BACTERIAL DISEASES

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Bacterial Diseases

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PREFACE

The book contains topics on Bacterial Diseases like Anthrax, pneumonia, Bacterial Tooth Decay, Bubonic plague, Tuberculosis, Leptospirosis, Syphilis, Leprosy, Burn Infection, Gas gangrene, Spontaneous bacterial peritonitis, Relapsing fever, Rat-bite fever, Brucellosis and many more. Each disease has been explained by its symptoms, diagnosis, causes, and treatment. At the start, there is a summary of the whole chapter, so that one can easily take the concept within the limited time. Keywords are also included for a quick indicator of the chapter. The book contains introductory material for pharmacy, medical, & dental students, also M Phil, Ph.D. for Pharmacology, Botany, Zoology, Microbiology, Pharmacy, Biotechnology, and all other related health sciences subjects. It is also very helpful for common people.

As an editor and author, and on the behalf of my co-authors, I declare that we have no conflict of interests, neither financial nor any other. Moreover, nothing to acknowledge.

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CHAPTER 1

Anthrax: A *Bacillus Anthracis* Infection

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Abstract: Anthrax is a bacterial disease and caused by the transfer of bacterial spores. *B. anthracis* is gram-positive, non-motile, and aerobic bacteria. There are 3 types of commonly caused anthrax: inhalational anthrax, cutaneous anthrax, and gastrointestinal anthrax; each with its signs and symptoms. In the old days, anthrax is diagnosed by clinical findings and by the exposure history to bacteria. In the laboratory, the Gram staining procedure, ELISA, screening, and serologic assays are used. Antimicrobial drugs are not given at once before the appearance of symptoms unless the evidence is found that the risk is present. Some antibiotics are also found to be effective against *B. anthracis* such as chloramphenicol, tetracyclines, rifampin, and other first-generation cephalosporins. Anthrax is not transmitted from one individual to another even in case of inhalational anthrax. However, standard precautions must be taken to avoid any risk.

Key Words: Anthrax, *B. anthracis*, Ciprofloxacin, Gram Staining Procedures.

INTRODUCTION

Anthrax is a bacterial disease of lungs and skin and progressive to severe ulceration caused by *B. anthracis* in humans and animals that exists as resistant spores in soil cause disease in humans and animals who have ingested or inhaled these spores. The major source of transfer of spores in humans is contact with other infected individuals for example wool, hair, the habitat of infected animals [1].

B. anthracis is gram-positive, non-motile, and aerobic bacteria. Spore-forming *B. anthracis* is large 3.0 to 10.0 μm by 1.0 to 1.5 μm. The optimum temperature for their growth is 37°C and they naturally grow in the form of colonies. In the laboratory, it grows and appears as a single organism but they are in the form of long chains. The pathogenicity of *B. anthracis* is present in two parts of plasmids, one causes the inhibition of phagocytosis by producing a polyglutamyl capsule

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and the other helps in the production of exotoxins and have genes for it [2].

SYMPTOMS

There are 3 types of commonly caused anthrax Fig. (**1**). In the case of inhalational anthrax, the initial attack is mild and non-specific, normally the disease is not identified at this stage. The patient bears fever, chest and abdominal pain, and cough. After some days a second stage begins suddenly and acute with fever, cyanosis, and diaphoresis. Patients have swollen lymph nodes, edema of neck and chest. This stage rapidly becomes severe and can cause death within 36 hours [3].

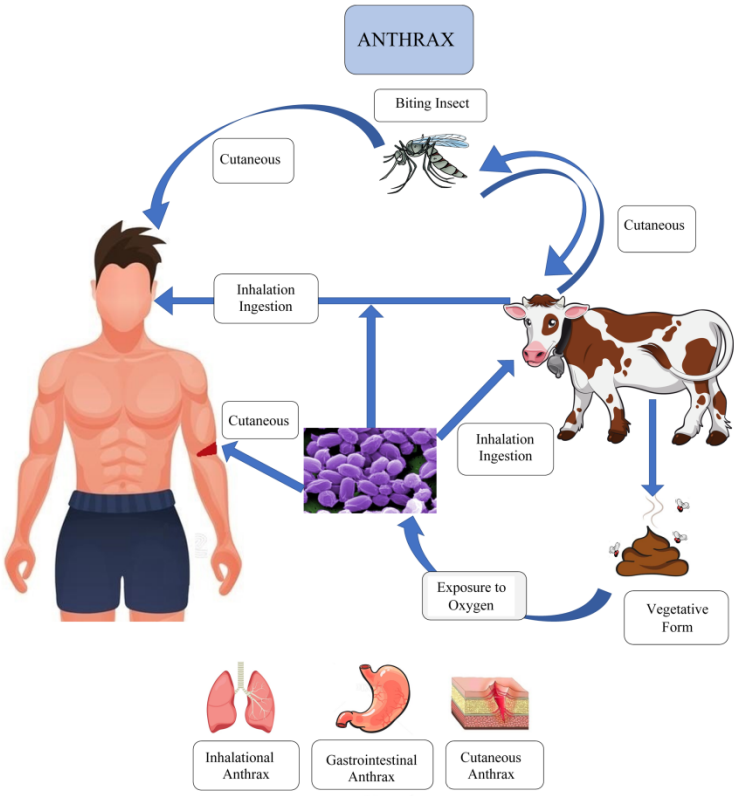

Fig. (1). Types and pathogenesis of anthrax.

In cutaneous anthrax, bacterial spores get entry into the body through wounds and cuts. After seven days of entry, primary lesions appear which are usually painless. In the next one to two days these lesions increase in size and filled with some fluid also containing leukocytes and gram-positive bacilli. Later, the lesion is enclosed by gelatinous edema. Patients have low fever and malaise. Naturally

occurring anthrax is 95% of cutaneous type.

In gastrointestinal anthrax, initial symptoms start appearing after two to five days of attack consists of nausea, fever, body pains, and vomiting. These lesions are formed in caecum and ileum. In some cases, gastric ulcers are also formed.

Sometimes, inhalational anthrax may result in causing anthrax meningitis which is less common but affects the cerebrospinal fluid. Patients have 100 percent chances of death if proper antibiotics are not given [4].

DIAGNOSIS

In the old days, anthrax is diagnosed by clinical findings and by the exposure history to bacteria. With the change in the history of exposure as the spores are now transferred either by air or some other delivery means. Anthrax is identified by the general symptoms that appear on the body [5].

LABORATORY DIAGNOSIS

In the laboratory, the Gram staining procedure is used for testing either by taking a sample from lesions or blood. Tests are also performed by checking the growth that appeared on sheep's-blood agar. Different colonies appeared indicating different strains. Growth cannot be checked on MacConkey agar. Confirmatory diagnostic tests are performed by checking the growth of virulent strains on nutrient media with the little addition of carbon dioxide. Some additional confirmatory test is used which involve lysis of bacteria by gamma phage or antibody staining of the cell wall antigen.

Screening assays are also directly used by taking samples (nasal swabs). Such samples are also used to check how the infection is occurred either by inhalation or by the wound. For retrospectively purpose serologic testing is useful and samples are taken from acute phases of illness [6].

MANAGEMENT

Antimicrobial drugs are not given at once before the appearance of symptoms unless the evidence is found that the risk is present. The unnecessary use of antibiotics without the confirmation of risk is also dangerous and can cause resistance to the strain. However, prophylaxis is recommended for a long period of time. As the strains of *B. anthracis* is used for bioterrorist attack and overseas strains are resistant to certain antibiotics, only ciprofloxacin is used in initial stages [7].

Some special anthrax vaccines, containing a sterile and attenuated culture of the

CHAPTER 2

Pneumonia: An Inflammation of Lungs

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Abstract: Inflammation of the lungs due to the attack of *Streptococcus pneumonia* bacterium is termed as pneumonia. Only one or both lungs may be affected. People of less developed countries are at substantial risk of suffering from pneumonia. Cough, high fever, breathing problems, and chest pain are some common symptoms of pneumonia. Chest X-ray, blood test, bronchoscopy are diagnostic methods to identify pneumonia. Certain antibiotics such as Penicillin, Augmentin, Erythromycin, Amoxicillin, Azithromycin, and Fluoroquinolones are used for the treatment of pneumonia. Vaccines are also available such as the pneumococcal conjugate vaccine (PCV13) and the pneumococcal polysaccharide vaccine (PPV23; Pneumovax). A healthy lifestyle including quitting smoking, hand washing, proper sleep, a healthy diet, and exercise strengthens the immune system and reduces the chances of pneumonia.

Keywords: Antibiotics, Bronchoscopy, Cough, Lungs, Pneumonia.

INTRODUCTION

Pneumonia is an inflammation of lungs due to infection caused by bacteria, viruses, or fungi. In this condition, pus accumulates in air sacs or alveoli of the lungs and blocks the air passage (Fig. **2**). Single or both lungs may be affected. *Streptococcus pneumoniae*, a gram-positive bacterium, is the most common type of bacteria which causes pneumonia [1]. *Mycoplasma pneumoniae*, *chlamydia pneumoniae* are some other types of bacteria that cause pneumonia [2]. According to study one million children of 5 years old or below are suffering from death due to pneumonia. 90-95% of deaths are reported to occur in less developed countries. South Asia is one of those countries which have the highest rate of deaths of children due to pneumonia [3].

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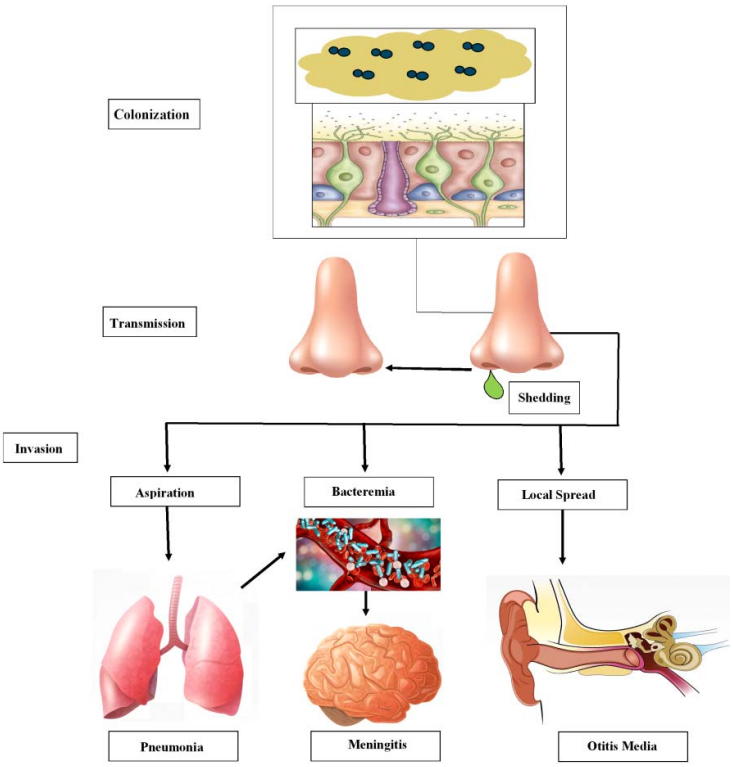

Fig. (2). Pneumonia pathogenesis.

SYMPTOMS

Common symptoms of pneumonia are:

- Cough with mucus
- Sore throat
- Chills
- Fever
- Pain in chest
- Fast breathing
- Shortness of breath

Symptoms of pneumonia can vary from mild to lethal. Further symptoms depend on the cause of the infection and its severity. Age and overall fitness of the individual also play a key role. As seen in Children, they don't have chest infection instead they suffer from high fever which becomes lethal and causes death. Similarly, older persons show different symptoms. In most cases, cold

followed by the fever of 104°F high and cough with mucus observed as initial symptoms of pneumonia [4].

Certain symptoms are relevant to the site of infection. For example, if air passages become infected cough with sputum is a predominant symptom. In some cases, the spongy tissue that contains the air sacs in the lungs is infected. In this situation, the lungs become stiff due to impaired blood oxygenation causes the difficulty in breathing. Pneumonia that depends on the causative bacterium has a slow onset of symptoms. A deteriorating cough, severe headaches, and pain in muscles may be the symptoms [5].

DIAGNOSIS

Pneumonia can be diagnosed by:

- Chest X-ray
- Blood test
- Sputum test
- Urine test
- Pulse oximetry
- Fluid sample test
- Bronchoscopy

Initially, a doctor hears abnormal, crackling sounds in the chest and then recommends a chest X-ray that confirms the infection. Pneumonia can be detected by sputum culture test, sputum samples observed under the microscope for identification of microorganisms. In some situations, the detection of pneumonia caused by *Legionella Pneumococcus* determines by urine tests. Blood tests reveal the immune response of the body to certain infections. (WBCs) white blood cells count through a blood test that often gives a clue about the severity and cause of pneumonia. Pulse oximetry is a method in which an oxygen sensor is positioned on 1 of the patient's fingers. It shows whether lungs properly move enough oxygen into the bloodstream. A urine test can detect *Streptococcus pneumoniae* and *Legionella pneumophila* bacteria [6].

If a doctor suspects liquid in the pleural space of the chest, the fluid sample test is done by taking fluid through a needle inserted between ribs. This test helps to detect the cause of infection.

Bronchoscopy test considers the air passages of lungs. This is done by using a camera attached at one end of a flexible, thin tube which introduced into the mouth/nose. It enables the doctor to examine the throat and lungs. Doctors do this

CHAPTER 3

Bacterial Tooth Decay: *Streptococcus mutans* is the Major Cause

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Abstract: Tooth decay is actually the destruction of the hard tissues of the tooth. This is caused by the acid attack due to the fermentation of carbohydrates due to bacterial attack by the bacterial species which colonize the mouth. *Streptococcus mutans* is the major cause of tooth decay. It occurs in different percentages in children of different ages. It is characterized by difficulty while eating, chewing, and even smiling. Clinical, radiographic, and technology-based methods are mainly used for the diagnosis of tooth decay.

Keywords: Bacterial Fermentation, Dental Decay, *Streptococcus mutans*.

INTRODUCTION

Tooth decay usually refers to the destruction of the dental hard tissues due to the acidic by-products which are produced due to the bacterial fermentation of the dietary carbohydrates. It is a chronic disease and it progresses slowly in most people. The surface of the tooth loses its tooth minerals due to the action of acids formed due to the bacteria after the ingestion of food which contains fermentable carbohydrates. When fermentable carbohydrates are taken in food and are eaten frequently they result in a decrease in pH and results in the loss of minerals from tooth [1].

CAUSES

The mouth is colonized by different types of bacterial species but few of them participate is dental decay. Dental decay is caused when solubilization of teeth occurs due to the accumulation of acid produced by certain types of bacteria in the mouth. Enterococci were the first bacteria that cause caries in gnotobiotic animals.

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Actinomycetes are also found in the human mouth and they cause caries in hamsters [2]. *Streptococcus mutans* are the major cause of tooth decay. The genome of *mutans* UA159 has completely sequenced and is composed of 2,030,936 base pairs. The analysis of genome study showed that it has adaptations for the oral environment. *S. mutans* effect by metabolizing a wide range of carbohydrates [1].

PREVALENCE

Dental caries occurs about 23% in children aged from 2-6 years and about 56% are children aged 6-8 years. The prevalence of tooth decay is higher for Hispanic which is about 44% and for non-Hispanic blacks, the percentage is 44% which is compared with the non-Hispanic white children is about 31%. Non-Hispanic Asian children are likely to have dental caries [3].

SYMPTOMS

The tooth decay which occurs due to bacterial infection shows many symptoms which are followed by the experience of pain in the mouth, swelling in gums, pain while eating food or chewing, and even while smiling. Such that patients would not be able to eat easily. Bleeding from gums may also occur.

DIAGNOSIS

Clinical Methods

Visual detection of caries is the method most commonly used for the diagnosis of tooth decay. This method involves the oral examination which includes the cleaning and drying of the teeth and also the use of the explorers and also the use of visualizers to detect the area of concern. This process also helps in the detection of the area of the breakdown of the tooth.

Radiographic Methods

X-rays could also be used in dental applications. More recent developments include the higher-speed film and also the digital radiography. There are digital imaging techniques that could generate the image of the tooth and also the area of a breakdown of the tooth. The images of the teeth are obtained by the use of conventional films.

Technology-Based Methods

There are many other methods use for the diagnosis of tooth decay. Digital imaging is also used to detect the tooth surface. Polarized incident light is also

used for diagnostic purposes. Fluorescence is also useful because of tooth fluoresce when exposed to ultraviolet rays [4].

MANAGEMENT

Fluoride is also effective in reducing the decay of the tooth. The major purpose of the use of fluoride is that dental caries is decreased. Fluoride is applied to the decaying part of the tooth.

The management of tooth decay involves the detection which follows checking the decay type and also the pathological changes. It also involves the monitoring of the lesion to determine whether the re-mineralization or the restoration treatment should be performed. Assessing each risk that is associated with tooth decay is also involved in the management. Last but not least monitoring of the follow-up patients periodically is also done [5].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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CHAPTER 4

Tuberculosis: A *Mycobacterium Tuberculosis* Infection

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Abstract: Tuberculosis is a bacterial disease caused by *Mycobacterium tuberculosis* and can adversely affect the lungs and other parts of the body. It can be easily transmitted and can even cause death if not treated on time. In a report by WHO 10.4 million people were infected with TB in 2016. People with a weakened immune system, poverty, malnutrition are more susceptible to this disease. Different skin TST and blood tests IGRAs followed by chest radiography are conducted for diagnosis and confirmation of this disease. Antibiotics such as isoniazid, rifampicin, or rifapentine are prescribed in case of infection. BCG vaccine is effective for infants and not recommended for adults.

Keywords: Antibiotics, IGRAs, *Mycobacterium tuberculosis*, Weakened Immune System, Persistent Cough.

