced platelet numbers. The boy's history is significant for his living in a rural area on a dairy farm. The boy had been in the woods with his father cleaning out their hunting cabin which was full of mouse droppings. Both father and son have similar symptoms. (5 points)

What is wrong with this boy? (Hint: mice are an important clue.) *Hantavirus*.

What is the outlook for the boy's disease? (2 points) *Varies from short term mild illness to rapidly fatal due to pulmonary complications.*

How is this infection acquired? Is there any evidence for person-to-person transmission? (2 points) *Contact with feces or urine from rodents such as the white footed mouse, cotton rat or rice rat.*

4. A 5-year-old child presents to her primary care physician with a sore throat, dry cough, headache, and conjunctivitis. The physician passes it off as a "cold" until he examines her mouth and observes tiny white lesions with a red border on her cheek membranes (Koplik's spots). He is now sure of his diagnosis. (4 points)

What does the child have? *Measles*.

What is its prognosis? *Normally uncomplicated recovery.*

What complications could ensue? *1 in 500 chance of contracting subsclerosing panencephalitis (SSPE) which results in death in months or years.*

What is the normal treatment? *Supportive care.*

Why are you unlikely to see a child with this disease now? *Development of a vaccine in the 1980's.*

5. An 18-year-old boy presents to his primary care physician with fever, headache, nausea, vomiting, and a stiff neck. He has had these symptoms for 48 hours but has become concerned because he cannot hear well out of his left ear. After a further 4 days, the patient recovers but is left slightly deaf in his left ear. This condition was caused by an enveloped, non-segmented RNA virus belonging to the paramyxovirus group. (5 points)

The patient's infection was a rare complication of an infection normally causing which condition? *Mumps*.

Could his infection have been prevented? How? (2 points) *Yes. Measles, mumps, rubella (MMR) vaccine administered at 15 months of age.*

How is the patient likely to have contracted this infection? Is it a normal disease for this age group? (2 points) *He came into contact with infected droplets. Infections of this type are more usual under the age of 15.*

6. A 6-month-old baby was admitted to the hospital in March with severe respiratory distress. Five days prior to admission she developed a cough and rhinitis. Three days later she began wheezing and was brought to the emergency room when she became lethargic. A chest X-ray revealed infiltration and hyperexpansion of the lungs. A rapid and confirmatory diagnostic test for this patient was the enzyme immunosorbent assay (EIA) for viral antigen on throat washings. (5 points)

How common is this disease? (2 points) *Very common, with 5 out of every 1,000 children under 1 year old hospitalized per annum.*

How is it spread? *Droplets and contaminated fomites.*

Does it have a seasonal variation? *Peaks in winter and early spring.*

What treatment would you give this child? *Ribavirin can be given although its usage is controversial. More commonly, the child is comforted and supportive therapy relied on in mild cases. For more severe cases, respiratory syncytial virus (RSV) immunoglobulin may be given.*

7. A 22-year-old volunteer worker at a wildlife refuge is admitted to the emergency room with agitation, disorientation, seizures, and pain on swallowing. Physical examination reveals a partially healed animal bite on his forearm. The animal which gave him this bite, a raccoon, died several days ago, having shown similar symptoms. Samples of brain tissue from the deceased animal reveal the presence of Negri bodies and viral antigens are found in serum samples from the patient. Reverse transcriptase polymerase chain reaction (PCR) on a skin biopsy from the patient (saliva may also be used) confirmed the presence of viral antigen from a bullet-shaped RNA-containing virus. (6 points)

What is wrong with the patient? What led you to this diagnosis? (2 points) *Rabies. Clues to the diagnosis: his occupation puts him at risk, the animal that bit him is a known reservoir, and the Negri body findings.*

How would you treat him? *Human rabies immune globulin (HRIG), clean wound.*

Explain the course of this disease when it remains untreated. (3 points) *Virus enters bite and remains there 1 week multiplying at the site. It then spreads to the brain, heart, or oral cavity and to the salivary glands; eventually infection results in death due to cardiac or respiratory arrest.*

8. A baby was born deaf, physically retarded and with a variety of skin lesions. His mother had an uneventful pregnancy, healthwise, but underwent no prenatal testing of any kind because she is a Jehovah's Witness. The virus which caused this baby's condition is an enveloped RNA virus. (5 points)

What happened to this baby? *He has congenital rubella.*

At what point during the mother's pregnancy is the virus likely to have been passed to the fetus? Explain your answer. (2 points) *The virus is likely to have been passed during the first trimester. If it were a later infection, the baby would have been more developed so the virus could do less damage.*

Could the baby's condition have been prevented? *Yes, with measles, mumps, rubella (MMR) vaccine; a prenatal test would have detected the abnormality.*

What precautions must you, as a hospital Physician's Assistant, now take with this baby? *He is still shedding virus so can transmit rubella to other babies and must therefore be isolated.*

9. A woman presents to her primary care physician with fever, backache, and a headache of two days duration. She also complains of intense myalgia in her upper arms and "pain on moving her eyes." The woman has just returned from a trip to El Salvador, organized by her church, where she had extensive exposure to mosquitoes. On examination, the patient is found to have a rash on

her face, trunk, and thighs. Blood work shows drastically reduced white cell numbers with normal hemoglobin and platelet counts. Convalescent antibodies to a mosquito-borne disease were diagnostic. (6 points)

