Escherichia Coli

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**Description of the Microorganism**

Escherichia coli is commonly known as E. coli, a bacterium that lives in the lower intestine of warm-blooded animals. It is a gram-negative, coliform bacterium that belongs to the Escherichia genus. It is a rod-shaped bacterium and each has a width of 0.5 µm and length of 2µm. E. coli cells are stained gram-negative as they have a cell wall that is made up of 1 or 2 layers of peptidoglycan. This microorganism is harmless but there are some serotypes or strains that could cause severe food poisoning in the host they live in and are responsible for food contamination. There are many types of bacteria, but among them E. coli has no pigment, so it won't be wrong to say that their colonies lack color. Focusing on the morphology, it could be seen that E. coli is pink because of lactose that indicates it is a gram-negative bacterium. It has a single cell arrangement and can live with or without oxygen.

**Virulence factors**

Uropathogenic Escherichia coli (UPEC) are the major agents that infect the urinary tract, cystitis and pyelonephritis. All the complications caused by this microorganism lead to renal failure and the patients may need renal transplants. Virulence factors help the pathogens of bacteria in invading the host and then causing diseases. In the next step, this pathogen evades the defense system of the host. Components on the surface allow the bacteria to encode themselves on the plasmids, but in most cases, they encode themselves on chromosomes. Studies show that pathogenic bacteria most of the time become colonize areas around the mucosal sites by getting the assistance of pili (fimbriae) to adhere to the cells.

**Immunity**

Evidence has shown that in some people, immunity genes protect the body from E. coli infections while other people fall ill. According to the research, resistance to E.coli bacteria in patients comes down to their DNA. The activity of 29 immune-related genes predicts illness or wellness of the person exposed to E.coli. The immune system creates some antibodies as well as some immune cells that destroy or deactivate infectious E. coli microorganisms. Immunity against E coli could be developed through vaccination. There are certain molecules called HVEM. These molecules are present on the lining of both the intestines and lungs. These molecules are viewed to be important for protecting the body from E. coli infections.

O15: H7 strain of E. coli initiates the infection and gives a signal to the host’s immune response. A protein called NIeH1 is secreted by invading bacteria. This protein directs the host's immune enzyme IKK-beta to initiate specific immune responses.

**Infectious disease information**

* E. coli is one of the infectious bacteria that cause many infections such as cholecystitis, cholangitis, urinary tract infections, traveler’s diarrhea, and bacteremia. Pneumonia and neonatal meningitis are some other conditions caused by E. coli.
* E. coli can affect the urinary track that would cause kidney damage as well.
* Infection of the E. coli can be easily treated, but if the infection is left untreated the consequence are severe. They include hemorrhagic diarrhea and kidney failure that ultimately lead towards death.
* An individual's immunity system and the severity of an attack of E. coli determines whether the infection will be chronic, latent or acute. In most of the case, it has been witnessed that infection is wither acute or chronic.
* Urinary and respiratory organ systems are mainly infected by this bacterium.
* It is an opportunistic kind of bacteria. It is most commonly found in the gut of both warm-blooded animals and humans. Some of the strains of these bacteria like Shiga toxin cause foodborne diseases.

**Epidemiology**

During an outbreak investigation of hemorrhagic colitis in 1982, the Escherichia coli was recognized for the first time. Before 1993 the E. coli infections were linked to undercooked and raw food. It was considered to be a threatening pathogen. Disease control and prevention departments highlighted the epidemiology of these bacteria from 1982 to 2002. WHO provided scientific assessments to control the E. coli infections through the proper treatment of food. These assessments were based on guidelines provided by authorities responsible for framing international food standards and guidelines. The aim of these steps taken by WHO is to promote and strengthen food and safety systems and educate people regarding the appropriate consumption of food whilst avoiding contamination. Not only is food hygiene important, but good practices of personal hygiene are also essential to control E. coli infections. Proper management of water and wastes has a positive influence on reducing infection risks. Household preventive measures can reduce the risk of E. coli infection to a great extent.