INTRODUCTION

Tuberculosis (TB) is among the deadliest disease caused by bacterium *Mycobacterium tuberculosis,* which can affect many body parts (Extrapulmonary TB) like lymph nodes, bones, spine, kidneys, and larynx, but most commonly lungs (Pulmonary TB). It can easily be transmitted to healthy people by coughing and sneezing near them. Inhalation of droplet nuclei from coughing and sneezing, in the air, enters from the mouth or nasal openings, passing through upper respiratory tract and bronchi, reaches the alveoli of the lungs. It affects approximately 10 million people every year but with timely diagnosis and proper treatment, it can be cured. One in three persons is known to be infected with this disease. According to a WHO Global Tuberculosis Report 2017, Tb is ranked 9th in death-causing diseases worldwide, and 10.4 million people infected in 2016 (10% are HIV co-infected) [1]. HIV patients are more susceptible to this disease

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as compared to other risk factors, for example, malnutrition, age (in the context of a weak immune system of very young and very old ones), *etc.* 1n 2016, 374000 deaths were reported among HIV positive TB patients. Over the last ten years, significant progress has been made to reduce the infection and mortality rate. 35% and 20% reduction in mortality and TB incidence was reported as compared to the data of 2015 [2].

SYMPTOMS

When infection starts and no symptoms appear, it is latent TB and it is called active TB when its symptoms appear Fig. (**3**) [3].

- A persistent cough that lasts for more than three weeks
- Weight loss
- Tiredness
- Fatigue
- Swelling of neck
- Fever
- Loss of appetite
- Chills
- Night sweats
- Chest pain

RISK FACTORS

Weak Immune System

People infected with different diseases, for example, HIV, cancers and chemotherapy, diabetes, kidney disease, *etc.* have weakened immune systems and such people are at high risk to be infected with TB [4].

Poverty and Malnutrition

Poor living conditions, lack of proper medical facilities, and malnutrition are some factors that can put people at high risk of TB.

Living in Areas which are at High Risk of Tuberculosis

People living in Asia, Russia, Africa, Caribbean Island, and Eastern Europe are at very high risk to be infected with TB.

PREVENTION OF TRANSMISSION

Some prevention guidelines for transmission of tuberculosis are mentioned below:

- Cover mouth and nose while coughing and sneezing.
- Washing of hands after coughing and sneezing.
- Isolation from office, schools, or workplaces.
- Less contact with unaffected people.

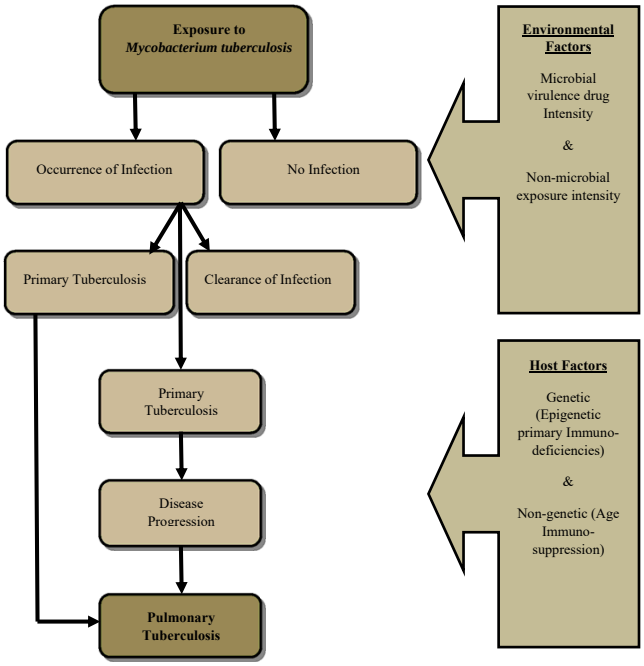

Fig. (3). Tuberculosis pathogenesis and factors affecting different phases of pathogenesis.

DIAGNOSIS

Different tests are used to diagnose TB and few of them are mentioned below:

Tuberculin Skin Test

TST is also known as Mantoux Test and most commonly used for latent TB [5]. In this test, a specific amount of PPD Tuberculin is injected into the skin of an arm. The red small and hard bump will appear on the spot of injection within 2 to 3 days if a person is infected with this disease due to sensitivity to PPD tuberculin [6]. If the prevalence of TB is high at that time, then the positive predictive value of the test will also be high. Incase to repeat the test, perform on another arm. This test is now considered outdated because of less specificity and sensitivity. In the case of Bacillus Calmette Guerin (BCG) vaccination skin will show mild response to the Mantoux test.

CHAPTER 5

Leptospirosis: An Infection Which Leads to Kidney & Liver Damage

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Abstract: Leptospirosis is a bacterial disease caused by *Leptospira interrogans* which affects humans as well as animals. It can be transmitted from animals to humans in different ways. Global mortality and morbidity data indicate that of almost 1 million cases nearly 60,000 die each year. The agent responsible for this disease is common in tropical regions and the most suitable time for its growth is summer. People working with animals are more likely to contract this disease. It involves some flu-like symptoms: fever, diarrhea, cough, and severe pain. It can also damage the liver and kidneys and can also be fatal. Several methods have been devised for its diagnosis and mostly used methods are gene-based and serological. The main treatment of this disease is the use of antibiotics or a mix of antibiotics depending upon the status of the disease. Prevention from this disease is important as it can even cause death.

Key Words: Antibiotics, Kidney & Liver damage, Leptospirosis, *Leptospira interrogans*.

INTRODUCTION

Leptospirosis is a widely spread anthropozoonotic disease (a disease that can be transferred from animals to humans) mainly caused through a bacterium *Leptospira interrogans* [1]. Leptospires belong to phylum spirochetes. They are of two types: Saprophytes (non-pathogenic) and Pathogenic leptospires. These pathogenic leptospires are responsible for causing an infection known as Leptospirosis [2]. The natural host for leptospires are mammals, and they live in the proximal renal tubes of the host's kidney [3]. When these hosts urinate, then they are excreted out along with urine and can survive up to several months depending upon the environmental conditions. The urine of the infected mammals can contaminate soil, standing water, rivers, and streams. Humans always acquire

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Leptospirosis from other animals like rats, pigs, dogs, and cattle, *etc.* by the direct interaction with these animals, from their excreted urine, from the environment in which they excrete their waste, *etc* [4]. This bacterium enters into the human body through open or wounded skin and mucosal membranes and if not treated may result in kidney and liver failure, meningitis, respiratory distress, and even fatal. Commonly, Leptospirosis is a disease of rural areas, but now even severe cases have reported in urban areas [5].

GLOBAL MORBIDITY AND MORTALITY

It was estimated in 2015 that yearly there were 1.03 million cases of Leptospirosis and about 58,900 patients died per annum because of this lethal infection. Mostly tropical regions had the highest morbidity and mortality rate around the world, *i.e.* countries located between the tropical regions of Cancer and Capricorn had about 73% of the incident and death rate. Men with 20-29 years age had the highest incident rate which was about 35.27/100,000, while men with 50-59 years age had the highest death rate, *i.e.* 2.89/100,000. Most of the morbidity and mortality cases of Leptospirosis were from the South and Southeast Asia, East Sub-Saharan Africa, Andean, Oceania, Central, and Tropical Latin America and the Caribbean [6].

Etiology

Several threats are linked with the occurrence of Leptospirosis. Depending upon the environmental conditions leptospires can be present anywhere.

Geographical Location

It is the most important factor as the highest morbidity and mortality rates were found in tropical regions. So, people living in those areas have the highest chances of developing Leptospirosis. Some other countries like South and Southeast Asia, East Sub-Saharan Africa, Andean, Oceania, Central, and Tropical Latin America and the Caribbean have the highest incidence and death rates [6].

Temperature

Temperature also decides the presence and absence of this infectious bacterium *Leptospira interrogans.* The most suitable temperature for the survival of this bacterium is summer in a rainy season. After rainfall, the standing water is the best habitat for this bacterium to survive [7].

Professional Activities

Professional activities can also become a risk factor if an individual is working in

a place where he/she is in direct contact with the animals. As animals are the highest reservoirs of this bacterium so working with animals can end you having Leptospirosis. Dairy farmers, abattoir workers, veterinary employees, *etc.* are at the highest risk of developing Leptospirosis because they can acquire this disease after animal biting, contact with contaminated urine, contact with animal blood, and during the time of milking. Also, those individuals who have the chances of contact with rodents are at high risk like miners, rodent controllers, foresters, workers in a sewer system, hunters, fish farm workers, soldiers, *etc.*

Pet Animals

Having pets like dogs, cats can also act as a risk factor for developing Leptospirosis Fig. (**4**). Although the risk is not as higher in cats as with other mammals like dogs, but still they are capable of causing Leptospirosis. The level of risk also depends upon the sanitary conditions of the pets and their separation from possible sources of Leptospires.

Wounded Skin

Open or wounded skin can also make you vulnerable to Leptospires. The normal route of entry of this bacterium is through the wounded or cracked skin. So, wounded or punctured skin increases the chances of the entry of the pathogen into the body resulting in infection [8].

SYMPTOMS OF LEPTOSPIROSIS

There are several symptoms associated with Leptospirosis. Most of its symptoms match flu, which is the reason that sometimes it is misunderstood as flu. There are two stages of Leptospirosis:

The First Stage is known as an acute stage. It is also called as Septicemia. Its duration is about 3-10 days. Symptoms associated with this stage are:

- High Fever
- Myalgia (muscle aches)
- Diarrhea
- Cough
- Abdominal Pain
- Headache
- Nausea and Vomiting
- Chills
- Skin Rashes
- Redness of Eyes

CHAPTER 6

Syphilis: A Disease Which Spreads Through Sexual Contact

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Abstract: Syphilis is an infectious disease caused by a bacterial strain named as *Treponema pallidum* and is spread through sexual contacts with the infected person, blood transfusion, and sharing of syringes with the infected person. The symptoms of this disease include an outgrowth on the skin, dizziness, skin rashes, irritation, and even stroke in severe cases. This disease is diagnosed both by using non-Treponema tests and by specific-Treponema tests. Culturing of the sample taken from the rash or outgrowth is also very helpful to diagnose the presence of infectious entities. It is a curable disease and is easily cured by a short term course of antibiotics. Another method to cure this disease is the use of penicillin injection after the regular interval of time. This chapter summarized the causing agent, symptoms, commonly used diagnostic tests and management strategies to cure this disease.

Keywords: Cure, Rapid Syphilis Test, Rapid Plasma Reagin Test, Syphilis, *Treponema pallidum*, Symptoms.

INTRODUCTION

Syphilis is an infectious disease that is transmitted by sexual contacts to an infected person. This disease is caused by the bacteria named *Treponema pallidum.* Syphilis is spread by sexual contacts with the infected person, by blood transfusion, by sharing injections and also transmitted from an infected mother to the child during pregnancy. By sharing clothes, bathrooms, cutlery with the diseased person there is no chance to be infected. In 2006 roundabout 9.7 million small children less than 5 years old and almost 4 million neonatal Childs were died off due to this disease in developing countries. There is 3.2 million infected childbirth globally, which includes more than 90% of children belong to developing countries. In Africa there is an estimate that 2.7% of pregnant women are infected with this disease indicates that round about 900,000 pregnancies at ri-

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sk each year. Syphilis in the pregnancy become a serious global health burden with adverse outcomes, for example, infant mortality. Approximately 3.6 million Childs are affected due to infected or diseased mothers each year.

The medical cost for this disease is about 309 million dollars [1]. According to the world health organization, approximately 700,000-1.5 million people with this disease were reported in 2004. Roundabout 45-70% of the infected person catches this disease from the infected mother. This disease causes 420,000-600,000 death out of which 40% includes stillbirth and 20% includes neonatal deaths [2]. WHO estimates that 2 million women are infected due to syphilis annually, most of the carrier pregnant women belonged to low/middle income countries. Roundabout 69% of untreated pregnant women show severe pregnancy outcomes such as stillbirth results in about 25% cases, neonatal death results in about 11% cases, infected childbirth results in 20% cases, and low birth-weight childbirth results in 13% cases [3]. According to the CDC report related to STD, there were only 5979 syphilis cases reported in the U.S out of which 59% were male and 41% female victims. The gradual increase in cases day by day, including 8724 cases in 2005, 13774 cases in 2010, and 19999 in 2014 out of which 91% were male and only 9% were female in the USA.

SYMPTOMS

Syphilis is divided into three categories based on their symptoms named primary syphilis, secondary syphilis, and tertiary syphilis. The first symptoms of syphilis appeared after 10 days-3 weeks of infection. The most common symptoms of primary syphilis include the painless sore that appears on the point at which an infectious entity is transmitted usually on the vagina and penis. That sore disappeared in about 2-6 weeks after infection. If the infection remains untreated then it causes the secondary stage of syphilis. Symptoms of secondary syphilis start after few weeks of the disappearance of sore and these include a non-itchy rash of the skin, tiredness, joint pains, headaches, fever, small skin outgrowths on the vulva in the woman's case and around the anus in the case of both men and women, hair loss, swollen lymph glands, and weight loss. These symptoms also disappear after a few weeks, or in months. Without any treatment, syphilis becomes 'latent' and no symptoms appear at all, but the infection is there. This stage could be happened for years in some cases even for decades and known as tertiary syphilis. Common symptoms of syphilis include dementia, paralysis, heart diseases, loss of coordination, deafness, stroke, blindness, numbness and skin rashes, *etc.* Tertiary syphilis also causes death in some cases so it is important to go to the healthcare center and properly examined by the professionals.

DIAGNOSIS

To diagnose syphilis first basic way is the physical examination by a doctor or nurse who will ask to examine genitals in case of male and inside the vagina in the case of women and a physical examination of other parts of the body to check for growths or rashes on the skin may be caused due to syphilis. Another way is to test blood which shows that either infectious agent of this disease is present in the body or not, either this disease present in the past or not. Blood test for a few weeks is done at regular intervals then accurate results could be obtained. Another way to check out the presence of syphilis is the swab test for which a swab is used to take a sample of fluid from any sores and after culturing of this sample it can be checked either syphilis causing agents are present or not. Syphilis is an important health issue in mostly low-income countries because these have limited or no capacity for testing and mostly rely on the non- specific Treponema test. According to the recent development of a new rapid Treponema, tests can increase the screening process where traditional tests are not available due to any reason. According to recent studies ICS syphilis tests which is a newly developed test have high sensitivity of about 0·86 median and 0.75-0.94 interquartile range. This test also has a higher specificity as compared to the non-specific Treponema test. And further research evaluating the ICS tests, in primary syphilis cases and among the patients infected with HIV is also effective in syphilis screening programs. ICS syphilis tests are easy to perform, economic in range, and there is no need to be refrigerated and no need to highly trained laboratory professionals for carrying out the test [4]. Another study highlights the importance of a point-of-care syphilis test which has high accuracy, simple to use and has the potential to increase the coverage of antenatal screening. This study also suggests that the use of ICS tests for antenatal screening of syphilis disease is highly cost-effective in low-income countries such as Africa with a reduction in disability-adjusted life years [5]. An assessment by Bonawitz suggests that recently developed rapid syphilis tests commonly abbreviated as RST have a high sensitivity of about 85.7%-100% and specificity of about 96%-100% and these tests do not require the traditional laboratory infrastructure that is usually required to carry out rapid plasma regain test commonly abbreviated as RPR test [6]. Another study by Owusu-Edusei of 1000 pregnant women in the population having a high prevalence of syphilis disease was done. He develops a model which is based on the comparison between health and economic outcomes of traditional tests for the detection of syphilis such as rapid plasma regain anti- *Treponema pallidum* assay abbreviated as RPRTPHA and new tests such as dual point of care commonly known as dual-POC and ICS. He found out that ICS testing was the most cost-effective strategy after the dual-POC strategy [7]. Kuznik's study suggests that immune-chromatographic point-of-care tests are time-saving, reliable, simple to perform, inexpensive, and economically suitable for antenatal care settings [8]. A

CHAPTER 7

Leprosy: An Infection Which Leads Characterized by Granulomata

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Abstract: Leprosy is actually a disease that is said to be chronic and it is caused by a mycobacterium *Bacillus leprae*. It is related to physical or mental disablement and mainly it affects eyes, skin, peripheral nerves, and various organs. It is endemic to various domains of the world. Lesions appear on the body and the peripheral nerves become thick and tough which are the main symptoms of the disease. Thus, it can be diagnosed by performing a smear test or by a biopsy experiment. First-line drugs, second-line drugs, and various vaccines are available for the treatment of leprosy.

Keywords: *Bacillus leprae*, First-Line Drug, Leprosy, Peripheral Nerves, Smear Test.

INTRODUCTION

Leprosy or Hansen disease is a constant disease that is characterized by granulomata and the causal agent behind this disease is mycobacterium *Bacillus leprae*. A Norwegian physician named Gerhard Henrik Armauer Hansen identified this mycobacterium in the 19th century [1]. Leprosy is related to physical or mental unfitness. It mainly affects the skin and the nerves lying outside the brain and the spinal cord (peripheral nerves) and to this time indigenous in different domains of the world. Clinical demonstration of the disease relies upon the condition of the immune system of the patient during transmission and throughout the disease [2].

Leprosy programs that were enforced from 2006 to 2010 at the national levels had a positive outcome as they met up with the WHO's aim for the areas where leprosy is indigenous [3]. The written report of the prevalence of leprosy of about

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212802 cases was given `in 2008. “Final push strategy” was given by the WHO in the early 1990s for leprosy having the open objective of elimination.

Countries like Mozambique and the Democratic Republic of the Congo reached the goal given by WHO, but many parts of the world remained highly prevalent by the disease [4].

SIGNS AND SYMPTOMS

The Peripheral nervous system is at first targeted by the *Bacillus leprae* which further leads to the huge range of clinical reflections that describe this infection from the mycobacterium. Peripheral nerves relating to the skin may be affected by lesions, mainly the medial, posterior tibial, lateral peroneal, and cubital nerves [5]. A perineural osteofibrosis response is a buildup that is not much deep, making the nerves capable of being perceived by the senses or mind at the time of physical examination. This nerve involvement gives rise to pain, thickening, and motor and sensory disablement [6]. Thickening of the outer or peripheral nerves is also there in many other diseases like primary amyloidosis and some other inheritable diseases (*e.g.*, Refsum diseases and Charcot-Marie-Tooth disease). Therefore there must be some kind of differential diagnosis. In most of the 95% of cases, it affects the musculoskeletal system [7] and [8]. Osteoporosis is the most significant and the second most usual sign observed in leprosy patients [9].