What viral disease did this patient acquire? What led you to this conclusion? (2 points) *Dengue. A mosquito-borne disease means yellow fever or dengue. Pain confirms dengue.*

What occurs during severe cases of the disease? (2 points) *Dengue hemorrhagic fever (DHF) and Dengue shock syndrome (DSS): Bleeding, pulmonary edema, and central nervous system (CNS) complications, which are usually fatal.*

How can this disease be prevented? (2 points) *No vaccine is available, but should use insect repellent to reduce risk.*

10. A 1-year-old child was admitted to the hospital in December with fever and dehydration. Her parents reported she had a 1-day history of fever, diarrhea, vomiting, and decreased urine output. On examination, the child had a fever, rapid pulse and breathing, and was drowsy. Physical exam was unremarkable except for hyperactive bowel sounds. Enzyme immunoassay confirmed rotavirus infection. (6 points)

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How would you treat this child? *Oral rehydration therapy (ORT).*

Is there a vaccine? *A vaccine for this virus was recently released but had to be recalled.*

How serious a problem is rotavirus? (2 points) *It is a major cause of death in the developing world. It is usually self-limiting in the U.S., but can require hospitalization.*

Is there any seasonality to this infection? *Yes, it is also known as "winter vomiting disease."*

What other group of people would you frequently see infected with this virus? *People in chronic care institutions.*

11. A patient presents to the emergency room with a 3-day history of fever, malaise, and back pain. Blood work shows an elevated white cell count and abnormal liver enzyme levels. The patient later develops anorexia and jaundice. His history was negative for intravenous drug use (IVDU), sexual contact, or transfusions. Five weeks ago he visited friends in New York City and they ate oysters. One of his friends has a similar illness. Physical examination of the patient shows no rash or lymphadenopathy, but reveals a slightly enlarged liver. Over the next month his symptoms resolve and liver function tests return to normal limits. (6 points)

What is wrong with this patient? What clinical observations have led you to this diagnosis? (3 points) *Hepatitis A. An enlarged liver is indicative of hepatitis. It is not hepatitis B due to the patient's negative history and incubation period. Oysters are a common source of hepatitis A virus.*

How did the patient contract this infection? *Ate oysters that were uncooked.*

How can infections with this agent be prevented? (2 points) *Vaccine, cooking oysters before eating them (1 minute of boiling destroys virus).*

12. His distraught mother brings a 2-month-old baby to the emergency room because he is "not using

his legs or crying." The child's family recently emigrated to the U.S. from Egypt. The child was apparently well the previous evening apart from a "cold" (slight fever and sniffles). On examination, the child was extremely lethargic, very quiet, and exhibited a partial flaccid paralysis of his legs, abdomen, and back, although he was breathing normally. The baby had just received all the vaccinations normal for a baby of his age namely diphtheria, pertussis, tetanus (DPT), *Haemophilus influenzae* type b (Hib), and Sabin oral polio vaccine. Blood work demonstrated normal immunoglobulin levels in all classes, except IgA. The baby's condition required his stay in the hospital for a period of 6 weeks, during which time he required pain relievers, intubation, and antibiotic treatment. He also required physical therapy for many months afterwards. (5 points)

What is wrong with this baby? Is this a disease affecting many babies in the U.S.? (2 points) *Polio. No, the polio vaccine has meant no cases in recent history.*

How did the baby contract this infection? Explain. (2 points) *The Sabin vaccine is given orally to stimulate IgA-mediated immunity. This baby is IgA-deficient and the oral polio vaccine can produce a full-blown infection in these children.*

What further steps would you take to counsel the baby's family? *This condition is often genetic thus any more children could also be at risk from this vaccine schedule.*

13. Accompanied by his wife, a 74-year-old retired Air Force pilot presents to his neurologist with memory loss, headache, and fatigue. His wife of 50 years, said she sometimes "didn't know her husband" and that he was "different." Although their primary care physician had attributed these changes to "old age," the patient's wife had insisted that they see a specialist. CT scans showed mild cerebral and cerebellar atrophy, but no mass lesions. Blood work showed normal chemistry and hematology. Cerebrospinal fluid (CSF) obtained by lumbar puncture was normal. The patient's history was significant for his having received a corneal transplant one year ago when the sight in his left eye began to deteriorate. These mental and physical changes began to occur approximately 6 months later. The patient died seven days ago and an autopsy revealed extensive changes in his cerebrum, cerebellum, and basal ganglia to a spongiform consistency, which were diagnostic of the disease-causing agent. (5 points)

What was wrong with this patient and what role did his corneal transplant play in his illness? (2 points) *Creutzfeldt-Jakob disease (CJD), which has been observed following grafts, accidental inoculation, and handling of brain tissue.*

Similar diseases occur in animals. What are they? (2 points) *Scrapie in sheep, Bovine spongiform encephalitis (BSE; "mad cow disease") in cattle.*

A special kind of infectious particle is associated with this illness. What is it? *A prion.*

Viral Mini-Case History Studies for Courses Involving Medical Microbiology

DNA viruses

1. A 22-year-old physician assistant (PA) presents at her primary care physician with a painful abscess on the tip of her right middle finger. A tissue sample from the abscess reveals the presence of syncytial cells with some inclusions. The patient has just begun work as a PA and wonders whether she might have "picked something up" from one of her patients. (6 points)

What DNA viruses can cause skin lesions? (3 points)

What is wrong with this patient?