**Presentations**

A ten-year-old boy was transferred to a hospital with a 4-day history of diarrhea, anemia, and thrombocytopenia. Some of the basic symptoms that were diagnosed in that boy were malaise, mild dehydration and stomach cramps, vomiting, fever, and nausea. From the history, it was revealed that he probably acquired infectious E. coli by eating contaminated food, later revealed to be ground beef. Research shows that E. coli can survive on meat. After the examination and diagnoses, it was found that specific indicators were present in the blood. Generally, it has been seen that the level of sugar in the patient’s blood or urine elevates, but in this hypothetical situation glucose become the main source of sustenance for the E. coli, as it is used to provide faster growth than any other sugars. The most preferred source of food for E.coli bacteria is glucose.

**Preventions**

* E Coli is a bacteria living in the intestines of humans and animals. Most of its varieties are harmless and some cause brief diarrhea. People are exposed to E. coli due to contaminated food and water, especially undercooked beef and raw vegetables. There is no vaccine for E. coli infections, however researchers are working on potential vaccines. There are some steps that can help prevent this infection.
* Avoid risky foods and cook the food at higher temperatures.
* Drink pasteurized milk and juices. Bottled juices kept at room temperature and are pasteurized.
* Wash raw food gently to remove dirt and harmful bacteria to the greatest extent. Though rinsing cannot remove E. coli bacteria completely, especially from leafy green vegetables.
* Use hot water and detergents to wash all utensils before and after use, especially those which come into contact with raw meat and fresh produce.

There is a need for taking preventive measure at all the stages of the food chain, stating right from the agricultural production, and up to the processing and preparing of foods in household kitchens and commercial industries. Basic food hygiene practices must be promoted everywhere as suggested by the WHO. These practices are the five keys to safer foods. These five keys are

* Keep surroundings clean
* Separate both cooked and raw food
* Cook thoroughly
* Keep food at a safe temperature
* Use pure water.

**Treatments**

Antimicrobials are used to treat E. coli. The most commonly used agents against this microbe are β-lactams, aminoglycosides, and fluoroquinolones.

When an infection of E. coli is diagnosed, after confirming through a stool test in the laboratory, doctors prescribe the patient some precautionary measures. For an illness that E. coli caused, no current treatment can be viewed as effective. Most common suggested treatments for patients of E.coli infection are:

* Rest
* Fluids that help for preventing fatigue and dehydration.

Other measures that are an important part of the treatment suggested for the patients is that they have to avoid taking any anti-diarrheal medication as this kind of medication slows down the process of digestion that would prevent the body from getting rid of the toxins that need to be extracted. Antibiotics are not recommended as they could increase the risk of serious complications. In severe cases, E. coli infections may a syndrome called hemolytic uremic. Patients can be hospitalized and would require extensive care. This care would include kidney dialysis, blood transfusion, and IV fluids. Doctors asked will likely advise rest and plenty of fluids to replace the fluids that the body loses through diarrhea and vomiting.

**Clinical relevance**

* Trimethoprim-sulfamethoxazole is the multi-drug resistance most of the time collaborates with dihydrofolate reductase (DHFR) and dihydropteroate synthase (DHPS) genes in integrons. It is a healthcare-associated pathogen.
* In any healthcare setting, a young child or the older adult is at more risk of developing the infection, since they have a weakened immune system as well as reduced levels of stomach acid.
* Resistance to trimethoprim-sulfamethoxazole, ampicillin, and ampicillin-sulbactam is the most prevalent of all. Antibiotics that are used are against the MDR strains of E. coli are listed are ciprofloxacin, cephalosporin, and levofloxacin.
* E. coli bacteria cause a range of diseases such as urinary tract infections, diarrhea, and pneumonia. However, most of its strains are harmless to humans. The most common infections are fever, vomiting, and nausea. In some cases, E. coli infections can lead to kidney failure. Its symptoms usually appear in 3 to 4 days when a person is exposed to the bacteria. Abdominal pain and watery diarrhea start soon. In some cases, the toxin damages the intestines so it results in the bloody stools around the day.

References

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