DIAGNOSIS

In 1997, WHO’s proficient Committee on Leprosy set out the 3 fundamental signs based on which the disease is diagnosed clinically [2] and [10]. When a person who has not accomplished a course of medical care has one or more of these under mentioned signs, then the diagnosis is made.

These signs are:

1. The presence of a hypopigmented lesion on the skin
2. A tough or calloused peripheral nerve
3. A positive skin spot or presence of bacilli which have been discovered in a biopsy.

In case, all of these three signs are present in a person, then the symptomatic sensitivity has been said to be as serious as 97% [10]. The Smear test is performed mostly to diagnose the patients having the disease. This test is 100% specific and has 50% of the sensitivity. A smear is usually taken from an ear lobe, nasal mucosa, and/or from skin wounds [11, 12]. The stain that is used to make the mycobacterium visible is normally Ziehl-Neelsen stain. To interpret the results of

the smear test, bacterial index or Ridley's logarithmic scale are used, which are registered as a number that comes after a plus sign to show the level of scarcity or richness of bacteria for each field.

MANAGEMENT

Leprosy is a risk to health worldwide. Its removal is feasible, as this contagious disease is one of those few diseases that meet definite but not specified or confined requirements for eradication. It can be spread by affected but untreated persons and thus can be diagnosed by using simple tools. Furthermore, impressive therapy is also present and once predominance falls below a specific point in a population, the probability of revival is not proximate. Eventually, contrary to tuberculosis, the infection got by leprosy does n't seem to be affected by HIV (human immunodeficiency virus) infection negatively. Thalidomide is the drug of choice, but sometimes clofazimine or prednisone can be recommended. In the early stages, the dosage for Thalidomide is 100 to 200mg/d, the remedy has perfectly retreated after three to four weeks [13, 14]. WHO presented multidrug therapy with clofazimine, dapsone, and rifampicin with the aim of first-line treatment in 1981. All of the patients must receive this drug under some proper supervision monthly. Clarithromycin, ofloxacin, and minocycline are among those drugs which have been used with the aim of second-line treatments. However, the duration of this treatment is long and shows logistical difficulties.

First-line Drugs

In first-line drugs, Rifampicin, which has been taken from Streptomyces fungi, has antibacterial action which is based on its ability to inhibit the synthesis of RNA. Quality of being poisonous to liver cells, vomiting, nausea, inflammation on the skin, and fever is this drug's major adverse effects. Clofazimine has low antibacterial activity. Although it is recognized to bind DNA, the mechanism of action of this drug is still not well understood. Clofazimine is related to the changes in colouring of the skin [15]. On the other hand, second-line drugs have been reported as highly active ones, but they bear high costs which prohibit employing them as the highest preference treatments.

Vaccines

Different vaccines have been proven efficient to one extent or another in some of the countries where leprosy has been reported as indigenous. The preventive consequence of a vaccine for leprosy is gained by adjusting the immune system in opposition to common mycobacterial antigens. The Convit vaccine was brought into existence in 1992, which is BCG (Bacillus Calmette-Guérin) in combination with Mycobacterium ICRC and M leprae. Other vaccines are based upon

CHAPTER 8

Burn Infection: *Pseudomonas Aeruginosa* and *Staphylococcus Aureus* are the Major Pathogens

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Abstract: A burn is an injury to skin or tissues of the body caused by heat, electricity, cold, chemicals, and radiation. *Pseudomonas aeruginosa* (gram-negative bacteria) and methicillin-resistant *Staphylococcus aureus* (gram-positive bacteria) cause burn infections in humans. Burn causes breathing problems and redness of the skin, damage to blood vessels causes' skin to become black or brown with no blisters. Burn can be diagnosed by examination, depth of a wound, or its associated infections. In developed countries "treatment" cannot be difficult as much as in underdeveloped countries. This is because of lack of awareness or poor income in underdeveloped countries they depend on traditional treatment which left scars of a wound.

Key Words: Burn, Blisters, Injury.

INTRODUCTION

A burn is an injury to skin or tissues of the body caused by heat, electricity, cold, chemicals, and radiation. *Pseudomonas aeruginosa* (gram-negative bacteria) and methicillin-resistant *Staphylococcus aureus* (gram-positive bacteria) cause burn infections in humans. The risk of burn in females is more than that of a male because women can use cooking stoves or open cooking fires daily. While in males the risk of burn is less but it is present as in the form of alcoholism and smoking which is common in males. Burn occurs as a result of violence or self-harm. In the USA the common causes of burn are given as burn from the chemical is 3%, burn from electricity is 4%, burns due to scalding are 33%, burn from fire is 44%. Most of the injuries caused by the burn which 69% is at home. 2% assaulted burn injuries can be reported in the USA [1]. 1-2% burn injuries reported due to the suicide attempt which comes in the category of self-harm [2].

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Smoking causes 25% of burns in the USA or heating device here causes a 22% burn. The electrical burn causes a 60% burn in children.

SYMPTOMS AND TYPES

There are three types of burns. It exists upon which layer of your skin can be damaged by burn either it can be epidermis (the outer layer of skin), dermis (layer of tissue just beneath the skin), subcutis (deeper layer containing fat or tissue) superficial epidermal burn (epidermis is damage) or dermal burn epidermis or part of dermis damage), Partial-thickness burns (dermis and epidermis damaged), full-thickness burn all three layers of skin damaged epidermis, dermis or subcutis. Burn causes bacterial infection or increases the risk of sepsis. Burns damage blood vessels making low blood volume. Burn some time happens to cause breathing problems due to the smoke of the fire. Burn causes bone or joint problems due to the shortening or tightening of skin or muscle tendons. Burns causes the skin to be red, pale pink, dry blotchy, moist, swollen, and blistered, the texture of the skin can be leathery or waxy, brown or black with no blisters.

TREATMENT

Take away the person from the heat source. Immediately cool down the burn area with lukewarm water, ice water can note be used. Remove the greasy substances from the burn area. Remove the clothes or the jewelry from the burnt area of skin. Use a blanket to make the body warm but not rub that area of the body by using cling films to cover the area of the burn. For hand, burns plastic bags can be used. If the face or eye area is burnt then, to reduce swelling, a person should sit up instead of lying down.

PREVENTION

Keep the children away from the kitchen. Keep children away from hot drinks. Handle electrical appliances or instruments with CARE. Use chemicals with his/her proper care. Matches lighters or candles should be out of the reach of children.

DIAGNOSIS

Burn can be diagnosed by examination. First, we check its source either it is heat burn or chemical burn. Then we check its depth on how deep it is and see how much area is affected. Burn depth can be examined through biopsy. It can be difficult to find the accurate depth of a burn. In the case of the fire-related burn which causes “dizziness or headache,” these are symptoms that can be treated by carbon monoxide poisoning or cyanide poisoning. Estimation of the damaged part

of burn can be done by Lund or Browder charts which account for or perform various proportions of body parts determine. It can be divided into the minor, major moderate burn. Minor burn treated at home. Moderate burn treated at hospitals. Major burn treated in a burn center Fig. (**5**).

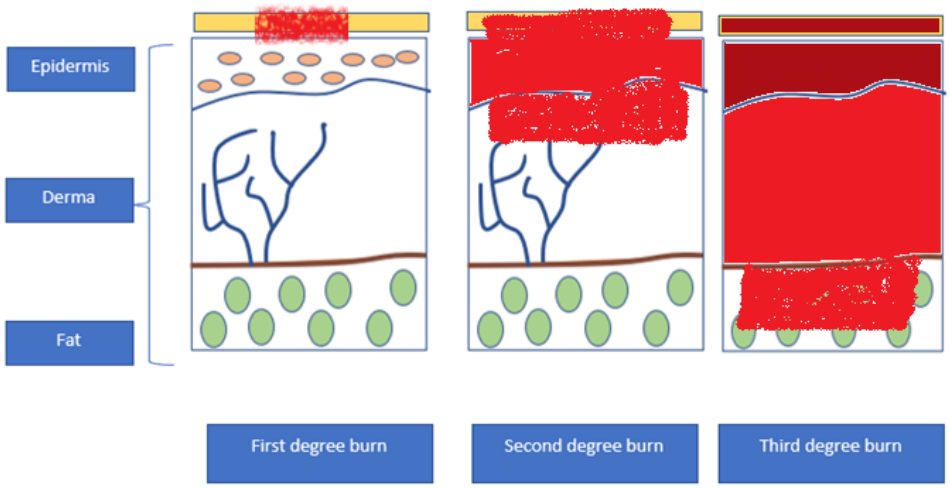

Fig. (5). Degree of burns.

MANAGEMENT

Treated patient with stabilization of airway, circulation, and breathing. Intubation is necessary if inhalation injury is expected and is followed by self-care of the burn wound. Treatment of burn wounds can be through medication surgery and self-care.

Medication

Medication can be through intravenous and oral. Analgesics can be used such as acetaminophen and also opioids can be used to treat burns patients like morphine. Burns are painful sometimes different pain killers were given to relieve the pain.

Surgery

We can do surgery to immediately treat a burn scar. We can do escharotomy to treat the skin of limbs or chest. In the case of electrical burns, fasciotomies can be required.

CHAPTER 9

Gas Gangrene: *Clostridial Myonecrosis*

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Abstract: Gas gangrene is a life-threatening disease which is caused by anaerobic bacteria. Most commonly the infection is a result of any kind of injury or wound. Bacteria grow in the wounded area when an individual does not take care of his wound. Different tests are available for the diagnosis of gangrene infection including a blood test or imaging tests. Treatment can be possible either through antibiotics or surgery. Hyperbaric oxygen therapy considered a lifesaving therapy as it increases the survival rate. Prevention is better in case of infection rather than cure after infection.

Keywords: Anaerobic Bacteria, Gangrene, Infection.

INTRODUCTION

Gas gangrene another term used for *clostridial myonecrosis* caused by a bacteria *Clostridium* perfringens. C. perfringens is an aerobic, spore-forming gram-positive bacteria that resides in the intestine of humans as well as in animals, but is commonly found in soil [1]. Myonecrosis is a state of tissue damage while gangrene means dead tissues. During the infection, a gas is produced in these dead or damaged tissues. Gas gangrene is divided into three main categories; post-traumatic, post-operative, and spontaneous type [2]. The third one that is a spontaneous type that is caused by *C. perfringens* has a high mortality rate [3]. The spontaneous myonecrosis mostly occurs in patients of diabetes [4]. Not only *Clostridium* perfringens cause myonecrosis infection but also there are certain other strains of bacteria like *Clostridium* septicum, *Clostridium* novyi, *Clostridium* bifermentans, *Clostridium* fallax, and *Clostridium* histolyticum. Among these *C. perfringens*, *C. navy* and *C. septicum* infections are most common [5].

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CAUSES OF GAS GANGRENE

Some of the main causes of gas gangrene are as follows;

A Limited Supply of Blood

Sometimes due to clogged, shrunk, or restricted blood vessels, blood cannot reach the specific tissues and the result is tissue damage at that particular site. This is one of the major causes of this infection.

Trauma

Tissue damage due to wounds or injuries that are a result of serious injuries like severe accident or gunshot. Sometimes bacteria raid in the tissues and cause infection which turns to myonecrosis.

Infection

When bacteria successfully colonize at a specific part or tissue they start damaging tissues and the ultimate result is infection.

Some other factors which contribute to infection are excessive use of tobacco, obesity, use of illegal drugs, immunosuppression, and also some diseases like diabetes and liver cirrhosis.

PREVENTION

Some of the measures can help in the prevention of infection and these are:

- Take care of your diabetes and examine your hands and feet regularly.
- Prevent smoking.
- Control your obesity.
- In case of wounds try to keep them clean.

PREVALENCE

The mortality rate of myonecrosis infection is about 20-30% but it can be increased up to 50-80% depending on how much infection spreads.

DIAGNOSIS

Early diagnosis of the infection is a very difficult task. Early signs of *C. perfringens* infection include sudden changes in a wound, fever, and accumulation of fluid under the skin or wound area, and sometimes changes in mental health

conditions [6].

Blood Test

If the level of WBCs in the blood is elevated abnormally then there are chances of the presence of these bacteria.

Surgery

Surgery of the infection determines how much infection spreads in the body of the patient.

Tissue Culturing

Fluids or tissues are taken from the site of infection as a sample and culture in the labs to see the presence of bacteria.

Imaging Test

Certain imaging tests like MRI, CT-scan, and X-rays can also be used to see the presence of gas in the tissues.

MANAGEMENT

Damaged tissues cannot be saved, but some measurements can be used to treat the disease, and doctors suggest one of these depending on the extent of infection.

Surgery

During the surgery, dead tissues are removed to prevent the spread of infection. More than one surgeries re-performed.

Antibiotics

Intravenous or oral antibiotics are given. Penicillin most commonly used in *C. perfringens* infection [7].

Hyperbaric Oxygen Therapy

Besides surgery and antibiotics, hyperbaric oxygen therapy can also be performed to treat gangrene infection. This therapy reduces the mortality rate [8]. During this therapy the patient is situated in a camber; especially design for this and pasteurized with pure oxygen. The treatment lasts for about 60-90 minutes and the patient needs about 2-3 treatments daily.

CHAPTER 10

Spontaneous Bacterial Peritonitis: Accumulation of Fluids in the Abdomen in Abnormal Way

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Abstract: Spontaneous bacterial peritonitis is a disease that is associated with other types of disorders. It occurs due to the storage of fluids in the abdomen in an abnormal way as well as in the absence of abscess such as intra-abdominal inflammatory focus. Various types of bacteria are involved in this infection these may be both aerobic and anaerobic as well as gram-negative and gram-positive bacteria *e.g.* klebsiella, pneumonia, and some species of streptococcus pneumonia. People suffering from heart diseases and liver disorders have more chances of this disease. About 20% of the patients die due to this disease.

Keywords: Klebsiella, Pneumonia.

INTRODUCTION

Spontaneous bacterial peritonitis also abbreviated as (SBP) can be defined as a severe infection of ascites that is the accumulation of fluids in the abdomen in an abnormal way. The most obvious cause of SBP is anaerobic gram-negative bacteria of which 50% species were of Klebsiella pneumoniae. 75%of SBP is caused by gram-negative bacteria and 25% are caused by gram-positive bacteria including Streptococcus pneumoniae or viridans. SBP occurs in children as well as in adults mostly in the children of 5 years old [1]. Chances of this disease become more obvious in the patients who suffered from cirrhosis (a disease in which liver cannot work properly because of long-term disturbance of liver as normal liver tissues are replaced with the scar tissues) it can also occur as a complication of any disorder that causes accumulation of ascitic fluid these disorders are liver disease, budd- chiari syndrome, congestive heart failure, renal failure, and cancer. About 10% to 25% of the people having such disorders have more chances of SBP of which 20% have the chances of death. It can also occur

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due to the absence of visceral perforation and intra-abdominal inflammatory focus *e.g.* abscess.

SYMPTOMS

Patients suffering from SBP have a severe history of medical deterioration. Major symptoms of SBP that occur in the majority of patients are chills, abdominal pain fever, diarrhea, paralytic ileus, and changed mental status (new-onset encephalopathy). On examination, some patients also have tender abdomen [2]. The most common symptom is a fever that proves as a clinically beneficial symptom as the temperature of the body increases in the condition of cirrhosis. In some cases, SBP may occur without any symptoms and can be incidentally found.

Most of the patients suffer from fever which is the most obvious symptom of spontaneous bacterial peritonitis. Thus patients can be easily identified.

CAUSES

Some causes of spontaneous bacterial peritonitis are various types of disorders related to heart, brain, kidney increase in the number of poly morpho-nuclear leukocytes (PML). If these PML increases more than 250 cells/μ the risk factor increases by up to 93%.

BACTERIAL TRANSLOCATION

In some cases, SBP results due to translocation of bacteria from the gut which increases the risk of changes in the gut flora and also causes resistance in the functions of gut flora. This increases the risk factors of SBP. It is also stated that these bacteria cause SBP to come from the intestinal lumen.

Some other causes of SBP:

- Heart disorders
- Kidney failure
- Cirrhosis
- Cancer
- Budd chiari syndrome.

People suffering from these diseases have more chances of SBP.

MANAGEMENT AND CONTROL

The fluid of the peritoneum is analyzed by counting the cells, by checking the lactate level, by measuring pH level. All the patients who are suspected of SBP

should be examined properly this can also be treated by removal of the fluid from the peritoneum by using catheters. Ultrasonography is also used in patients who have mild effects of SBP. Cultures of blood and urine are also collected from the patients who determine the infection site. All these measures should be taken before starting antibiotic therapy.

Some cirrhotic patients with SBP and either a serum creatinine greater than 1mg/dL, a blood urea nitrogen (BUN) greater than 30mg/dL, or total bilirubin greater than 4mg/dL should be given adjunctive (*i.e.* , in addition to antibiotics) albumin intravenously. This has been shown to reduce both in-hospital mortality and renal damage when compared to the use of antibiotic therapy alone.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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CHAPTER 11

Relapsing Fever: Transmitted by Ticks and Lice

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Abstract: Relapsing fever has been a major epidemic disease in Europe and Africa. It is transmitted by tick or louse and has two types, LBRF and TBRF. Patients have repeated episodes of fever and other symptoms. The cause of infection is Borrelia species of bacteria. It is treated by antibiotics and single doses are preferred over multiple doses because multiple doses are difficult to implement.

Keywords: Borrelia Species, Control, Episodes of Fever, Treatment, Types of Relapsing Fevers.

INTRODUCTION

Relapsing fever has been one of the major epidemic diseases because of its significant impact on Livingstone throughout Europe and Africa. The clinical cases of this disease were first used to describe in Edinburgh. It is a kind of infection transmitted by louse or tick. The patient has recurring fever episodes and other nonspecific symptoms *e.g.* headaches, joint aches, muscle aches, nausea, stiff neck, shaking chills, seizure, and coma. The infection caused by borrelia species causes the illness. The Borrelia species have different surface antigens leading to repeated spirochaetosis and thus the immune system is stimulated by each new antigen and the febrile response is given by the patient [1].

TYPES AND CAUSES OF RELAPSING FEVER

There are two types of relapsing fever.