How did she contract the infection?

What treatment would you prescribe for the patient?

2. A 2-week-old baby is taken to the primary care physician with severe ulcerations covering the skin of his entire body. The physician first suspects child abuse since it appears that the baby has been burnt all over with cigarettes. Human embryonic fibroblast tissue culture of the double-stranded enveloped viral agent responsible results in the production of giant cells (syncytia) with multiple inclusions. (5 points)

What is wrong with the baby? How did he contract this infection? (2 points)

What DNA virus or viruses can produce this infection?

What is the outlook for this baby?

What further action would you take?

3. An 18-month-old child presents to her primary care physician with fever and diffuse vesiculopustular lesions over her entire body. Two days ago, she developed a rash on her scalp, face, and trunk. On examination, the child has a mild fever and rapid heart rate and is in some distress because the lesions are "itchy." Her family physician tells the child's parents to take her home and prescribes ointments to alleviate the skin lesions. In addition he says that they should, under *no circumstances*, give her aspirin to alleviate the discomfort. In caring for her child, the mother also comes down with the same condition. Both patients recover from her infection but some of the skin lesions do heal leaving a tiny pit or scar. (5 points)

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What is wrong with this child?

Should her condition have been prevented? How?

Why did her physician negate use of aspirin? In what other condition is the use of aspirin

prohibited? (2 points)

Is this child likely to get the virus again?

4. A 17-year-old high school student presents at her primary care physician with an asymmetrical vesiculopapular rash on her chest and back which is tender and painful. The rash is unusual in that it does not cross the mid-line of her body. The patient's history is unremarkable except for recent surgery to remove a benign tumor from her lower back. The physician's diagnosis is that the rash is caused by a double-stranded DNA-containing virus belonging to the herpesvirus group. (5 points)

What is wrong with this patient?

How did she get this illness? (2 points)

What is the outlook for the patient? (2 points)

5. A baby was born with hepatosplenomegaly, jaundice, and microcephaly. Analysis of his spleen tissue reveals the presence of enveloped double-stranded DNA viruses and giant cells. (5 points)

What has happened to this baby? (2 points)

Is his condition common?

Name another group of individuals for whom this virus causes problems.

Name another mode of transmission of this virus.

6. A college student presents to his primary care physician with a sore throat, high fever, and skin rash. On examination, his pharynx is noted to have a gray-white exudate and his distended abdomen results from an enlarged spleen and liver. Blood work demonstrates lymphocytes containing abnormally large nuclei perforated with holes, a hallmark symptom of this condition. (6 points)

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What is the patient suffering from? What components of the case history are clues to the diagnosis? (3 points)

How may he have contracted it?

What treatment would you recommend?

What is the prognosis of the disease?

7. A 19-year-old, HIV-negative female college student presents to her ENT clinic with hoarseness and difficulty in swallowing. She has a 1-week history of sore throat, fever, tiredness, and myalgia. On examination, she has grossly swollen tonsils with an exudate present. Her cervical lymph nodes are enlarged, as is her spleen. Blood work demonstrates a normal hematocrit and white cell count, but an altered lymphocyte component of 28% normal and 12% atypical lymphocytes. (6 points)

What is wrong with this patient? What led you to this diagnosis? (3 points) *Mononucleosis (mono)*.

Name two complications of this condition that could occur in otherwise normal hosts. (2 points)

Where did the patient contract this virus?

8. James, a 5-year-old African-American boy, has just returned from a 3-month summer vacation with his family to visit his grandparents in Nigeria. While there, he was sick with what his mother termed "really bad tonsillitis" and a fever which lasted for about 2 weeks. After his recovery, the child had a 3-week bout of malaria, which was successfully treated with mepacrine and chloroquine. On his return, his mother noticed that his right jaw and cheek were somewhat enlarged and thought he might have "mumps." On examination, the child is found to have a grossly swollen right jaw and cheek. The left side is normal. A biopsy sample taken from the right jaw reveals a B-cell carcinoma. (4 points)

What is wrong with James? Explain the sequence of events. (3 points)

What is the significance, if any, of his being sick in Africa? (2 points)

In which group of patients is this condition most common?

9. A young woman presents to her primary care physician with malaise, fever, arthritis, abdominal discomfort, and a body rash. Blood work demonstrates leukopenia and the agent is isolated in the form of a Dane particle. Confirmation of the diagnosis is made by positive serology (presence of antibody) to both early antigen and to core antigen. The young woman is very agitated since she received a needle stick injury during her operating room technician job about 2 weeks ago and did not mention it to anyone. She has no history of intravenous drug use (IVDU) and is not currently sexually active. (5 points)

What disease is the patient suffering from?

