INFECTIOUS DISEASE CHARACTERISTICS AND HUMAN ANATOMY

What's the difference between infection and disease?

Infection results when a micro-organism has been able to multiply on a body surface or within the body. The infection may or may not result in disease.

Disease is an illness that damages the body. This distinction is important because many of the microorganisms that are sexually transmitted may result in infection, but not disease.

Disease usually has symptoms and/or signs. Symptoms are what a patient notices or feels. Signs are objective manifestations of a disease – an examiner would notice them, but a patient might not.

What are the four major groups of organisms that cause STDs? How do they differ?

**Bacteria** are single-celled organisms that are found on all body surfaces. Many play a beneficial role. There are three shapes – round (c cocci or diplococci), rod (bacilli) and spiral (spirochetes). The Gram stain is a simple lab test to differentiate bacteria under a microscope. Gram positive bacteria show a purple dye. Gram negative are pink, and some do not reveal any dye. A few bacteria such as Chlamydia trachomatis are difficult to grow and test. Examples of bacterial STDs are: Chlamydia, Gonorrhea, Chancroid, and Syphilis.

**Viruses** are much smaller and simpler than bacteria and live within a cell. They can only multiply within the host cell. They are difficult to grow in a lab setting. STD examples are: genital Herpes, Hepatitis and HIV/AIDS.

**Metazoa** (parasites) are tiny animal forms that cause diseases and infestations, such as pubic lice and scabies.

**Protozoa** are large one-celled organisms, larger and more complex than bacteria. The only STD they cause is trichomoniasis.

**Fungi** that are one-celled are called yeasts such as Candidiasis. Most yeast infections are not technically STDs.

What four conditions are necessary for microorganisms (microbes) grow? What are the two modes of transmission?

To grow and replicate, microorganisms require four conditions: moisture, warmth, specific receptors on human cells, and proper pH.

The mode of transmission can be person-to-person such as coughing or sexual contact. Or the mode may be from fomites. Fomites are nonliving substances or objects contaminated with an organism. Microbes are transmitted when a person comes in contact with a fomite, for example, contaminated food or water.
**What are the portals of exit and entry for microbes?**

Portals of exit are the different ways microorganisms leave an infected person. Exit portals include: respiration, urination, defecation, coughing, and shedding of infected skin. During intimate contact, bodily fluids such as blood, pus, saliva, mucous and vaginal and seminal fluids are also portals of exit.

Portals of entry for microorganisms to infect a person include the respiratory tract, digestive tract, urogenital tract, skin, and mucus membranes of the mouth, genitals or under eyelids.

**What is efficiency of transmission and why is it important?**

Some organisms are so efficiently transmitted that acquiring only a few of them can cause disease. For example, syphilis requires less than 100 organisms to cause disease. Efficiently transmitted diseases are highly infectious and usually spread more rapidly.

**What happens during the incubation period and why are incubation periods important in the spread of disease?**

Once an organism infects someone, it takes time before signs and symptoms develop. During this incubation period, the person may be infectious but not know it or show it. Diseases with long incubation periods can often spread more widely.

The five stages in the progression of disease include:

- Organisms are introduced into the body
- Organisms get to the right body location
- Organisms multiply and create toxins or damage-causing virulence factors
- Symptoms and signs appear
- Consequences of infection develop. Some diseases remain local such as a sore, and some spread to more distant parts of the body.

**What are the body’s three barriers against infection?**

Barriers to infection include:

- Mechanical barriers such as skin and nails that prevent a microorganism from entering unless they are broken.
- Chemical barriers such as tears, saliva, and stomach acids that dilute, wash away, or kill microorganisms.
- The immune system which is the most complex.

**In the immune system, what is the role of the phagocytic system?**

The first line of defense is the **phagocytic system** which responds within minutes of invasion by microorganisms. Phagocytes engulf and ingest a wide variety of microbes. If only a small number of organisms are involved, the phagocytic system can be sufficient to prevent disease.
In the immune system, what is the role of the cell-mediated system?

If the phagocytic system cannot prevent disease, the body notices the presence of abnormal microbes, and activates the cell-mediated immune system. The body recognizes abnormal microbes through the presence of antigens. **Antigens** are unique molecules on the cell membrane or envelope of a microorganism. Cell-mediated immunity involves T-cells which, in turn, activate B-cells. T-cells and B-cells are types of lymphocytes, or white blood cells.

T-cells mature in the thymus. There are three types of **T-cells**:

- T-helper cells recognize specific antigens and signal the B-cells to produce antibodies to combat the antigens.
- T-killer cells help destroy infected or damaged host cells.
- Memory T-cells remember specific microbes from the past, so that the body can respond faster if it is infected with that microbe again.

HIV causes AIDS by infecting and destroying T-helper cells so that cell-mediated immunity cannot work and, therefore, cannot activate the rest of the immune system.

In the immune system, what is the role of the humoral immune system?

Humoral immunity involves the B-cell, a type of lymphocyte or white blood cell produced in the bone marrow. B-cells produce antibodies in response to a specific foreign microbe. The antibodies form an exact fit over antigens and flag them to be cleared from the body.

How do vaccines work?

Vaccines contain killed or weakened microorganisms that stimulate the body to produce antibodies even though there is no disease. Memory T-cells remember and can respond quickly whenever that particular microbe enters the body again. Two STDs can be prevented with vaccines: Hepatitis B and Human Papillomavirus (HPV).

What is the purpose of blood tests that measure antibodies? What are the limitations?

Blood tests that measure antibodies are useful for diagnosing past infection. However, it takes from 10-14 days from initial infection before the body produces enough antibodies to be measurable. Antibodies remain in the blood after the infecting organism has been killed. Over time, the level of antibody may diminish and be non-detectable by lab tests.

It is important to know that having antibodies against an organism does not mean a person is actively infected with the organism. It only means the person has been exposed or vaccinated at some time in the past. However, blood titer (the magnitude of the antibody level in the blood) may indicate whether the exposure was recent. For example, a very high titer would usually suggest a recent infection.
What are the structures of the male reproductive and genitourinary tract? Which parts are vulnerable to STD infection?

Most STDs in men occur in the penis. These are primarily skin infections or genital ulcers such as chancroid, syphilis and genital herpes. Men with ulcer diseases may have swollen and painful lymph nodes in the groin as one of their early symptoms. The urethra is vulnerable to microorganisms like *N. gonorrhoeae*, *C. trachomatis*, and *T. vaginalis*.

The testes and scrotum are rarely infected. In rare cases primarily in young men, the prostate gland may be infected by gonococcal epididymitis caused by *C. trachomatis*.

What are the structures of the female reproductive and genitourinary tract? Which parts are vulnerable to STD infection?

Female anatomy is more complex. The external genitalia include the mons pubis, the clitoris, and the outer and inner labia. Internal anatomy includes the cervix, uterus ovaries, and fallopian tubes. The cervical os is normally filled with a thick, mucus plug. This plug forms an effective, but not invincible, barrier between the vagina and the uterus. Adolescent women are vulnerable to chlamydial infections at the tip of the cervix and may develop mucopurulent secretions of mucus mixed with pus.

Glands can also be infected by microorganisms and become very painful and inflamed, e.g., Bartholin’s glands. Inflammations of the uterus or Fallopian tubes may cause scarring that may cause infertility or ectopic pregnancy.