- TBRF (tick-borne relapsing fever) it is transmitted by *Ornithodoros tick*. These are the bacterial species that causes the TBRF is *Borrelia duttoni*, *Borrelia hermsii*, *Borrelia parkerii*. This kind of relapsing fever usually occurs in Spain, Asia, Saudi Arabia, and in some specific areas of the United States.

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- LBRF (louse-borne relapsing fever) is transferred from body lice and is associated with *Borrelia recurrentis*. This disease is present in Asia, Africa, and South America. Now by improving the living standards of a human being caused a reduction of body lice which is the vector for *Borrelia recurrentis* (louse-borne relapsing fever) [2]. The tick-borne relapsing fever is caused by spirochete *Borrelia crocidura.* This pathogen is transferred by the tick *Ornithodoros sonrai* formerly *Alectorobius sonrai.* This tick is an ectoparasite, it used to live in insectivores and rodents.

EFFECTS AND SYMPTOMS

This disease affects people during their sleep because the hosts make burrows in the bedrooms. This disease can cause illness in people. If this disease is not treated people could have this fever for months and many complications of severe meningoencephalitis can occur [3]. In tick-borne relapsing fever, the patient has recurring episodes of fever which may last up to 3 days. Then the patient does not have the fever up to 2 weeks, and then it returns. In louse-borne relapsing fever, the fever occurs and remains for 3 to 6 days this is usually the only and milder episode of fever. The fever in both forms of relapsing fever ends in trouble. This can be fatal and can lead to death when there are shaking chills, low blood pressure, sweating, and falling body temperature. Relapsing fever is usually the infection of blood but it can also affect the eyes and nervous system. After clinical examinations and treatments of relapsing fever of humans, the results showed that *Borrelia turicatae* and *Borrelia duttonii* which are the agents of tick-borne relapsing fever can cause involvement in the nervous system. Lymphocytic meningitis and facial palsy frequent occurrence in the brain and other tissues of the nervous system of humans and the brain infections persistence even after treatment with antibiotics that do not penetrate the blood-brain barrier, it proves the above logic [4].

TREATMENT

Antibiotics are used for the treatment of relapsing fevers. The single dose of antibiotics is preferred over multiple doses which are difficult to implement. Antibiotics that can be used for treatment could be penicillin, tetracyclines, ampicillin, and erythromycin [5]. In adults, patients having louse-borne relapsing fever single dose of tetracycline 500 mg, while doxycycline 200 mg is given. In case if tetracyclines are in counter position than 500 mg erythromycin is given.

POSSIBILITY OF CONTROL

The relapsing fever has been reducing from global infection to a very small region so it might lead to speculation that we could eradicate this disease. For this, we

need to understand the interactions of spirochete with its host and vectors. It can be possible that spirochete is adapted to transmission of a louse from tick-borne *B. duttonii,* it can also be possible that ticks are the reason for the transfer of *B. recurrentis*. The cloth lice are eliminated significantly but the headlice is still present. Headlice is still a major problem worldwide. The ability of these spirochetes to persevere within immunologically protected niches *e.g.* brain could serve as a source for revival of infection [6].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

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CHAPTER 12

Rat-bite Fever: *Streptobacillus Moniliformis* and *Spirillum Minus* Infection

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Abstract: Rat-bite fever is a zoonotic infection that is caused by these two bacteria *Streptobacillus moniliformis* and *Spirillum minus*. These two bacteria cause similar but distinct infections, that are transmitted through rats bite, mucous or other feces. It is a rare disease and practices are uncommon on this infection it can be fatal if not treated on time. It is transmitted through rat's feces, mucous of rat mouth, nose or may be transmitted through contaminated products with rats. Patients undergo fever, rashes, joint pain due to infection. Moniliform bacteria cause Arthritis. As, there is no vaccine available for Rat-bite fever, practices on development for infection treatment are on the way. Antibiotics and Antiallergens are available to cure rashes and infection. This infection can cause syndromes, so treatment on time and preventive measurement are necessary.

Keywords: Human Infections, Rat-Bite Fever, *Streptobacillus moniliformis*, *Spirillum minus*.

INTRODUCTION

It is a disease caused by two bacteria *Streptobacillus moniliformis* and *Spirillum minus* transmitted by rats. Humans infected with this disease through rats. It can be transmitted through food that humans eat and contaminated with infectious rat secretions from mouth, eyes, and nose. Other animals that are exposed to contaminated things or infectious mucous may be disease transfer to humans. Other carriers of this disease are pet animals such as cats and dogs that can infect humans when exposed to infectious rats [1].

But this disease is more spread by the bite of a rat than other contaminated things. In history, this disease attacked only lab-workers that do experiments on rats by a bite or to peoples who are living miserable lifestyle. But, over time when people

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take rat as pet animal rats start attacking children and they get infected more by this disease [2].

It has different alternative names such as epidemic arthritic erythema, streptobacillary, spirally fever based on its symptoms, or bacteria that infect. In Asia infection is more spread by *Spirillum minus*. If proper treatment is not done, it will cause a 13% mortality rate. 1% of bites are by rats Each year 2 million peoples infected with infectious diseases and 1% is with rats bite. Wild and Pet rats are both causes infection by biting mostly in children's and workers that work in pet houses and labs. In some cases, it would be cured in a year, but it might take a longer time to end or maybe a death in some infections [3].

These bacteria that cause infection are anaerobic, facultative, and gram-negative bacteria. These two bacteria cause different two diseases that are distinct.

STREPTOBACILLOSIS

It causes Haverhill fever and arthritic erythema by moniliforms bacteria. After two to ten days this fever start showing other symptoms such as pain in joints, cold, pain in the head, and cause death if not treated on time. In 20% of cases, it will cause death, if left untreated.

SPIRILLOSIS

It is also known as sodoku. Symptoms do not appear in **2-4** weeks of infection. Gastrointestinal, rectal pain is not severe in this bacterial infection but fever lasts for a long time than it cures. It is mostly found in the Asian region [4].

SYMPTOMS

Its symptoms vary with the type of bacteria which infect a person with different strains. Some of the symptoms are common in every infected person, but some are specific types of every individual bacterial infection. These symptoms come in different phases during wound healing. In 2-10 days after infection generally, symptoms start appears. Peoples living in poor sanitary conditions are at risk of this disease, as have more risk of bitten through rats [5].

- Rashes on the infection area, the colour becomes purple or reddish.
- Aches in muscles of an infected person.
- Swallowed and painful joints of an infected person.
- Inflammation on skin and itching due to infection [6].
- The swelling of lymph nodes, particularly in the underarm or in the neck.
- It leads to fever, rashes, tenderness, and pain in joints [7].

DIAGNOSIS

There are different tests present for testing different strains. Such as;

- Blood Antibody Tests
- Direct visualization
  - In the diagnosis of *S. minus* bacteria, Direct Visualization is done of samples taken from lymph nodes, tissue, or maybe blood.
  - In the diagnosis of Moniliforms bacteria, fluid taken from joints is cultured having organisms [8].

PREVENTIVE MEASURES

By taking preventive measures, the risk factor for this disease can be decreased, as there is no vaccine generated for this infectious disease [9].

- Wash hands after touching rats or any animal that can become a vector of that infectious disease.
- Take care of pets and be sure not to ingest those animals with infection.
- Antiseptics should be used after working with those animals in labs, pet houses by care-takers, or laboratory workers [10].

MANAGEMENT

If not treated, it will cause some infections of disease to cause deaths. It affects the lungs, brain, spinal; cord, and heart inner-lining [11].

- Spirillosis which is also known as sudoku treated by Antibiotic Penicillin.
- Streptobacillosis which is treated by Penicillin or maybe by Doxycycline or Tetracycline.
  - Antibiotic is the only option for the treatment of rat-bite fever because there is no prepared vaccine for the disease. Erythromycin is used for allergic reactions with Rat-bite fever [12].

CONCLUSION

Rat-Bite Fever is characterized as rashes or inflammation on the skin. It is a bacterial disease transmitted by rats to humans. It is an infectious disease and causes other types of diseases, such as fever, headache, joints pain, and inflammation, or rashes on an infected or bitten place on the skin. Antibiotics are used to cure it. But, preventive measures and awareness about this infection can help people to save from rat bites and rat-bite fever.

CHAPTER 13

Brucellosis: A *Brucella* Infection

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Abstract: Brucellosis is a bacterial disease that affects humans and cattle. In humans, Brucellosis is characterized by nonspecific influenza and fever-like symptoms. Brucellosis is caused by different strains of *Brucella* like *B. abortus, B. melitensis, B. suis, and B. canis*. Brucellosis is transferred from sexual contact or breastfeeding. Brucella infection is rare without contact with tissue or blood. Proper treatment of this disease not done timely then it becomes a chronic and life-threatening but very rare case it may cause death. Brucellosis in humans is transmitted through animals. Eating of raw animal products may have a high risk of brucellosis these products are raw meat and unpasteurized milk products. Testing may include are Urine culture, Blood culture, Bone marrow, Testing for antibodies, and Cerebrospinal fluid testing. Avoid consuming raw materials of animals like cheese, ice-cream, unpasteurized milk, and meat.

Keywords: Brucellosis, *Brucella* Species of Bacteria, Risk Factors, Infection.

INTRODUCTION

Brucellosis is a zoonoses disease. It can affect any organ of the body, but the most important infection is gastrointestinal. Brucellosis is a systematic infection or Malta fever that considers myalgias, arthralgias, and sweats. Brucellosis is a disease caused by a group of bacteria from the same genus known as *Brucella.* This type of bacteria causes infection in both humans and animals [1]. Brucellosis is spread due to the eating of contaminated food in which include raw meat and unpasteurized milk. This bacterium is transferred due to air or contact with an open wound [2].

RISK FACTORS THAT EFFECTS THE DISEASE

Brucella bacteria are present in saliva and animal vault. Different animals contract with brucelloses like goats, cows, and dogs. Brucellosis is transferred in humans

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by contact with infected animals. Different Bacteria of *Brucella* species are *B. abortus, B. melitensis, B. suis, and B. canis* can transfer through contact with open a wound, ingestion, and inhaling. In these cases, if you spent more time in animals [3]. Brucellosis is easily transferred from an animal to humans. The risk of brucellosis is higher in those people who contact with animal blood, tissue, and urine. Sometimes, Brucellosis is transferred in casual contact with animals. Eating of raw animal products may have a high risk of brucellosis [4]. The products that carry *Brucella* bacteria are raw meat and unpasteurized milk and cheese. The chance of getting brucellosis is higher when you eating affected meat and raw dairy products from the area of Europe, Asia, and Africa where the disease is more common in the world [5].

SYMPTOMS

The followings are the symptoms of brucellosis in humans are similar to like flu that may include Headaches, Lethargy, Chills, Back pain, Loss of appetite, Pain in bone and joint, pain in the abdomen, loss of weight and Fever that comes and goes.

TRANSMISSION OF DISEASE

Brucellosis is rarely transferring from one human to another. Brucellosis is transferred from sexual contact or breastfeeding. Infection of this is rare without contact with tissue or blood.

DIAGNOSIS OF BRUCELLOSIS

Testing may include are Urine culture, Blood culture, Bone marrow, Testing for antibodies, and Cerebrospinal fluid testing. Doctors may test you, when you have not explained flu-like symptoms and contact with animals then the above tests are recommended that might have brucellosis [6]. Exposures of Brucellosis are not recent even sometimes months or years ago to contact with animals [7].

TREATMENT

Treatment of Brucellosis takes at least six weeks. Doctors may prescribe antibiotics like Doxycycline and rifampin.

Complications of Brucellosts

Sometimes antibiotics will not kill brucella bacteria. Doctors may prescribe some other drugs to treat this disease. Brucellosis causes complications, in that case, their treatment is not successful. These may include:

- Endocarditis (Infection of heart inner lining)
- Lesion on the bones and joints
- Encephalitis and meningitis (inflammation of the brain and membrane around your brain)
- Anorexia
- Depression

Some complications are lethal, but death from brucellosis is rare [8]. The mortality rate is less than two percent from brucellosis. Most cases of this disease can survive if they do not have any complications [9].

Prevention Measures of Brucellosis

Lower chances of brucellosis, you should have to vaccinate by brucellosis. Unfortunately, there is no vaccine is available, that's why following the steps are important to protect yourself from brucellosis:

- Always wears gloves and protective glasses when handling animal tissues and animals.
- Cover your skin and open wound when you contact with animal blood.
- Always wear protective gloves and clothing when helping in animal birth.
- Avoid consuming raw materials of animals like cheese, ice-cream, unpasteurized milk, and meat.

To lower the chance of getting brucellosis, it is preventable [6].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

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CHAPTER 14

Mycetoma: An Infection by the Formation of Grains on Skin

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Abstract: Mycetoma is a chronic disease characterized by the formation of grains seen in the tropical and sub-tropical areas where the rate of rainfall is less. It is caused by both bacteria and fungi called actinomycetoma and eumycetoma. Swelling on skin, Painless nodules formed in this disease which later formed grains. In advanced stages of the disease, it can lead to amputation. For diagnosis of this disease direct microbiological observation, serological test, and imaging techniques used. For treatment antibiotics and anti-fungal with surgery used depending upon the agent. Herbal drugs can also be used.

Keywords: Antimicrobial, Actinomycetoma, Eumycetoma, Mycetoma.

INTRODUCTION

Mycetoma is a chronic disease characterized by the formation of grains that affect the subcutaneous tissues, bones, and skin. The infection starts from the site of trauma or injury *e.g.* splinter or cut can lead to granulomatous reactions. The spread of this disease starts from the skin facial plane and at later stages can involve bones. It mostly involves foot, but in some cases hand, neck, legs, back, shoulder also involved. It is prevalent in tropical and sub-tropical regions. In Africa, this disease has the highest prevalence. In most cases, this disease occurs in a hot climate and have a short period of rainfall [1]. This disease was first recognized by Gill in 1842 in southern of Madura. Godfrey firstly reported a case of mycetoma in India [2]. Carter classified mycetoma based on causative agents [3]. Mycetoma is mostly found in young adults and males are more affected in this disease than females [4].

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Mycetoma is caused by bacteria (actinomycetes) and fungi. It is called as the eumycetoma and actinomycetoma [5]. Actinomycetoma is caused by the aerobic species of the actinomycetes which belongs to genera *Actinomadura,Streptomyces* and *Nocardia* and with the *Actinomadura pelletieri, Actinomadura madurae, Streptomyces somaliensis and Nocardia brasiliensis.* Eumycoticmycetoma is caused by many forms of fungi, from which the most common is *Madurella mycetomatis* [4].

SYMPTOMS

It is a slow-spreading skin infection. In this disease swelling of the skin, pus on the skin, and the small painless nodules formed. With the time these nodules soften and then ulcerates to discharge purulent, viscous fluid containing granules. Eventually, affect the bone and lead to amputation. The granules are different in size, consistency, and color, depending upon the species. Although the color of grain can be indicative of the causative agent, it cannot be the final identification. In past yellow grains were considered indicative of bacterial agents responsible for this disease, so when yellow grains formed treated with the anti-bacterial agents. Now a day, it is reported from some studies that the fungus *Pleurostomophora ochracea* can also produce yellow grain, which represents that it is necessary to identify the causative agent at the species level. The chemical structure of grains is not completely known [4].

DIAGNOSIS

The diagnosis of causative microorganism based on the morphology of grains. It can be done by microscopic observations, serological tests, and imaging technology. Microscopic observation involved evaluation of variation in color, consistency, and size of grain which help in determining causative agent. At present no reliable serological test available, which is reliable however many serological assays have been used such as ELISA, indirect hemagglutination assays, immunoblots, immunodiffusion, and counter immunoelectrophoresis. Ultrasonography and radiology enable the diagnosis of disease extent and involvement of the bone. X rays can also be used [3].

MANAGEMENT

At the initial stage, mycetoma is a curable disease, but when it is at the advanced stage only amputation is only available treatment. Due to the painless progression of the disease, it is diagnosed at the advanced stages. The treatment of mycetoma depends upon the site of infection, etiological agent, and extent of disease. In the case of actinomycetoma usually, antibiotics used while in the case of eumycetoma combination of surgery and anti-fungal used. Most commonly prescribed

antibiotics for actinomycetoma are streptomycin plus (either dapsone or TMP-sulfamethoxazole). In the case of eumycetoma, triazole antifungal with the surgical excision of the lesions is done. In severe cases, amputation is the only treatment. The treatment is prolonged and expensive. There is no vaccine available for this disease [5].

Prevention is difficult. Instruct the patients to avoid thorny branches and carrying sticks that have contact with the soil especially in the case when contaminated with the cattle dung.

Researchers and the health care provider believe that wearing shoes can prevent injuries that can cause mycetoma because doing this can protect feet while walk or the work outside in the area where germs that can cause the mycetoma are present in the soil and water. Early diagnosis and the treatment, before the symptom causes a serious effect, can decrease the chances of disabilities due to mycetoma and might cure this condition.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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CHAPTER 15

Plague: *Yersinia Pestis* Infection

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Abstract: A gram-negative bacterium called *Yersinia pestis* causes plague. Plague is a deadly fatal "disease" and it killed millions of people during its three pandemic outbreaks. Due to the discovery of the causative agent of the plague by Alexandre Yersin, it was named as *Yersinia pestis*. Two types of plagues, bubonic plague, and pneumonic plague are caused by the bacteria. The bacteria use some rodents and fleas as a transmission vector. Fleas need a specific temperature and humidity for its developmental stages. The victim of the plague is not infectious for normal people. Symptoms of bubonic plague include severe headache, bleeding in mouth, restlessness, limb pain, and irritation. Sometimes, Yersinia makes its way to the liver, lungs, spleen, and other organs of the body. The patient feels burning fever and wishes to take a bath with cold water. A rapid diagnostic test is applied to assess the level of disease. An early diagnosis can lead to more chances to cure the disease. Vaccine for the bubonic plague was designed at the start of the last century but it is not efficient rather it is reactogenic. Antibiotics for bubonic plague are more efficient but fail for pneumonic plague.

KeyWords: Antibiotics, Fleas, RDT, Rodents, Vaccine.