What is the prognosis?

How could this infection have been prevented?

Do you anticipate any long-term problems?

What is unusual about this infectious agent?

10. A 22-year-old college student presents to his primary care physician with malaise, fever, arthritis, abdominal discomfort, and a body rash. Blood work demonstrates leukopenia and the agent is isolated in the form of a Dane particle. Confirmation of the diagnosis is made by serology in which anti-HBsAg, IgM anti-HBc, and total anti-HBc were all found to be highly elevated. The patient admits to several homosexual encounters and is currently sexually active. He has no history of intravenous drug use (IVDU) or recent blood transfusions. (6 points)

What is wrong with this patient?

Name another virus he is at risk from because of his lifestyle APART FROM HIV.

Could his condition have been prevented?

Do you anticipate any long-term problems resulting from his infection?

What is unusual about this infectious agent?

If serology had shown elevated anti-HBS only, what conclusion would you have come to about the patient?

11. A 10-year-old boy presents at his primary care physician with dysuria and increased frequency of urination. Urine samples are negative for bacteria, but contain >50 white cells and up to 10 red cells/high power microscope field. The agent causing the boy's disease is a naked, double-stranded DNA-containing virus. (5 points)

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What is wrong with this patient? Is his age significant? (2 points)

Can this condition be prevented? (2 points)

How would you treat the patient's infection?

12. An 18-year-old teenager, who is sexually active, presents to her gynecologist for a routine Pap smear. Her physician notices that the patient has 4 tiny, flat, painless genital warts on her labial area and asks her about them. The patient has apparently never noticed them and is unsure when they appeared. Her Pap smear shows no abnormalities. The patient's condition is being caused by a naked, double-stranded DNA virus. (4 points)

How commonly is this condition seen in this age group?

Are genital warts a cause for concern? Why? (2 points)

How common are they?

13. A 7-year-old child presents to his primary care physician with a red rash on his cheeks and a low-grade fever. His mother was worried initially that the child might have been hit by another child at pre-school and paid little attention, since the boy was always "getting into mischief." The agent causing the infection is a small, non-enveloped single-stranded DNA virus. (5 points)

What is wrong with this child?

Name two groups of individuals in which this condition might be cause for concern. (2 points)

Name a disease that this virus can cause in other mammals.

RNA viruses and unconventional virus-like agents

1. A patient presents to his primary care physician with muscle weakness and numbness in his lower limbs. After exhaustive testing he is found to have Guillain-Barre syndrome. This is thought to be the result of an adverse reaction to being vaccinated with a particular RNA virus.(4 points)

Which virus was this patient vaccinated with?

How frequently does this condition result from such a vaccination?

What is likely to happen to this patient?

How effective is the RNA-virus vaccine at preventing this particular viral infection?

2. A 35-year-old physician living in Boston was in his usual state of health until he developed an

abrupt onset of headache, fever, and body aches during the month of October. He subsequently developed a sore throat and non-productive cough. Diagnosis of an RNA-containing virus was confirmed through rapid antigen detection using an enzyme immunosorbent assay (EIA). Culture and typing was also performed by a sentinel lab, which monitors the strains of this virus causing infections. (5 points)

What pulmonary complications may this patient encounter? Are these common? (2 points)

What non-pulmonary complications may the patient encounter? Are these common? (2 points)

Name a group of people at risk for developing severe infections with this virus.

3. A 12-year-old California boy presents to his primary care physician feeling "hot and tired" and with periumbilical pain, cough, sore throat, fever, and myalgia. His physician diagnoses the flu and sends him home. Four hours later, the boy is admitted to the emergency room vomiting and short of breath. A chest X-ray shows pulmonary edema and blood work demonstrates significantly reduced platelet numbers. The boy's history is significant for his living in a rural area on a dairy farm. The boy had been in the woods with his father cleaning out their hunting cabin which was full of mouse droppings. Both father and son have similar symptoms. (5 points)

What is wrong with this boy? (Hint: mice are an important clue.)

What is the outlook for the boy's disease? (2 points)

How is this infection acquired? Is there any evidence for person-to-person transmission? (2 points)

4. A 5-year-old child presents to her primary care physician with a sore throat, dry cough, headache, and conjunctivitis. The physician passes it off as a "cold" until he examines her mouth and observes tiny white lesions with a red border on her cheek membranes (Koplik's spots). He is now sure of his diagnosis. (4 points)

What does the child have?

What is its prognosis?

What complications could ensue?

What is the normal treatment?

Why are you unlikely to see a child with this disease now?

5. An 18-year-old boy presents to his primary care physician with fever, headache, nausea, vomiting, and a stiff neck. He has had these symptoms for 48 hours but has become concerned because he cannot hear well out of his left ear. After a further 4 days, the patient recovers but is left slightly deaf in his left ear. This condition was caused by an enveloped, non-segmented RNA virus belonging to the paramyxovirus group. (5 points)

The patient's infection was a rare complication of an infection normally causing which condition?

Could his infection have been prevented? How? (2 points)

How is the patient likely to have contracted this infection? Is it a normal disease for this age

group? (2 points)

6. A 6-month-old baby was admitted to the hospital in March with severe respiratory distress. Five days prior to admission she developed a cough and rhinitis. Three days later she began wheezing and was brought to the emergency room when she became lethargic. A chest X-ray revealed infiltration and hyperexpansion of the lungs. A rapid and confirmatory diagnostic test for this patient was the enzyme immunosorbent assay (EIA) for viral antigen on throat washings. (5 points)

How common is this disease? (2 points)

How is it spread?

Does it have a seasonal variation?

What treatment would you give this child?

7. A 22-year-old volunteer worker at a wildlife refuge is admitted to the emergency room with agitation, disorientation, seizures, and pain on swallowing. Physical examination reveals a partially healed animal bite on his forearm. The animal which gave him this bite, a raccoon, died several days ago, having shown similar symptoms. Samples of brain tissue from the deceased animal reveal the presence of Negri bodies and viral antigens are found in serum samples from the patient. Reverse transcriptase polymerase chain reaction (PCR) on a skin biopsy from the patient (saliva may also be used) confirmed the presence of viral antigen from a bullet-shaped RNA-containing virus. (6 points)

What is wrong with the patient? What led you to this diagnosis? (2 points)

How would you treat him?

Explain the course of this disease when it remains untreated. (3 points)

8. A baby was born deaf, physically retarded and with a variety of skin lesions. His mother had an uneventful pregnancy, health-wise, but underwent no pre-natal testing of any kind because she is a Jehovah's Witness. The virus which caused this baby's condition is an enveloped RNA virus. (5 points)

What happened to this baby?

At what point during the mother's pregnancy is the virus likely to have been passed to the fetus? Explain your answer. (2 points)

Could the baby's condition have been prevented?

What precautions must you, as a hospital Physician's Assistant, now take with this baby?

9. A woman presents to her primary care physician with fever, backache, and a headache of two days duration. She also complains of intense myalgia in her upper arms and "pain on moving her eyes." The woman has just returned from a trip to El Salvador, organized by her church, where she had extensive exposure to mosquitoes. On examination, the patient is found to have a rash on her face, trunk, and thighs. Blood work shows drastically reduced white cell numbers with normal hemoglobin and platelet counts. Convalescent antibodies to a mosquito-borne disease were diagnostic. (6 points)

What viral disease did this patient acquire? What led you to this conclusion? (2 points)

What occurs during severe cases of the disease? (2 points)

How can this disease be prevented? (2 points)

10. A 1-year-old child was admitted to the hospital in December with fever and dehydration. Her parents reported she had a 1-day history of fever, diarrhea, vomiting, and decreased urine output. On examination, the child had a fever, rapid pulse and breathing, and was drowsy. Physical exam was unremarkable except for hyperactive bowel sounds. Enzyme immunoassay confirmed rotavirus infection. (6 points)

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How would you treat this child?

Is there a vaccine?

How serious a problem is rotavirus? (2 points)

Is there any seasonality to this infection?

What other group of people would you frequently see infected with this virus?

11. A patient presents to the emergency room with a 3-day history of fever, malaise, and back pain. Blood work shows an elevated white cell count and abnormal liver enzyme levels. The patient later develops anorexia and jaundice. His history was negative for intravenous drug use (IVDU), sexual contact, or transfusions. Five weeks ago he visited friends in New York City and they ate oysters. One of his friends has a similar illness. Physical examination of the patient shows no rash or lymphadenopathy, but reveals a slightly enlarged liver. Over the next month his symptoms resolve and liver function tests return to normal limits. (6 points)

What is wrong with this patient? What clinical observations have led you to this diagnosis? (3 points)

How did the patient contract this infection?

How can infections with this agent be prevented? (2 points)

12. His distraught mother brings a 2-month-old baby to the emergency room because he is "not using his legs or crying." The child's family recently emigrated to the U.S. from Egypt. The child was apparently well the previous evening apart from a "cold" (slight fever and sniffles). On examination, the child was extremely lethargic, very quiet, and exhibited a partial flaccid paralysis of his legs, abdomen, and back, although he was breathing normally. The baby had just received all the vaccinations normal for a baby of his age namely diphtheria, pertussis, tetanus (DPT), *Haemophilus influenzae* type b (Hib), and Sabin oral polio vaccine. Blood work demonstrated normal immunoglobulin levels in all classes, except IgA. The baby's condition required his stay in the hospital for a period of 6 weeks, during which time he required pain relievers, intubation, and antibiotic treatment. He also required physical therapy for many months afterwards. (5 points)

What is wrong with this baby? Is this a disease affecting many babies in the U.S.? (2 points)

How did the baby contract this infection? Explain. (2 points)

What further steps would you take to counsel the baby's family?