INTRODUCTION

Yersinia pestis is the gram-negative bacteria. This strain of bacteria affects the rodents but it also harms the humans causing plague in them. The bacteria are airborne, water-borne, and food-borne. In humans, Bubonic plague and pneumonic plague are caused by the mentioned strain of bacteria. This disease killed 200 million people in the past. The disease is transmitted by fleas in human fellows. When the foregut is blocked by plague bacillus then, it is transmitted to human beings. The bubonic plague spreads mainly through fleas, so, it depends upon the active fleas. Rodents and fleas both are the vectors for the plague involving 200 species and 30 species orderly [1]. The reproduction of fleas depends upon environmental factors because humidity and temperature mainly

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influence the egg-laying and the progression of larvae. Temperature below 7°C retards the developmental steps and the temperature ranging from 18°C to 27°C and 70% humidity are the best conditions for the development of fleas. Plague disease consists of three major types, pneumonic plague, bubonic plague, and septicemic plague. The pneumonic plague spreads more rapidly and progressively and if not treated early it can lead to the death of its victim. When the patients of pneumonic plague cough, they release airborne droplets which can spread to other people increasing the risk of the disease to the healthy individuals. Plague followed three major pandemics starting from the 6th century and killed millions of people and led to enormous short epidemics and acts as a source to spread other diseases. The very pandemic is thought to be originated in central Asia and then followed other trade pathways. When the disease reached the Mediterranean, it swiftly stormed to Italy, France, and Greece following the sea traffic. Later on, the disease spread to the whole of Europe through the land. The third and major worldwide pandemic occurred when the disease arrived at Canton and Hong Kong. Alexandre Yersin made the first breakthrough in Hong Kong by identifying the plague Bacillus. Due to this attempt, the disease was named *Yersinia pestis* in1970. Yersin was the very first person who linked plague and rats. He claimed that plague disease has a relation with black rats and the reservoir of black rats was infected before human fellows. However, Hankin and Simond refuted the theory of Yersin by arguing that bacillus can survive only outside the body of victims and it is rarely recoverable from the victims. Ogata and Simond working independently discovered the role of fleas as the transmission vector of the plague [2] Fig. (**6**).

SYMPTOMS

Infected flea-bitten patients suffering from bubonic plague are not serious infectious to the normal persons, so they could be placed and nursed in the general ward. The start of symptoms appears after two to six days when the temperature of the victim rises to 38.8°C–39.4°C and the patient feels rigors, chills, and severe type of headache and the splitting pain in the abdomen, limbs, and back. The symptoms also include an acute type of lymphadenitis that occur in lymph nodes and then spreading to the liver, spleen, and the other organs of the body. Plague is present in the world even today though reasons are not there to explain it [3]. The patients feel restlessness, confusion, irritation and mostly vomit. Death occurs in most cases in three to six days. They may recover if they are lucky enough to survive on the seventh day. In 5% of victims of bubonic plague, Yersinia makes its way to lungs and the sputum of the victim contains bacteria when he coughs out, leading to the transfer of bacteria to a healthy person who is very close to the patient and making him also a prey. The patients cannot walk and move to some distance. Without any treatment, they die in three to six days. During the Athens

plague, the victims felt a severe kind of headaches, bulging eyes, and bleeding that occurred from the throats and mouths. They also suffered heavy coughing and chest pains. Unquenchable thirst, diarrhea, vomiting, and stomach cramping also appeared. The blisters and small brakes occupied the skin. The victim preferred to dive in cold and chilled water due to burning in high-temperature fever and he wished to go naked [4 - 7].

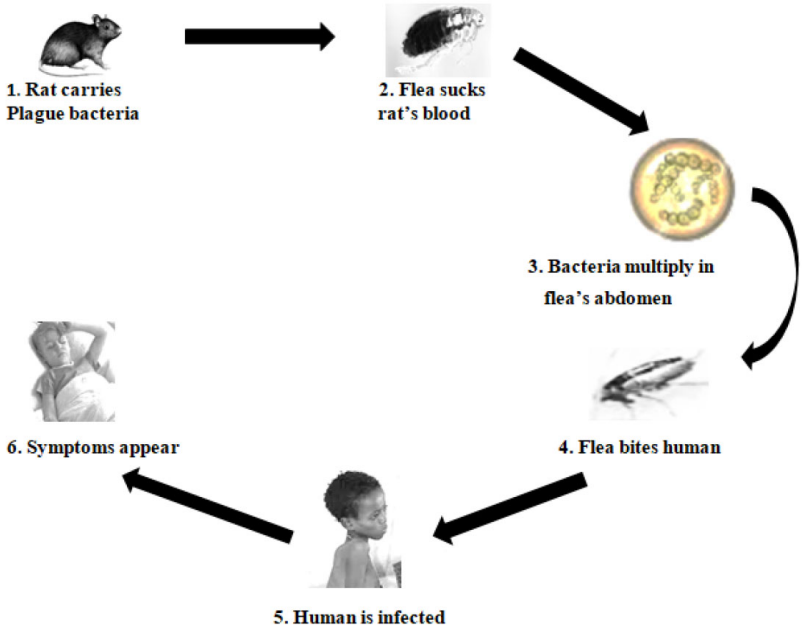

Fig. (6). Transmission of plague.

DIAGNOSTIC TEST

Plague is a deadly fatal disease if not treated appropriately. Poor people and the remote populations are their prey. Human death and the outbreak of disease is also facilitated by late diagnosis. A rapid diagnostic test is also applied to assess the disease level. Rapid diagnosis test uses the monoclonal antibodies that were produced against F1 antigens of *Yersinia pestis*. From the available samples, specificity and sensitivity were judged and these were compared with the calculations from tests for the disease and the findings of ELISA.

Rapid diagnosis test is much reliable, target-specific, more sensitive, very rapid for the diagnosis of bubonic and pneumonic plague, and can be performed easily by some workers. The test would be more helpful in endemic countries to limit the plague [8].

CHAPTER 16

MRSA Infections: Methicillin-Resistant *Staphylococcus Aureus* Infections

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Abstract: Methicillin resistant *Staphylococcus aureus* (MRSA) stays as one of the most vituperative human pathogens and has been documented recently in veterinary settings also. The prevalent use of antibiotics both in human and veterinary medication resulted in the appearance of resistant strains of *S. aureus*. Resistance to methicillin is resolute by *mecA* gene, encoding affinity less penicillin-binding protein PBP 2. Cohort animals, counting dogs, cats, horses, small foreign animals, wildlife animals, and farm animals may comprise a pool for MRSA transmission to humans and others. The appearance, risk factors for MRSA transmission among colonized or infected animals, and possible treatment for infection control are reviewed in the present paper.

Keywords: Close Contacts, Escort Animals, Inspection, Morbidity, MRSA, Prevalence, Transience.

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) are types of *Staphylococcus* bacteria that are unaffected by beta-lactam antibiotics, including penicillin, ampicillin, amoxicillin, methicillin, cephalosporin & monobactams. Staph bacteria live on the skin and in the nose generally exclusive of causing problems. It cannot be treated with common antibiotics such as methicillin so it is different from other types of bacteria. They are problematic only when grounds infection in any species. These infections turn into serious in a week and ill people. This pathogen is mostly present among humans and animals. Staph's strains known as MRSA are arduous to treat as they do not retort to common antibiotics used to eradicate bacteria. It becomes hardest to remove the infection when strong antibiotics such as methicillin do not influence bacteria. Using antibiotics repeatedly and not in the right way is the leading cause of MRSA emergence. As

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time passes antibiotics no longer work well on bacteria as bacteria become resistant to them, So MRSA is termed as “superbugs”. Ogston and Rosenbach discovered it the first time in 1882, from that time it stays as a very affluent bacterium. From the mid-1940s it shows a continuous advancement in terms of antibiotic resistance, as beta-lactam producing strains were resolute. *S. aureus* is found on the genomic islands of the chromosome, which are mobile genetic elements and are classified according to the place of their attachment site and the progression process of their integrase gene. MRSA impose serious trouble not only in medical & economic cost but also cause numerous morbidity & transience. In Europe MRSA infections roughly affect more than 150,000 patients annually causing the extra cost of 380 million in healthcare units [1].

HISTORICAL BACKGROUND OF MRSA

MRSA was first reported in 1960 and in these days are acting as a chief hospital-acquired pathogen globally. A brief timeline for the emergence of MRSA has been described in Table **1**.

Table 1. Timeline for the emergence of MRSA.

1929	**Fleming reported fungal contaminant producing penicillin**
World war I & II	Penicillin remained as a major drug against *S. aureus.*
1940	Beta-lactam enzyme discovered in *E. coli* naming penicillinase
1944	Penicillinase production in *S. aureus*
1948	50% of hospital patient found to be resistant to penicillin
1959	Methicillin introduction which was resistant to penicillinase-resistant penicillin
1960	Methicillin resistant strain was introduced
1962	The epidemic occurred in hospitals
1968	United States recorded the first outbreak of MRSA
1970	*S. aureus* strains become resistant to most penicillinase
1972	MRSA isolated in mastitic cow
2004-12	MRSA isolated in domestic and wild animals

CAUSES

MRSA stretches through casual contact or unhygienic objects like all other staph bacteria transmission. It normally extends from the hands of MRSA suffering that might be anyone from health care setting or society. Unlike the flu virus, MRSA does not spread through the air until a person has pneumonia and coughing. Hospital gained MRSA is called healthcare-associated methicillin resistant

Staphylococcus aureus. Healthcare-associated methicillin resistant *Staphylococcus aureus* occurs mostly in sick persons with a destabilized immune system and infection mostly happens in wounds, burns, eyes, blood, or other sites where tubes enter the body. In the past, MRSA tainted only ill people but now MRSA is widespread more in healthy people who have lesion or abrasion and those who are in physical contact.

On the skin and in the nose of hale and hearty people *Staphylococcus aureus* is mostly found. Strains of *Staphylococcus aureus* possess ß lactamase substance making them resistant that degrades penicillin by killing its antibacterial activity. Antibiotic methicillin is a type of penicillin that was developed in the early 1960s [2].

LABORATORY DIAGNOSIS

MRSA detection and categorization have been done based on new swift techniques. In laboratories for the detection of MRSA strains, real-time PCR and quantitative PCR is using mostly. Solid agar media for screening cannot be used commonly. Multiplexed PCR primer is a molecular method that detects precise genes for *S. aureus*. Phenotypic methods for *S. aureus* recognition are Gram staining and coagulase tests. Genes of *S. aureus* can be finding out by Oxacillin & cefoxitin test. Pulsed-field gel electrophoresis is a molecular typing method used in detection [2].

ANTIBIOTICS ACTIVITY AGAINST MRSA

Antibiotics using for the treatment of MRSA is one topical agent, a restricted number of oral agents and numerous agents for intravenous (IV) infusion.

Topical Agents

Mupirocin is used as a topical agent to treat *S. aureus* infections and it works by inhibiting bacterial protein and ribonucleic acid production.

Oral Agents

Oral therapies frequently used in the treatment are tetracycline, linezolid, clindamycin, and rifampin and they work by inhibiting bacterial protein production.

Oral and Intravenous Agents

In oral and IV form Linezolid & Clindamycin are accessible. Due to certain advantages, such as it is availability to body easily after oral organization, pierce

CHAPTER 17

Otitis Media: An Inflammation of the Ear

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Abstract: Otitis media is the most occurring disease in Childs regarding bacterial infections especially *streptococcus* pneumonia. Monitoring of these disease-causing agents is necessary to generate new means of treatment, vaccines, and precautionary measures. This chapter will show different methods of diagnosis either based on symptoms or with the help of other means, also the treatment policy by using antibiotics or other options such as surgery are discussed along with the precautionary measures that are to be taken to prevent the Children from such a serious disease.

Keywords: Management, Otitis Media, *streptococcus* pneumonia.

INTRODUCTION

Otitis can be defined as the inflammation of the ear. Mostly middle part of the ear is affected so it can be named Otitis Media. Otitis Media is characterized by severe pain and swelling on the ear usually in children [1 - 4].

CAUSES

The origin of this disease mostly correlates with the Bacterial infection in the throat that can be extended to the ear and cause inflammation of the ear. It can also be of viral infection (influenza, rhinovirus, adenovirus, and coronavirus). Mostly bacteria *streptococcus pneumoniae*, *Moraxella cattarhalis*, non-typeable *Haemophilus influenzae,* and Group A *streptococcus* are involved in this infection [5, 6].

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SYMPTOMS

The following symptoms can be observed in the case of Otitis Media [7, 8].

- Severe pain in the ear and the surrounding region
- Swelling
- Fever
- Temporary hearing loss
- Permanent hearing loss may occur if it is not treated
- Disability in speaking and language problem may occur due to hearing loss
- Consistent drainage of fluid from the ear
- Lack of balance *etc.*

DIAGNOSIS

The following tools can be used for the diagnosis of Otitis Media in children [9].

A common or frequent way to diagnose the Otitis Media (infection) is to observe the ear of the patient with an otoscope that assists the physician to observe the eardrum and outer ear with light provided by the otoscope. Inflammation (redness, swelling, hot, pain) will indicate the infection.
A pneumatic otoscope can also be used for its diagnosis by blowing a puff of air on the eardrum to check the movement of the eardrum. If liquid or fluid is present behind the eardrum due to infection, the eardrum will not show such a movement that is present when there is a presence of air behind the eardrum. So with the help of the pneumatic otoscope physician can diagnose Otitis Media.
Tympanometry is also a test to diagnose the Otitis media by observing inflammation (showing infection) of the middle ear by inserting a small, very soft plug containing device to change the air pressure in the ear canal. Also, a speaker and microphone are the parts of tympanometry

MANAGEMENT

In management practices, the following tools may be used to tackle that problem or disease [10, 11].

- Treatment Otitis media can be efficiently treated by using antibiotics until recovery. If there is a problem of bacterial resistance against the available antibiotics then the option of treatment with several antibiotics should have to be used so that these medicines can act synergistically to overcome the problem of resistance presented by the bacteria. Another problem can occur in the form of

side effects of such drugs or medicines that are going to be used such as vomiting like conditions and diarrhea *etc.*

- Myringotomy Hearing loss may occur if fluid sustains for more than three months behind the eardrum due to infection so, an operation named as myringotomy is done to remove that fluid including the insertion of small but very soft tubes of plastic in the opening of eardrum to maintain pressure between inside the ear and outer environment after giving the anesthetic drug. Metal tubes can also be used depending upon the conditions and recommendations of the physician. These tubes can be removed after 6-12 months. Hearing should be restored properly after the removal of fluid. The operation can be repeated in such a case when there is a return of otitis media including the fluid production behind the eardrum. After the operation, it should be informed to prevent the entry of water in the ear while bathing and swimming by applying a plug.
- Prevention Availability of certain vaccines can assist to control such type of cases.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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CHAPTER 18

Yaws Disease: A *Treponema Pallidum* Infection

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Abstract: Yaws disease is an infectious disease which is caused by *Treponema pallidum*. It is an endemic non-venereal disease. In the tropical regions where humidity is present yaws are spread by skin to skin contact. The main camping was started to eradicate this disease by using injectable penicillin. It mainly affects children who are living in poor areas they resultantly suffered from lesions of the bone, cartilage, and skin. The reinfection risk caused by repetitive contact with those children who have an infection and they seem to be a key factor in predicting the treatment failure.

Keywords: Intramuscular Injection, Penicillin G Benzathine, *Treponema pallidum*, Yaws Disease.

INTRODUCTION

Yaw is an infectious disease it is a debilitating disease that mainly affects the children especially in the rural areas and in the tropical regions [1]. Yaws can easily be treated with antibiotics and present in the World Health Organization's eradication list. Yaws is a disease which is caused by the bacteria called Yaws, *Treponema pallidum* [2].

CAUSE

It is one of the endemic non-venereal diseases caused by *Treponema pallidum* [3]. Earlier, yaws were common all over the tropics [4] In the tropical regions where humidity is present Yaws is spread by skin-to-skin contact. The clinical indexes for syphilis show that syphilis does not transmit from mother-to-child [5]. *T. pallidum* is the main pathogen, studied in humans that have evaded in the *Vitro* cultivation [6].

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PREVALENCE

In the 1950s and 1960s, the main camping was started to eradicate the yaws, by using injectable penicillin, yaws were treated and reduced the number of cases by 95% worldwide, but in recent years, yaws has again reappeared in Africa, Asia, and the western Pacific. In 2012, it has been seen that in the treatment of the disease one oral dose of azithromycin was effective as compared to the intramuscular penicillin, and WHO launched a new initiative to eliminate yaws by 2020 [5].

SYMPTOMS

It mainly affects children who are living in poor areas they resultantly suffered from lesions of the bone, cartilage, and skin. The untreated disease can cause destructive lessons in the bones and cartilage [4]. In bones, Yaws disease was studied for clinical and X-rays aspects. Some patients were suffering from yaws disease having multiple symmetries or no-symmetry papules and nodes on their skin. They have a systematic toxic symptom. Patients who have Yaws disease, they have brown abscess under the extremities of the skin. Surrounding the ulcer they also have multiple bayberry-like nodes up and down surrounding the ulcer. The bone lesions were predominantly periosteal proliferation and hyperostosis. The lesions on the bone were hyperostosis and destroy the bone. With the help of the CDC, lesion samples were tested by using multiple numbers of the real-time PCR assay. In the start, samples were tested for the identification of bacteria *T. pallidum* DNA [7]. If the result of PCR was positive for *T. pallidum* subsp. *pertenue* then the second multiplex RT PCR procedure is performed to check that 23S rRNA becomes mutated or not, because of this gene related to the resistance of azithromycin. These samples were also tested with the help of a duplex RT PCR for the recognition of *Haemophilus ducreyi* and *Mycobacterium ulcerans* [8]. All the test of the laboratory was performed for the clinical findings. 6 months to 15 years children were conformed serologically to diagnosis the yaws disease, by using the computer-generated randomization sequence. This result described the cure rate and show that 6 months treatment decrease in rapid plasma re-agitate and within 2 weeks applicant who has primary ulcers, also by epithelialization of lesions [9].