13. Accompanied by his wife, a 74-year-old retired Air Force pilot presents to his neurologist with memory loss, headache, and fatigue. His wife of 50 years, said she sometimes "didn't know her husband" and that he was "different." Although their primary care physician had attributed these changes to "old age," the patient's wife had insisted that they see a specialist. CT scans showed mild cerebral and cerebellar atrophy, but no mass lesions. Blood work showed normal chemistry and hematology. Cerebrospinal fluid (CSF) obtained by lumbar puncture was normal. The patient's history was significant for his having received a corneal transplant one year ago when the sight in his left eye began to deteriorate. These mental and physical changes began to occur approximately 6 months later. The patient died seven days ago and an autopsy revealed extensive changes in his cerebrum, cerebellum, and basal ganglia to a spongiform consistency, which were diagnostic of the disease-causing agent. (5 points)

What was wrong with this patient and what role did his corneal transplant play in his illness? (2 points)

Similar diseases occur in animals. What are they? (2 points)

A special kind of infectious particle is associated with this illness. What is it?

Viral Mini-Case History Studies for Courses Involving Medical Microbiology-- Answer Key

DNA viruses

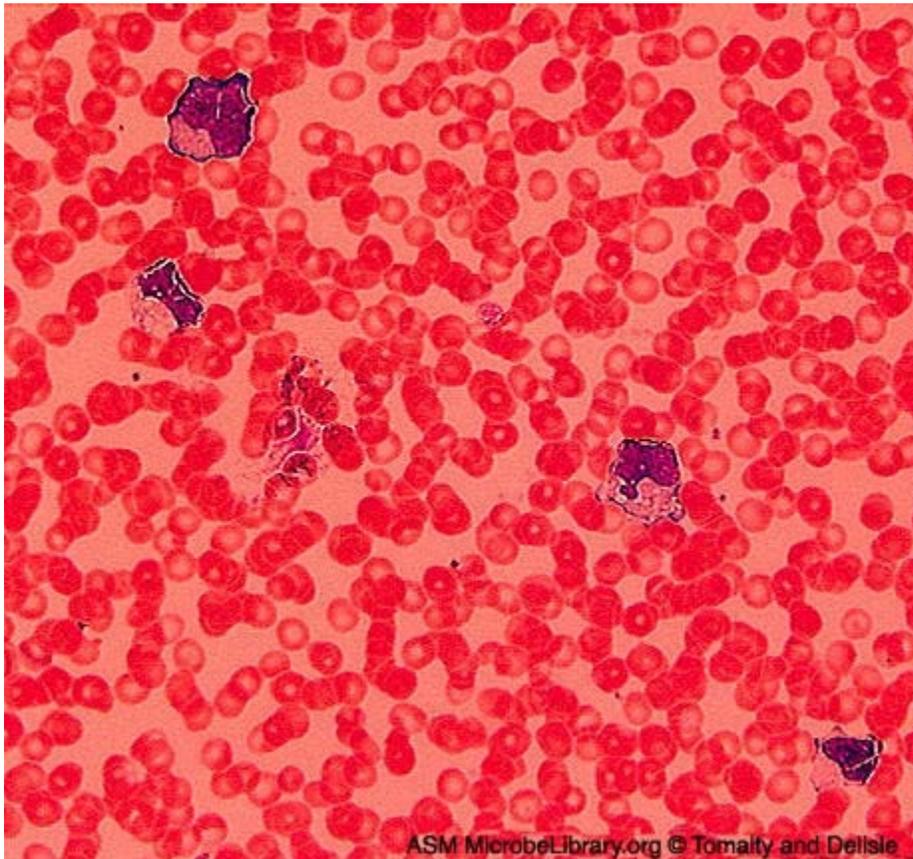
Q. 3 A



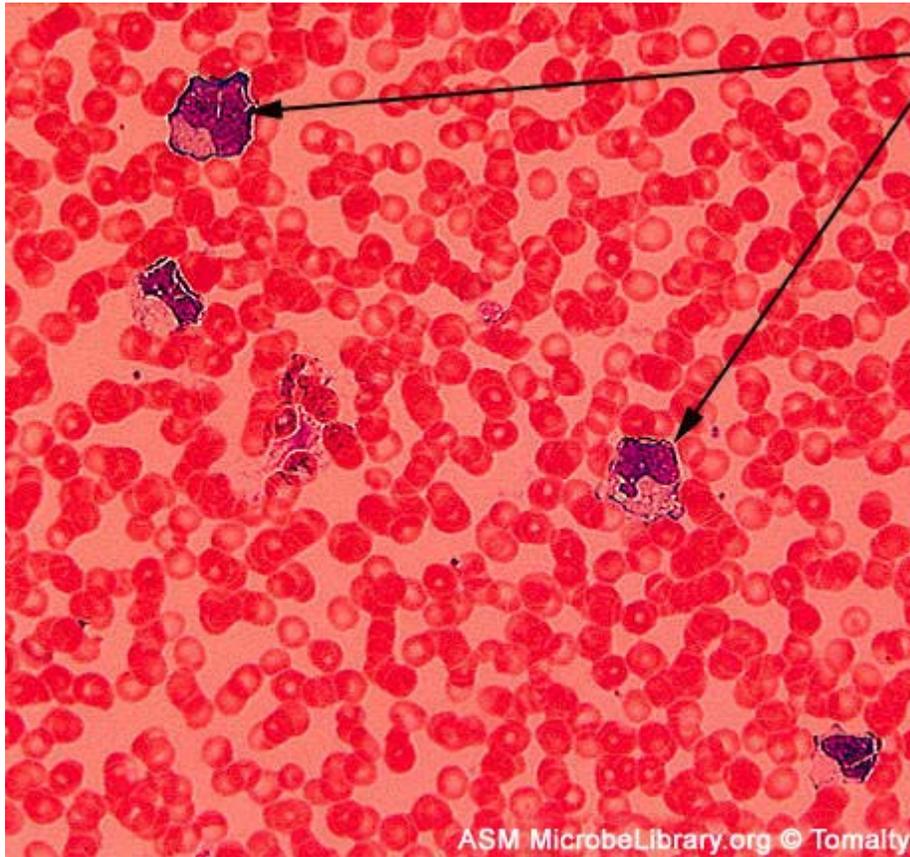
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Q. 6 A



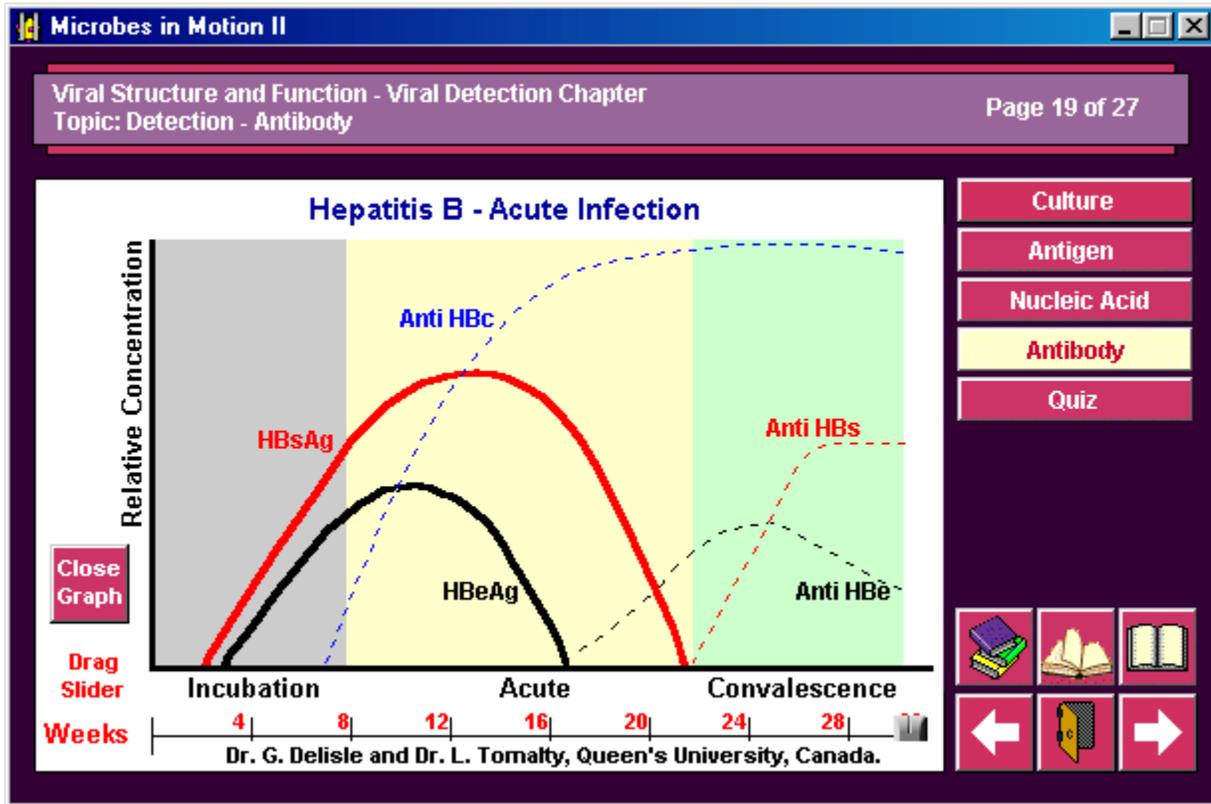
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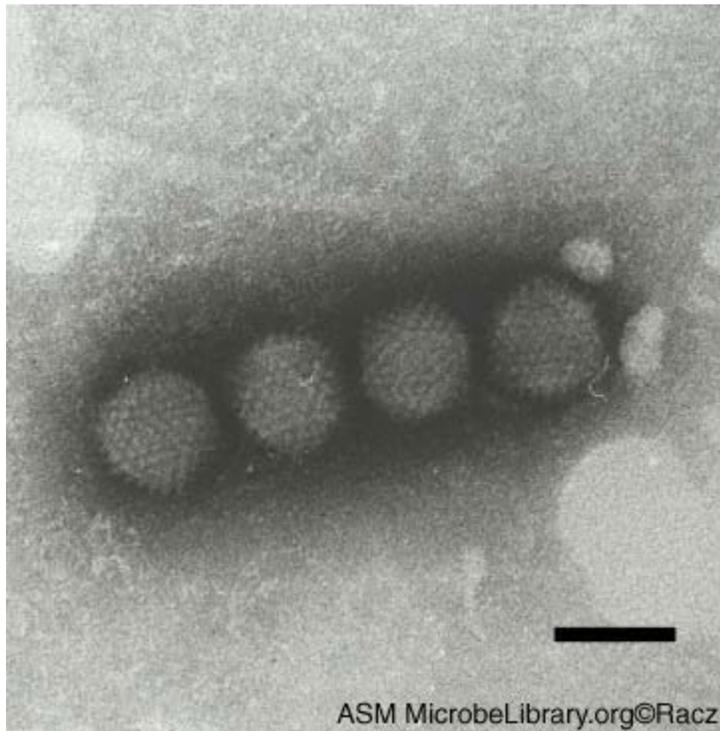
Atypical lymphocyte with deformed nucleus and dark rimmed cytoplasm