MANAGEMENT

It is thought that it is very difficult to resolve chronic infection [10]. Even though it has been reported that penicillin treatment is failed for yaws disease [11] until the resistance for penicillin has not been proven. Maximum medical well-defined treatment becomes failing due to two reasons first reinfection after treatment and second are patient-to-patient variations.

A series of experiments perform which was based on mass-treatment which is done with intramuscular penicillin. In 1996-97, in India Yaws Eradication Program was launched. At the start, the YEP was used as a pilot study in Koraput district, and then later on extensively study in ten states and cover the 49 districts. The goal of the study is to eliminate the disease from the country [12]. It is trying to eradicate the Yaws but it has not yet been eliminated from many terrestrial areas, though, it is already rising in some countries. The disease is not a household disease but somewhat, the transmission of the yaws in the children is a community, public place, or the school. More programs will be needed for the elimination of the yaws disease and need of information to deliver and administer drugs in secluded and under-resourced communities [13].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

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CHAPTER 19

Pharyngitis: An Inflammation of the Throat

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Abstract: Pharyngitis is a throat infection and the back throat inflammation causes throat infection and it is a common reason to visit physicians. Swallowing may be uncomfortable and painful. Commonly, throat infection symptoms are illness, like the flu or cold. In this review, we have discussed the national perspective, epidemiology, regional perspective, clinical diagnosis, pathogenesis, clinical presentation, and causes of inflammation pharynges.

Keywords: A Respiratory Infection, Pharyngitis, Sore Throat.

INTRODUCTION

In most cases, the viral origin of throat infection however microbial etiology is described and in the Group A *streptococcus* bacteria cause of severe pharyngitis [1]. Severe throat infection is an inflammation disorder considered by swelling, heat, redness, and pain. Word Throat infection frequently used to define laryngitis, tonsillitis, and pharyngitis that happen for a short period, which affects respiratory tract infection. Mainly four regions larynx, pharynx epiglottis, and tonsils are involved. Anyhow normal of an epidemic influenza time, a mature may be infected with influenza two to three times in one year [2]. Throat infection by non-infective normally caused by the change of environment like air pollution, low humidity, smoking, and change in temperature. Throat infection has an important effect on the usual regular functioning and activities of a patient, including eating, talking, swallowing, concentration, and sleeping. The literature of throat infection indicates that infection of bacteria does not cause of throat infection caused by group A bacteria B-hemolytic *streptococcus* (*streptococcus pyogenes*) contribution to almost 20% of all total throat infection and throat infection in mature. Approximately 80% of a throat infection in mature is

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produced by influenza virus critical respiratory syndrome respirational syncytial virus, rhinovirus, and coronavirus. Therefore, antibiotics are commonly not the first treatment for severe throat infection. Treatment of throat infection by prescribed antibiotics and guideline of the World Health Organization have discouraged prescription antibiotics [3]. Moreover, the prescription of antibiotic decreases would decrease the produce resistance of antibiotics in the public and decrease the total charge problem on the healthcare system.

SYMPTOMS

Many ways of throat infection affect an individual and symptoms of throat infection differ from person to person. Therefore, particular define disorder symptoms as a feel tickling and scorching feeling in the throat. Throat infection affects the person as a common pain sensation that starts at the oral back and slowly increases in the area of the central throat Fig. (**7**). In many circumstances of severe throat infection no signs of problems, like difficulty in breathing and prolonged fever conventionally without antibiotics may be managed [4, 5].

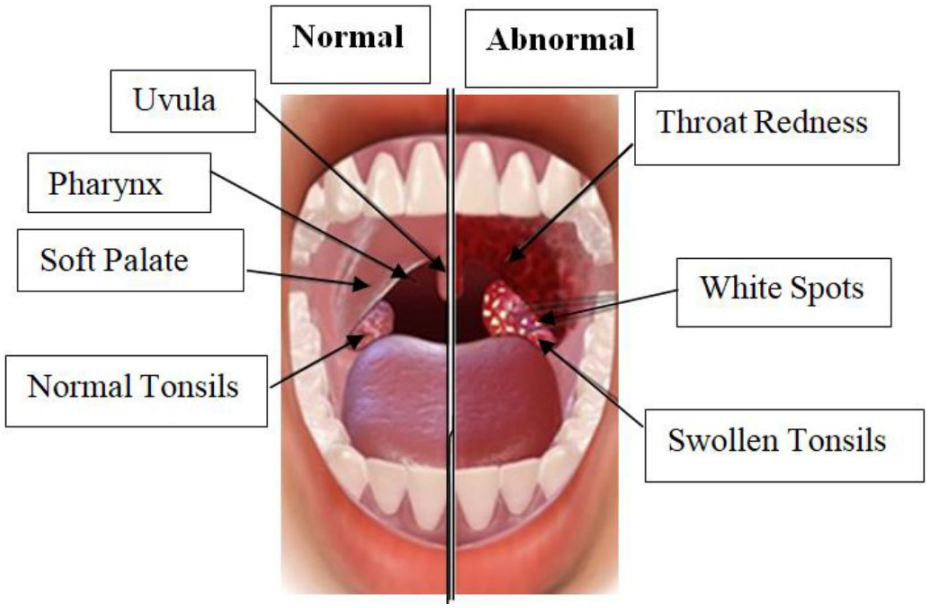

Fig. (7). Throat infection.

DIAGNOSIS

Culture of *Streptococci* through the swab throat from an upper respiratory tract to diagnose the pharyngitis of severe *streptococcal*. The sensitivity of single swab throat culture has 90 to 95% to detect the group A hemolytic *streptococci* in the

upper respiratory tract and numerous variables affect the results of throat culture accuracy. The technique in which the Impact of a secured swab important on *streptococci* yields from culture.

Swab throat samples would be taken from both tonsillar or tonsilsupper pharyngeal wall and fossae. Mouth and oral pharynx areas are not suitable sites, and swab would not be touch these sites already or after the suitable parts have been tested. If a patient takes antibiotics already or at the time of swab throat gained and obtained results should be negative-false.

It has been stated that the use of selective culture media and anaerobic incubation can enhance the results of positive culture proportion. Though, data are incompatible concerning the effect of the environment of culture media and incubation, in the lack of a certain advantage, the effort and increased cost related with selective culture media and usage of anaerobe incubation are problematic to validate, especially for physicians who procedure throat culture [6]. The clinical importance of many of the colonies of group A β-hemolytic *streptococcal* present on the culture plate of the throat is difficult. However, patients with an exact severe group A *streptococcal* pharyngitis are expected to have positive and strong cultures as compare to *streptococcus* carrier patients. The results of throat culture too much overlap distinction cannot be made alone on this basis exactly.

MANAGEMENT

These reflect historical and not current immunological actions and are not significant in the severe pharyngitis diagnosis. They are significant for confirmation of earlier infections of *streptococcal* in patients assumed to have post-*streptococcal* severe glomerulonephritis or severe rheumatic fever. They are also useful in likely studies of epidemiological, for differentiating patients with severe infection from carrier patients. The foremost purpose uses antibiotics for the treatment of pharyngitis and throat infection to avoid rheumatic fever. Meanwhile, in the population occurrence of rheumatic fever is low, and has less over the last 30 years, many of the treatments written for drugs and reduction of antibiotics [7].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

CHAPTER 20

Gonorrhea: *Neisseria Gonorrhoeae* is the Causative Agent

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Abstract: Gonorrhea is the 2nd most sexually transmitted disease and is very contagious. The causative agent of this disease is *Neisseria gonorrhoeae.* According to WHO (World Health Organization), the ratio of new cases of gonorrhea reported every year is 1.6 million worldwide. Symptoms of gonorrhea in females are dysuria, vaginal discharge, rectal and/or lower abdominal discomfort, abnormal uterine bleeding, and dyspareunia, and in males, symptoms are dysuria, urethral itch and/or discharge and rectal or testicular pain. Gonorrhea screening is facilitated by NAATs (Nucleic Acid Amplification Tests) in the last decade. Prescribed medication for gonorrhea disease is combination therapy together with a single dosage of ceftriaxone 250 mg given deep into the muscles plus oral intake of either 100 milligrams of doxycycline or 1 gm of azithromycin twice a day for one week. This disease can be prevented by avoiding sexual intercourse, the use of condoms, modifications in sexual practices, and reduction in the number of sex partners.

Keywords: Gonorrhea, NAAT, Sexually Transmitted Disease (STD), Symptoms, Treatment.

INTRODUCTION

Gonorrhea is the set of various clinical conditions in which infection is caused by bacteria acquired sexually [1]. Gonorrhea caused by the bacterium *Neisseria gonorrhoeae* is the 2nd most sexually transmitted infection (STI) and is a very contagious disease that can be transmitted by anal and genital sex and can also be transmitted by oral sex, but less frequently [2]. It has been estimated by WHO worldwide, that 106 million new cases of gonorrhea are reported every year [3]. Gonorrhea affects ethnic, racial, and sexual minorities disproportionately [4]. In certain geographic areas and demographic groups, there have been observed continuously increasing gonorrhea rates. Particularly, 337.5 cases in adolescents,

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500.5 cases in adults, 426.6 cases in non-Hispanic blacks, and 128.6 cases in residents of Southern US per 100,000, population are bearing the highest-burden of gonorrhea [5]. Some factors increase the risk of infection such as affected with gonorrhea previously or with other sexually transmitted diseases, age less than twenty-five years, inconsistent use of condoms, having new or many sex partners, using drugs or living in regions where the disease is highly prevalent and commercial sex work [6].

SYMPTOMS

Gonorrhea has symptoms in males and in females it is asymptomatic. Clinical presentations of gonorrhea in females when it is symptomatic include dysuria, vaginal discharge, rectal and/or lower abdominal discomfort, abnormal uterine bleeding, and dyspareunia. Symptoms for males include dysuria, urethral itch, and/or discharge and rectal or testicular pain. The most frequently affected sites of gonorrhea are the cervix and urethra followed by pharyngeal and anal areas [7].

DIAGNOSIS

Gonococcal infections can be prevented in infants by the screening of all women that are sexually active and have a greater risk of infection. Heterosexual women and men who are at low risk for gonorrhea infection are not recommended for screening. Routine screening of gonococcal at anatomical sites of gonorrhea exposure is suggested for sexually active men having sex with men (MSM) every year [6]. Three ways are used to facilitate the diagnosis of gonorrheas such as traditional culture, nucleic acid hybridization, and nucleic acid amplification tests. Traditional culture technology is the only way that is approved to detect *N. gonorrh*ea from both non-genital (conjunctival, pharyngeal, and anorectal) and genital (urethral and endocervical) mucosal surfaces and this technique requires actual cells collected from infected mucosal areas. Cultures may give results of antimicrobial susceptibility and in cases of documented or suspected treatment failure; the cultures ought to be the test of choice. A nucleic acid hybridization test is used in the detection of gonococcal DNA and some of its categories are used for testing chlamydial DNA. These tests are prescribed on samples collected from surfaces of the genital tract such as the vagina and urine. Recently, NAAT is the standard way of screening gonorrhea. Polymerase chain reactions, strand displacement amplification, and transcription-mediated amplification are three basic types of NAATs and to enhance the detection, these types of NAATs identify and then copy gonococcal DNA [1]. This test is usable in both urethral swabs and urine specimens. As compared to culture techniques, NAATs are not much labor-intensive, have improved sensitivity, and have fewer transport requirements and less tight handling [8].

MANAGEMENT

After the development of antibiotic therapy for *Neisseria gonorrhoeae*, the bacteria have developed resistance against the previously used drugs for its treatment, such as penicillin, fluoroquinolones, tetracyclines, and sulfonamides [9]. Medication prescribed for pharyngeal, urogenital and anorectal gonorrhea is combination therapy together with a single dosage of ceftriaxone 250 mg given deep into the muscles plus oral intake of either 100 milligrams of doxycycline or 1 gm of azithromycin twice a day for one week. Prolonged therapy is required in invasive gonorrhea infection (meningitis or endocarditis). If signs remain, sensitivity tests and gonococcal culture tests should be carried out because of having the capability for antibiotic resistance and a specialist of infectious diseases should essentially be consulted. Hospitalization can be required if the infection becomes complicated. For minimal risk of infection again, sexual contact should be avoided at least for a week by patients and until all sex partners are treated. Prevention is important for the individual patient and in communities to improve reproductive and sexual health. Effective strategies for prevention are prior diagnosis, efficient cure, and urge for managing sex partners. Counseling and education are necessary to reduce the infection rate for persons who are at risk and for the asymptomatic gonorrhea infection. After several months of appropriate treatment, retesting for gonorrhea is necessary to detect if the infection is repeated. The behavior for reducing infection rate includes avoiding sexual intercourse, the use of condoms, modifications in sexual practices, and reduction in the number of sex partners [6].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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CHAPTER 21

Chlamydia: A Common Sexually Transmitted Disease

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Abstract: There are many species of genus *Chlamydia* which causes human diseases, but this genus causing diseases in humans like as *Chlamydia trachomatis* and other species are *C. pneumoniae* that is a human pathogen, *C. psittaci* causes psittacosis in avian but causes infection in humans as zoonosis case, the transmission is rare in-person to person transfer. In women, this leads to severe genital infections like pelvic inflammatory disease, tubal infertility, infertility, ectopic pregnancy, and chronic pelvic pain. The high risk of this infection is usually at a young age. Symptoms are; the burning sensation while urinating or abnormal vaginal discharge, lower abdominal pain, nausea, lower back pain, pain during sex, fever, and pain while passing urine,*etc.* Different types of tests are used to diagnose the infection. Prevention for reduces infection, the use of a condom, number of sex partners will be limited, going to the laboratory regularly for screening. Medicines that are taking against infection are quinolone and tetracycline, erythromycin, clarithromycin, ampicillin, *etc.*

Keywords: Antibiotics, CFT, Culture, PCR, Prevention, Serology, Sexually Transmitted Disease.

INTRODUCTION

There are many species of genus *Chlamydia* which causes human diseases, this genus causing diseases in humans like as *Chlamydia trachomatis* and other species is *C. pneumoniae* that is a human pathogen, *C. psittaci* causes psittacosis in avian but causes infection in humans as zoonosis case, the transmission is rare in-person to person transfer. Chlamydia is caused by bacteria named *Chlamydia trachomatis*. Chlamydia is a bacterial infection that is commonly found all over the world and is sexually transmitted among persons [1]. In women, this leads to severe genital infections like pelvic inflammatory disease, tubal infertility, chronic pelvic pain infertility, and ectopic pregnancy [2]. Due to this, control effort

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increases in some countries which enhanced treatment and detection of this infection in young women and taking much more coverage [3].

The particle which is responsible for an infection called the elementary body (EB), which attached the host cells and in the body of an organism by endocytosis. By the formation of the endosome, it enters within the cell and still there in the whole cycle. After 6-8 hours the EB cells changed into a reticulate body (RB) Fig. (**8**). This shows that the organism is active and starts reproduction. The RB is not causing infection. Approximately 48 hours it remains in the cycle and divides through binary fission. Within 24-48 hours some RB cells reorganize into EB and start causing infection. At last, the cells burst, and EB exit from the host cells for the infection in new host cells. Approximately 48 hours take to complete the cycle for virulent lymphogranuloma venereum biovar and trachoma biovar takes 72-96 hours [4]. These are the two strains of C. trachomatis which are divided into two biovars. Diseases caused at mucous membranes and where such types of cells are present by trachoma biovar. Such sites include a conjunctive, endocervical canal, urethra, gastrointestinal, respiratory tracts, and fallopian tubes [5].

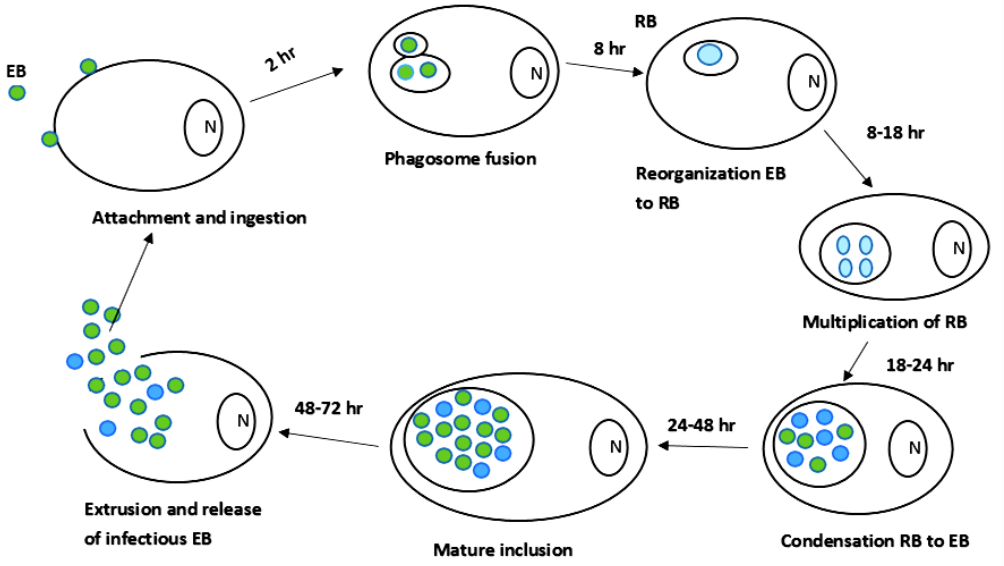

Fig. (8). *Chlamydia trachomatis* and *Chlamydia pneumoniae* infection in human. EB: Elementary body, RB: Reticulate body.

The prevalence of chlamydial infection is most commonly found in sexually active teenagers. The high risk of this infection is usually at a young age [6, 7]. Infants 60%-70% mostly exposed to *C. trachomatis* by passing through the

infected birth canal, cause infection. The lymphogranuloma venereum was considered as a disease which causes inguinal buboes and genital ulcer in men. This occurs in such men who have sex with men. For several decades, this circulation is present in the gay community. In endemic areas, this is spread from child to child. In the past, many hundreds of millions were at a high-risk factor for trachoma and millions are blinded. The disease must be disappeared by the improvement of sanitation conditions and all the environmental conditions. In developing countries, it is still a big problem which leads to infectious disease, causing blindness. Children develop infection earlier in holoendemic areas. At adult age, the blindness is caused [4].