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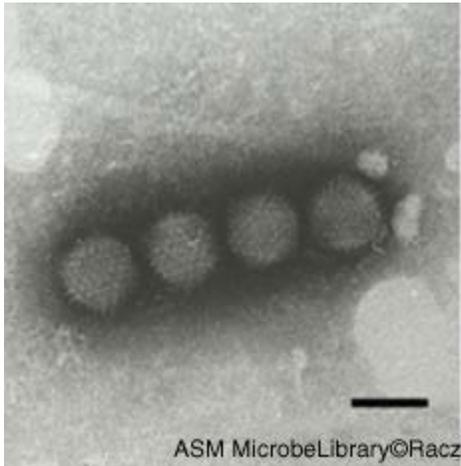
Q. 9



Q. 11 A

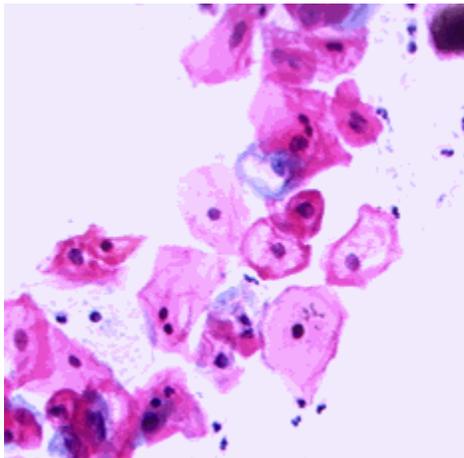


Q. 11 B



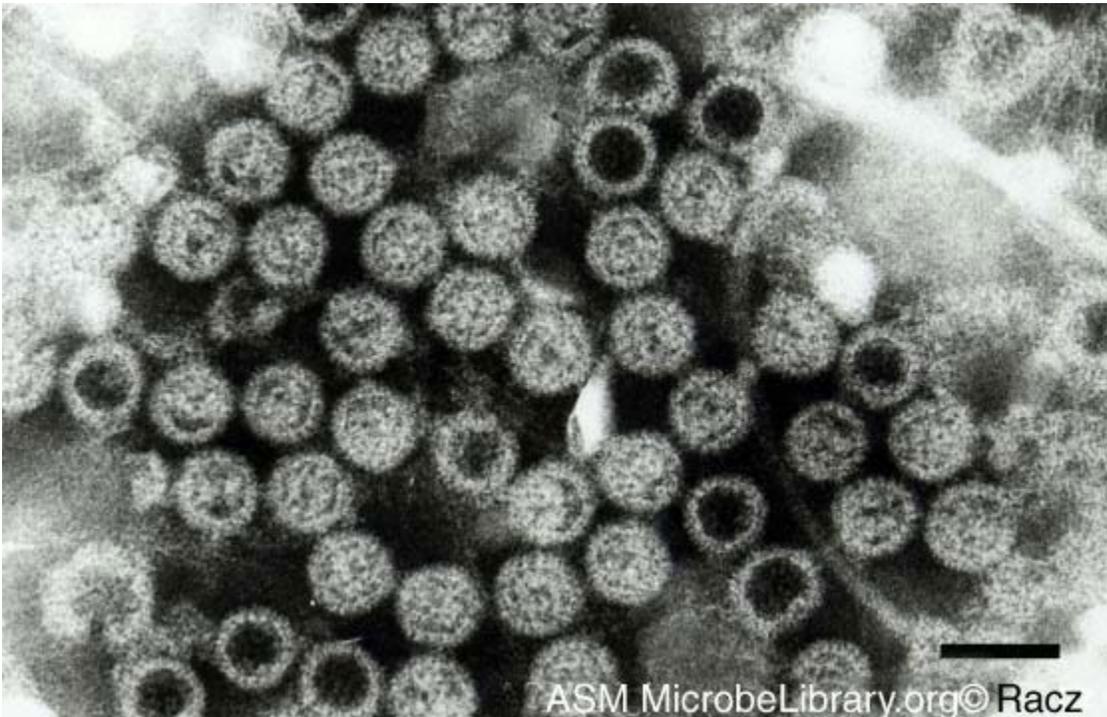
Adenovirus particles
Note the icosahedral symmetry

Q. 12



RNA viruses and unconventional virus-like agents

Q. 10 A



Q. 10 B