SYMPTOMS

Chlamydia is commonly known as the silent disease because of the majority of the females and half of the males having no symptoms. If the symptoms will occur, then it will be within 1-3 weeks after exposure from the virus. Likely symptoms areas; the burning sensation while urinating or abnormal vaginal discharge, lower abdominal pain, nausea, lower back pain, pain during sex, fever, pain while passing urine, bleeding between the menstrual period, frequency passing urine, and a pussy yellowish inflammation of the cervix seen on examination. This infection is not early diagnosed until it becomes complicated. It may cause proctitis which is an infection of rectum lining which will cause sex having a chlamydial partner. In pregnant women this infection causing premature delivery, due to this birth baby having eye infection called conjunctivitis or as pink eye another as pneumonia. In conjunctivitis infection, some type of discharge is excreting from the eyes of the baby and with swollen eyelids in the first 10 days after birth. In pneumonia, it starts with a cough which going to worse condition day by day and congestion in 3-6 weeks after birth. The symptoms shown in men are as discharge from the penis, burning, burning sensation while passing urine, and swelling in the scrotum. This shows the sign of epididymitis (inflammation caused in the male reproductive part). It shows the results of infertility [8].

DIAGNOSIS

Serology

The most common method of diagnosing chlamydia infection is the CFT in the United Kingdom. The micro-immunofluorescence test should be taken for the differentiation between the two species of chlamydia *C. psittaci* and *C. pneumonia* as a complete cell inclusion test of immunofluorescence.

CHAPTER 22

Typhoid Fever: *Salmonella* is the Causative Agent

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Abstract: Typhoid fever which is the systemic disease is caused by the *Salmonella* enterica or *S. typhi*. It has been a disease prevailing throughout the world most common in developing countries, with common symptoms like high fever, constipation, diarrhea, fatigue, and dry cough strategies for its diagnosis have been developed which includes Widal and typhidot, the typhidot technique has advantage on the widal test based on easiness and sensitivity, the different type of antibiotics has been produced for the treatment, but as the bacterial species are becoming resistance there is need for the development of other technique for the treatment which involves the development of vaccines for the prevention of typhoid fever.

Keywords: Antibiotics and Vaccines, High Fever, *Salmonella* enterica, Typhidot, Typhoid, Widal Test.

INTRODUCTION

Salmonella enterica serovar typhi, a gram-negative bacteria is the cause of a disease named typhoid fever or enteric fever which is a systemic disease [1, 2], this disease has challenged humans throughout history and still, it's been a major challenge faced by humans, the host of this bacterium is only human [3]. The various factor contributing to typhoid fever are poor sewerage systems, poor sanitation, and overpopulation [4]. The signs and symptoms of typhoid are high-grade fever, diarrhea, rose spots, and loss of appetite [5].

Although Typhoid is prevalent throughout the world, it is more common in developing countries, in Pakistan it is the sixth most common cause of death, it was estimated in 2000 that about 21 million people throughout the world suffer from typhoid and 0.21 million deaths are caused by it [5].

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Muhammad Imran Qadir (Ed.)

SYMPTOMS

Typhoid is caused by *S. typhi*, the incubation time of the bacterium is 1-2 weeks and can increase from 3 - 60 days the illness presents sustained fever and other symptoms which may include abdominal pain, constipation, diarrhea, fatigue, and dry cough [1] and rose spots [2, 6].

DIAGNOSIS

Typhoid fever which is a systemic disease is diagnosed by the Widal test which is widely used for its diagnosis, the test is easy to perform and requires low sophisticated equipment's and minimal training it depends on the agglutination reaction between S.typhi, the flagellar H antigen and somatic Lipopolysaccharides O antigen, one of the disadvantages is that different bacterium has similar properties that's why clinical signs and symptoms of typhoid are not recognized by the Widal test and it may lead patients to receive inappropriate and unnecessary treatment [7, 8]. An alternative strategy for diagnosis is typhidot which is highly sensitive and can easily be performed [9].

MANAGEMENT

As typhoid is an important cause of illness and death its management is important, different types of antibiotics are used for the treatment, for example, chloramphenicol is an antibiotic used for treatment as the bacterial species are becoming resistant to these antibiotics and various other antibiotics like fluoroquinolones, besides, another drug named azithromycin which is effective against multidrug resistance strains is being used, these multidrug resistance strains may lead to severe disease, therefore there is a need to prevent resistance development in strains against antibiotics and to discover new therapies for these salmonelloses [10]. Other managements were made which includes the development of vaccines for the control of typhoid fever, the commercially available vaccines are Ty21a and Vi polysaccharide but these are not used routinely, new modified Vi vaccines named as Vi-eEPA are under development, the disadvantage of these vaccines is these are only used for the *S. typhi*, not for other species other vaccines are under development which are used for the treatment of *Salmonella* species [11, 12].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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CHAPTER 23

Q Fever: A *Coxiella Burnetii* Infection

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Abstract: Q fever is a worldwide disease caused by a bacterium *Coxiella burnetti*. The *C. burnetii* is found in goats, sheep, and cows. A higher risk of Q fever is observed in farmers and veterinarians. Acute and chronic diseases are two forms of Q fever. The symptoms of an acute form of Q fever are illness, headache, myalgia, chills, fatigue, sweats, pneumonia, hepatitis, while endocarditis is the most lethal type of chronic form of Q fever. Nucleic acid testing and serological methods are the methods used to diagnose Q fever. In the case of acute disease, an antibiotic Doxycycline (100 mg) is recommended twice a day for its treatment while for endocarditis a combination of doxycycline and hydroxychloroquine or a combination of doxycycline plus a fluoroquinolone (FQ) may be prescribed.

Keywords: Acute and Chronic, *Coxiella burnetii*, Doxycycline, Fluoroquinolones and Endocarditis, Hydroxychloroquine.

INTRODUCTION

Query fever (Q fever) is a worldwide common infectious disease caused by the intracellular, gram-negative, and obligates bacterial form called *Coxiella burnetti*. *C. burnetti* is a bacterial type which is extremely resistant to ecological situations as they form common spores and transmit the infection from animals to humans [1].

PREVALENCE

The Q fever prevalence is observed worldwide but it is not reported in New Zealand. Its prevalence is observed greater in France and Australia as compared to the USA. In the case of age and gender, Q fever is reported in men with age group 40 and 69 because they have to work with animals as compared to women and children [2].

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CAUSES OF Q FEVER

C. burnetii are the microbes that are typically found in animals such as goats, sheep, cows, ticks, birds, and humans [3]. Humans are infected with Q fever when these animals transmit *C. burnetti* in milk, feces, urine, and fluids from giving birth Fig. (**9**). These substances may be arid in a farmyard where infected dust particles are present in the air. When the humans inhale the impure air, they get an infection of Q fever. In some cases, when humans drink unpasteurized milk, they also get an infection from this source. The higher risk of acquiring Q fever is observed in veterinarians, farmers, people who live close to a farm, researchers in the laboratory of *C. burnetti,* and workers in the meat and dairy industry. In the tase of human contact, the less risk is observed [4].

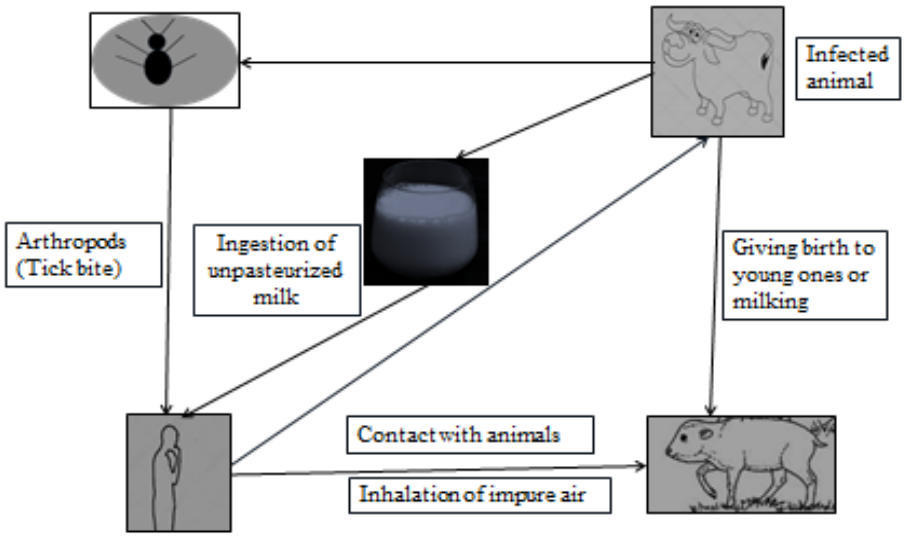

Fig. (9). Transmission of Q fever.

FORMS OF Q FEVER

There are two forms of Q fever:

- Acute Q fever
- Chronic Q fever

Acute Q Fever

The uncommon and less lethal form of Q fever called acute fever develops an incubation period ranging from 2 to 6 weeks. In acute fever cases, most of the

patients are asymptomatic while fewer patients may have a mild infection.

Symptoms of Acute Q Fever

The important symptoms in case of acute Q fever are febrile illness, headache, myalgia, chills, fatigue, sweats, Pneumonia, Hepatitis, nausea and vomiting, diarrhea [5].

Chronic Q Fever

The most serious, lethal, and less common type of disease is called chronic Q fever. Patients infected with chronic Q fever may retain this disease from months to years after initial symptoms.

Symptoms of Chronic Q Fever

The main clinical presentation of chronic fever is the inflammation of the inner lining of the heart called endocarditis leading to failure of the heart [6]. The other complications may be inflammation of the central nervous system called encephalitis, the inflammation of the lungs called pneumonia, inflammation of the liver called hepatitis, and infection of bones known as osteomyelitis. The people have weakened the immune system, valvular abnormalities and vascular infections are at high risk for developing chronic fever [7]. Moreover, women during pregnancy are also susceptible to chronic fever and cause miscarriage, low birth weight, premature birth, and stillbirth [8].

DIAGNOSIS

A blood culture diagnoses Q fever. Initially, the nucleic acid testing is performed for the diagnosis of *C. burnetti* through the Polymerase chain reaction (PCR) within a week [8]. But the most preferable method or the diagnosis of *C. burnetii* is Serologic methods. In the serologic method, the detection of phase I and II antibodies IgG titer of 800 or greater against phase I antibodies indicates a chronic infection and A titer of 200 or greater for IgG and 50 or greater for IgM against phase II antibodies indicates recent infection [9].

TREATMENT

100 mg Doxycycline twice daily for 14 days is recommended for adults in case of acute form. In the case of chronic disease, endocarditis is the most serious form and it is recommended that during 2.5 years patients should be treated with a combination of doxycycline and hydroxychloroquine [10]. Nowadays it is recommended that 100 mg two times a day of oral doxycycline and 200mg 3 times a day of hydroxychloroquine is a standard treatment and must be continued

CHAPTER 24

Buruli Ulcer: *Mycobacterium Ulcerans* is the Causative Agent

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Abstract: Buruli ulcer also called Brainsdale ulcer is the chronic, debilitating subcutaneous destructive infection of the skin, soft tissue, and adipose tissue. *Mycobacterium ulceran*s is the causative agent of BU. The infection of BU is prevalent in many areas of the world. However, wetlands and tropic to sub-tropic areas are more prone. The disease can be diagnosed by expert physicians as it can be confused with the other skin infection.IS2404 PCR is mostly used for the diagnosis of BU. Antibiotics and surgery are frequently used for the treatment. Heat treatment has also been found effective for BU. The condition could lead to disabilities if not treated on time such as amputation of the vital organ *i.e.* eye or the limbs. The affected person may face the problem of social stigma and economic challenges as a consequence of these disabilities. No vaccines are available yet for BU. However, short-lived protection is obtained using the BCG vaccine. The disease is not fatal, however.

Keywords: Deformities, *Mycobacterium ulcerans*, Necrotizing Ulceration, Rifampicin.

INTRODUCTION

Buruli Ulcer (BU) also called the Brainsdale ulcer, has been identified as a re-emerging endemic disease in many countries of the world including Africa, Asia, The Americas, and Western Pacific. But the situation is more dominant in Sub Saharan regions (predominantly in West Africa), where the prevalence of BU is more than tuberculosis [1]. BU has also been reported along the localized coastal area of Victoria in Australia [2]. The wetlands and flooded areas are more prone to BU.

The young adults of less than 15 years are mostly affected by the disease. About 24000 cases had been reported in West African regions (1978-2006), 7000 cases

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in Benin (1989-2006), and 21 cases in Nigeria respectively. In Ghana, about 1000 cases are reported annually where the nationwide prevalence is 150.8 / 100,000 individuals. 2037 cases were reported to WHO in 2015. The disease is characterized by chronic, debilitating subcutaneous destructive infection of the skin, soft tissues, and adipose tissue caused by *Mycobacterium ulcerans*, the same potential environmental pathogen which causes leprosy and tuberculosis [3]. The pathogen requires a temperature of 30-32C and low oxygen (2.5%) for its growth. The incubation period for *Mycobacteria ulcerans* is 5-8 weeks. It produces the toxins "mycolactone" which causes tissue damage and suppresses the immune response [4]. The most affected areas are the limbs (forelimbs and hind limbs) where 80% of the infection occurs. In advanced infections, the bones are adversely affected which causes gross disfigurement and deformities. However, the disease is not fatal.

There are controversies about the transmission of the causative agent. Various research projects are underway which will give a better understanding in the future for its dynamic transmission, thus control of the disease. Current studies suggest that the possible mode of transmission of the infection may be the abraded skin or traumatic injuries contaminating water, vegetation, or soil. Non-mammalian vertebrates and invertebrates (snail) have been reported to be the reservoir of *Mycobacteria ulcerans*. The aquatic insects and mosquito could also be a source of transmission of BU [2].

SYMPTOMS

In early infection, the disease appears as a nodule, plaque, papule, or oedema. If left untreated the condition of this ulceration may enlarge with undermined edges. The disease is characterized by a necrotic painless ulcer with no fever. The massive destruction of the skin leads to contracture deformities caused by cytotoxic mycolactone (a potential toxin which causes tissue damage and suppresses the immune response) and macrolide produced by *Mycobacteria ulcerans*. If delayed prolong, the disease may lead to amputation of the affected area, leading to permanent functional disabilities *i.e.* blindness or amputation of limbs.

The affected person may face the problem of social stigma and economic challenges as a consequence of these disabilities.

DIAGNOSIS

Clinical Diagnosis

The disease is diagnosed based on the location of lesions, the extent of pain,

geographical area, age, medical and travel history of the patient by the experienced doctors in these endemic areas.

Laboratory Diagnosis

According to WHO guidelines, the disease is diagnosed in the laboratory using IS2404 PCR, biopsy, histopathology, direct microscopy, and culture. However, PCR is most frequently used to test the occurrence of the disease [5]. Early diagnosis and early treatment will ensure the timely recovery from the infection.

DISEASE MANAGEMENT

Medicines

Treatment involves a combination of antibiotics and other complementary treatment irrespective of the stage of infection for 8 weeks [6].

- A combination of rifampicin (10mg/kg once daily)+streptomycin (15mg/kg once daily)
- A combination of rifampicin (10mg/kg once daily) + clarithromycin (7.5mg/kg twice daily) [7]
- A combination of rifampicin (10mg/kg once daily) + moxifloxacin (400mg once daily)

Surgery

Wound management and surgery are performed along with antibiotics to enhance the process of healing [8]. In some cases, surgery is inevitable for treatment in advanced infections. Surgery is performed to remove the necrotic tissue and grafting the resulting defect. Post-surgery nursing care will minimize the duration of treatment. Physiotherapy is performed to prevent the chances of disability in infected persons.

Heat Treatment

Buruli Ulcer can be treated with heat treatment along with sodium acetate trihydrate as a heat application system [9].

Vaccines

Currently, no vaccines are available for Buruli Ulcer [10]. However, short-lived protection is obtained using the BCG vaccine.

CHAPTER 25

Whooping Cough: *Bordetella Pertussis* is the Causative Agent

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Abstract: Whooping cough is a respiratory tract infection mainly occurs in children and infants. *Bordetella pertussis* is bacteria that is responsible for the cough. It is a gram-negative bacteria that belong to the Cocco-bacillus group. Whooping cough is also known as Pertussis. Parents and siblings play a major role in its transmission. It is transferred from person to person. Illness, sneezing, and cough are the main symptoms. By observing the victim it can diagnose easily, by a blood test or by physical examination. However, the treatment of cough is now present in this era. Vaccination is present for treating pertussis. These vaccines are effective, but not enough efficient in their performance. Before the advent of vaccines, pertussis is an epidemic disease, but nowadays it is working against cough for treatment to some extent. More advanced techniques are trying to discover for treating and curing pertussis.

Keywords: Epidemic, Pertussis, Transmission, Vaccine, Whooping Cough.

INTRODUCTION

Pertussis (whooping cough) is a respiratory tract infection. It is the oldest known epidemic disease. In early times, human beings thought about it had been occurring by an infectious agent like HIV. Later on, the main cause of whooping cough would identify, which is by *Bordetella pertussis*. Before the discovery of vaccination, people thought it was only a childhood disease [1]. It is a gram-negative bacteria that belongs to coccobacillus [2]. *Bordetella pertussis* enters into a respiratory tract which attaches with a cilia line and secret poison, which swells the cilia line and causes cough. It is transmitted by person to person by sneezing mostly by parents and siblings [2, 3]. It can affect all age group people but mostly affects the children or infants badly. It is both endemic and epidemic kind of disease. Vaccines are involved in the treatment of cough. There are different types of vaccines that are used nowadays for the treatment of Pertussis, among different

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types of vaccines being used Acellular pertussis is a type of vaccine which is widely used in New Zealand [4]. Babies cannot get vaccination until they reached the age of two months.

SYMPTOMS

Serious illness mainly occurs in infants, children, and somehow in adults but it also occurs sometimes without showing any illness Fig. (**10**).

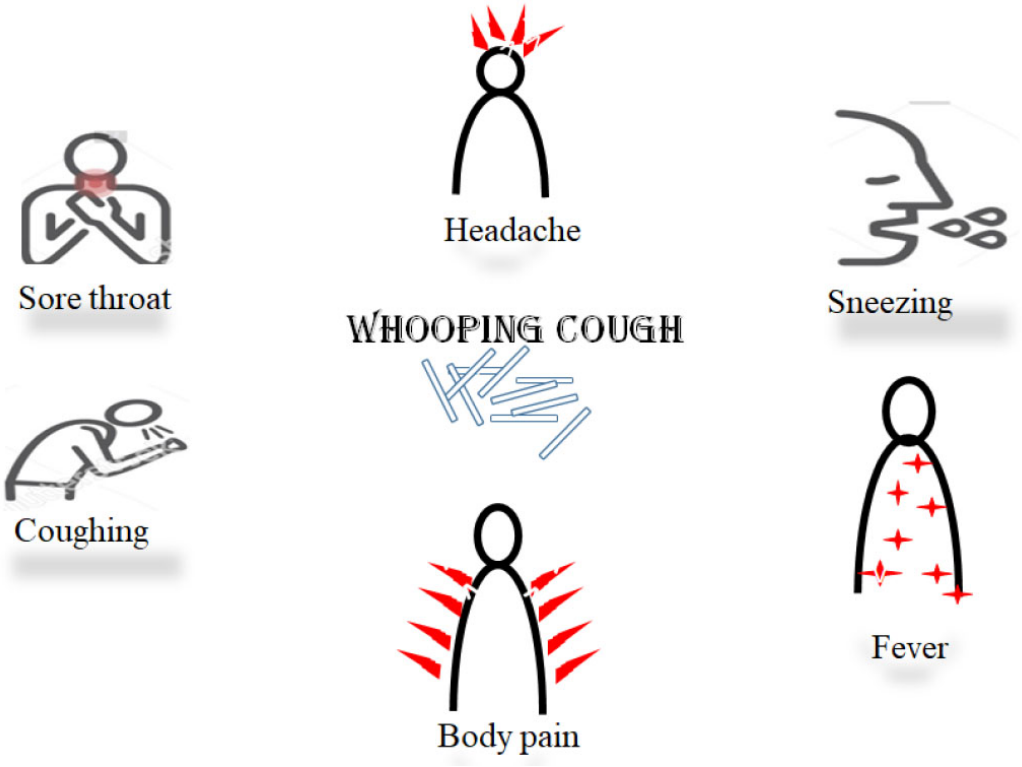

Fig. (10). Symptoms of whooping cough.

Usually, a symptom occurs within 5-15 days after exposure, common symptom includes sneezing, cough, and fever, *etc*. [2, 5].

DIAGNOSIS

By considering the victim, whooping cough is simply diagnosed. Few more steps are also done for diagnoses such as blood tests, symptoms, and physical examination. In recent advances, new techniques are used for diagnosis, especially for those infants who have no vaccination against pertussis like antigen

detection by PCR, most sensitive antigen detection into a blood serum and oral fluid. All these techniques have a rapid contribution in diagnosis and for preventing measures [5].

TREATMENT

Mainly treatment is not started in its early stages. In its harsh conditions, treatments are given to the patient from different ways depending on its severity.

Medicines are used to cure pertussis in a form of syrups such as hydryllin, tutsyia, and Benadryl.

Surgery and radiotherapy are not involved in pertussis treatment.

Vaccines are widely used for their curing purpose. For short treatment, erythromycin and azithromycin are used. There are macrolide antibiotics. Antibiotics have no clinical effect on pertussis but it eradicates *B. pertussis* to reduce the spreading infection. Unfortunately, there are still no disease-specific therapies present against pertussis.

Vaccines for Pertussis

From 1926 to 1930, approximately more than 30,000 deaths occurred due to pertussis in the USA. At the time of 1906 few organisms found to be used for vaccination. With early vaccination development, more doses were involved against pertussis treatment. In very early stages of vaccine formation, a whole-cell pertussis vaccine was developed. Later on, acellular vaccines of pertussis were developed. Numbers of proteins or factors were found in pertussis as toxins that were used as vaccines against cough [2]. In recent studies, vitamin C is found to have an efficient effect against whooping cough. Sodium ascorbate is another chemical involved in preventing measures of cough. Acellular vaccines need more doses as quantity increases reduce the efficiency of an immune system against cough. The natural immunity power against whooping cough remains at least 30 years while vaccine immunity remains for 3 years. Liposomal sodium ascorbate obtained from Amazon or i-herb. As vitamin C is non-toxic to a human body, its excess amount is naturally removed from the body even during the treatment of whooping cough. So many works have done by the body with the use of vitamin C [6].

CONSENT FOR PUBLICATION

Not applicable.

CHAPTER 26

Tetanus (Lockjaw): A *Clostridum Tetani* Infection

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Abstract: Tetanus is also known as lockjaw, *Clostridium tetani* are its infectious agent. A toxin is produced by that bacteria affects the nervous system and brain, which leads to muscle stiffness. Neurotoxin affects the nerves which control the movement of muscles when the spores of *Clostridium tetani* entered into the wound. When tetanospasmin enters into the bloodstream, it spreads into the body immediately, appearing tetanus symptoms. The person who is suffering from stiffness and muscle swamp should go for the medical checkup instantaneously. After 7 to 10 days of starting infection, the symptoms of tetanus usually appear. Doctors prescribe metronidazole or penicillin for tetanus treatment. These antibiotics stop the bacterium from producing endotoxin and multiplying that causes stiffness of muscles and muscle spasms. Tetracycline is given to allergic patients instead of penicillin and metronidazole.

Keywords: *Clostridium tetani*, Metronidazole, Penicillin, Tetanus, Tetanospasmin, Tetracycline.

INTRODUCTION

Tetanus is a disease caused by bacteria. The bacteria present in manure, environmental agents, and soil. A person who has a wound with polluted objects and got the infection that can damage the whole body [1]. It can be fatal. It is also known as lockjaw, *Clostridium tetani* are its infectious agent. A toxin produced by those bacteria affects the nervous system and brain, which leads to muscle stiffness [2]. Neurotoxin affects the nerves that control the movement of muscles when the spores of *Clostridium tetani* entered into the wound. In America, there are almost thirty cases per year [3]. Many people do not get vaccinated or do not take boosters within 10 years. Tetanus should be medically treated immediately. It will require antibiotics and violent wound treatment [4]. Serious breathing difficulties and muscle spasms caused by this infection which can be dangerous.

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The treatment of tetanus is not effected uniformly although it exists. The vaccine is the only method to escape from tetanus [5].

CAUSES

Clostridium tetani bacterium caused tetanus. The spores of this bacterium can live for the long-duration exterior of the body. When it got into the body it increases in number rapidly and produced tetanospasmin that is a neurotoxin [6]. When tetanospasmin enters into the bloodstream, it spreads into the body immediately, symptoms of tetanus appear. Tetanospasmin disrupts the signals coming from the brain to nerves and then the spinal cord, and then towards the muscles, causing muscle stiffness and spasms [6]. Mostly *Clostridium tetani* go inside the body mainly by the skin or through the wounds. If ant cut is cleaned thoroughly then infection is not developed. The easy way to diminishing tetanus is: which includes dead cells, wounds that are polluted with crush injuries, saliva, feces, or burns [5]. The rare methods of diminishing tetanus include injections in the muscle, insect bites, surgical procedures, compound fractures, intravenous drug use, superficial wounds, intravenous drug use, and dental infections.

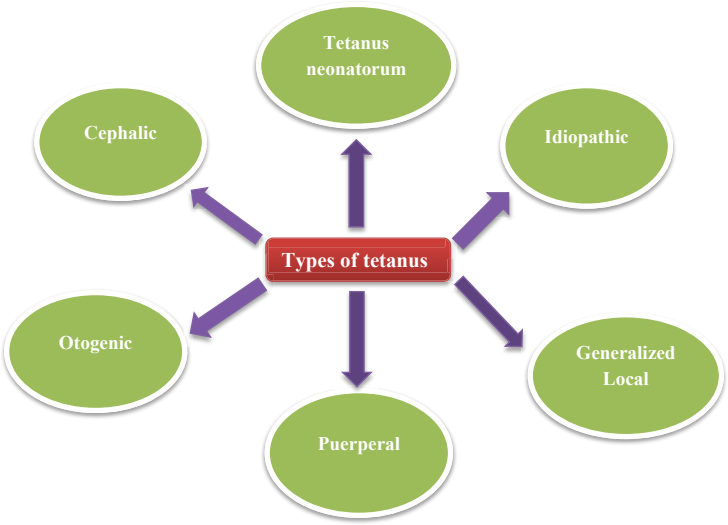

Fig. (11). Types of tetanus.

SYMPTOMS

After 7 to 10 days of starting infection, the symptoms of tetanus usually appear. But it may change from 4 to 21 days and in other cases, it prolonged till months

[7]. Commonly, if the injured place is away from the brain, the incubation period prolonged. If the incubation period is shorter patients have more harsh symptoms. Stiffness and spasms are symptoms of muscles [8]. Stiffness usually began with the grinding of muscles, therefore, called lockjaw. Throat and neck are affected by the muscle swamp and cause problems in swallowing. The spasms of facial muscle have common in patients. The stiffness of the chest and neck muscle may cause breathing difficulties [9]. Limb and abdominal muscles are also influenced by some people. In some cases when the infection is spread to back muscles, the spine roguish backward. It occurs usually when the disease of tetanus occurred in children Fig. (**11**). The symptoms of tetanus in organisms are as followed: rapid heartbeat, headache, bloody stools, sore throat, fever, touch sensitivity, diarrhea, and sweating [7].

DIAGNOSIS

Most doctors never tackled tetanus patients in many areas of the world. Infection is rare because the vaccine against tetanus is mostly given in childhood for immunity. For example, in 2009 in America, only 19 patients of tetanus were found. The treatment is more active when tetanus is analyzed in the early stages. A person who has stiffness and muscle swamp, the tetanus symptoms are more effectively-identified in him [10]. The patient who is taking drugs, the symptoms of tetanus appear later because their medical conditions are different [11]. A blood test confirmed the presence of disease. The person who is suffering from stiffness and muscle swamp should go for the medical checkup instantaneously. The danger of life is greater if the patient is not under the observation of a doctor and the death rate is different from forty to seventy-six percent [9].

COMPLICATIONS MAY COMPRISE

- Fractures Sometimes, bone fractures may lead by muscle convulsions and spasms, in severe cases.
- Pulmonary embolism Blood vessels of the lungs blocked and affect circulation and breathing. The patient will instantly require anti-clotting medication and oxygen therapy.
- Aspiration pneumonia If the stomach’s contents and secretions are gasped, lower respiratory tract infections develop, causing pneumonia.
- Tetanic seizures A person who is affected with tetanus experience fits if infection extends to the brain.
- Laryngospasm Spasm of the voice box cause breathing difficulties. The patient may suffocate in severe cases.

CHAPTER 27

Diphtheria: *Corynebacterium Diphtheria* is the Causative Agent

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Abstract: Diphtheria is an acute disease caused by a specific bacterium C*orynebacterium diphtheriae.* In 1883, Klebs first discovered this bacterium in diphtheritic membranes. Diphtheria can spread from one person to another person by direct contact or it may be spread by air. Different symptoms occur during infection and symptoms appear after 7 days of infection. Symptoms of the disease are changed from mild to severe. When the diphtheria disease occurs then a thick covering is formed in the throat. This covering causes difficulty during breathing and it can block the airway. PCR, ICS, and Elek test are used for the diagnosis of the toxin. Mostly children and adult lives are threatening by diphtheria. Vaccines are available for diphtheria disease. 5% to 10% of deaths occur in the affected person. Antibiotics and antitoxin are also available for the treatment of the disease.

Keywords: Antitoxin, Antibiotics, Diphtheria, ICS, Pseudo membrane.

INTRODUCTION

Diphtheria is an acute disease caused by a specific bacterium C*orynebacterium diphtheriae.* In 1883 Klebs first discovered this bacterium in diphtheritic membranes Table **2**. Diphtheria can spread by air, direct contact, and contaminated objects. Diphtheria can also spread with cough and sneezes of an infected person. When the diphtheria disease occurs then a thick covering is formed in the throat. This covering causes difficulty during breathing and it can block the airway. Diphtheria can cause paralysis, heart failure, and may even cause death. The symptoms of Diphtheria disease are changed from mild to severe. The symptoms appear two to five days after infection. In the beginning, the symptoms come gradually with the fever and sore throat but in severe condition, a white layer is formed at the back of the throat [1]. Diphtheria can

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Muhammad Imran Qadir (Ed.)

spread from one person to another person by direct contact or it may be spread by air. Sometimes *Corynebacterium diphtheriae* is present in some people but they have no sign of disease but they can spread the Diphtheria in other people. Mostly children and adult lives are threatening by diphtheria. Vaccines are available for diphtheria disease [2]. 5% to 10% of deaths occur of the affected person.

Table 2. History of diphtheria.

History	*Work*
5th century BCE	Hippocrates is the first to describe the disease.
6th century	First observations of diphtheria epidemics by the Greek physician Aetius.
1883	The bacteria identified by the German scientists Edwin Klebs and Friedrich Löffler.
1892	Antitoxin treatment, derived from horses, first used in the U.S.
The 1920s	Development of the toxoid used in vaccines

SYMPTOMS

Different symptoms occur during infection and symptoms appear after 7 days of infection. The different signs and symptoms of diphtheria are painful swallowing, headache, cough, sore throat, fatigue, fever, difficulty in breathing, nasal discharge. When infection occurs then healthy tissues are destroyed in the respiratory system [3]. These destroyed tissues form a layer in the throat or nose. This layer is also called a pseudomembrane. This membrane covers the tissues in tonsils, voice box, and nose cause difficulty in breathing [4].

DIAGNOSIS

Different tests are used for the identification of diphtheria. These are the following tests.

ICS Test

ICS test ICS is standing by an immune-chromatographic strip and it is used for the detection of toxin produce by diphtheria [5].

Elek's Test

Elek's test The Elek test is also called an immuno-diffusion technique. This test is used to check the toxigenicity of *C. diphtheriae.* Stephen Dyonis Elek was a microbiologist and discovered the Elek test. An antitoxin paper strip is used in the Elek test [6].

PCR

PCR The PCR is used for the detection of toxin genes present in diphtheria. Specific primers are used for the detection of a toxic gene.

Enzyme Immunoassay (EIA)

Enzyme Immunoassay (EIA) The EIA is another diagnostic test use for the detection and identification of toxigenicity of diphtheria and enzyme immunoassay is a simple, accurate, rapid method. In EIA polyclonal antitoxin is used [7].

MANAGEMENT

When diphtheria infection occurs then different treatments should be taken from the prevention of disease. Antitoxin and antibiotics are administered to neutralize and kill the bacteria and its infection. In the early stage, diphtheria antitoxin should be used to reduce bacterial infection [3].

Diphtheria is a serious disease therefore doctors try to treat it immediately. They recommend an antitoxin and antibody.

Antitoxin

When diphtheria infection occurs then doctors administer an antitoxin to remove and neutralize the toxin that is already present in the bloodstream of an infected person. Doctors perform a different allergy test before administering the antitoxin to make sure that the infected one has not any allergic problem [8].

Antibiotics

Another important element that is used for the treatment of diphtheria is antibiotics which include penicillin or erythromycin. These antibiotics are used to kill the bacteria and remove the infections and the recovery period is a few days after antibiotics taken [9].

Vaccines

Diphtheria vaccines are available that use against *C. diphtheriae.* The vaccine reduces the number of affected people. During childhood, three doses are recommended. Diphtheria vaccine is safe and has no side effects and only a bump is formed at the injection site of the vaccine. The diphtheria vaccine is administered with a combination of other vaccines *e.g.* Hib vaccine and hepatitis vaccine. Infanrix and Daptacel are the brand name of the diphtheria vaccine [9].

CHAPTER 28

Cholera: A Waterborne Disease Characterized by Diarrhea

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Abstract: Cholera is a disease caused by a bacterial strain *Vibrio cholerae* in the small intestine which is a waterborne disease characterized by diarrhea cause loss of water from the body. *Vibrio cholerae* is the major etiology agent of the cholera disease. There are two O1 and O139 strains of bacteria that produce a toxin which can cause cholera disease, blood infection, and also cause the economic loss of the world. The major causes of cholera are contaminated food and unhygienic water. The bacteria causing the disease exist in water, lakes, and rivers. Over 100,000 deaths occur each year due to cholera. Different management systems are used to control the disease in which different vaccines are used like a rotavirus vaccine, Killed Oral Cholera Vaccine, which includes Dukoral, Shankol, and Euvichol. Different antibiotics used for control of disease and oral-radiation therapy are used to control the disease. Infectious diseases are avoided by taking different preventive measures like hygienic food and hygienic water.

Keywords: Cholera, Cholkit Test, Diarrhea, Dipstick Test, Hygienic Food, Hygienic Water, Rotavirus Vaccine, *Vibrio cholerae*.

INTRODUCTION

Cholera is a disease caused by a bacterial strain *Vibrio cholerae* in the small intestine which is waterborne disease diarrhea that causes loss of water from the body. *Vibrio cholerae* is the major etiology agent of the cholera disease. There are two O1 and O139 strains of bacteria that produce a toxin which can cause cholera disease, blood infection, and also cause the economic loss of the world. It is an infectious disease and the bacterial strain present in contaminated food and water, and this bacterial infection spread due to unhygienic conditions [1]. This bacterial strain is gram-negative. The major cause of cholera is food and water which is contaminated with faces and this problem occurs due to lack of sanitation. So this

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bacterial strain gets high prevalence due to the unhygienic food and water uptake [2]. There are different risk factors for cholera which include unhygienic and unboiled water; poverty is one of the factors for cholera, and lack of proper sanitation. And some risk factors related to the food which includes the uptake of specific food products like vegetables, fruits, or rice and consumption of shellfish. And another risk factor is the association between the host and the pathogen *Vibrio cholerae*. These bacteria also found in rivers, lacks, and water coastal. This bacterium affects aquatic animals so industries that are related to these aquatic organisms are also affected. And the contaminated water can cause infection in neighboring areas. There are many outbreaks of cholera in different countries of the world like Kenya, Bangladesh, and Haiti [3]. Over 100,000 deaths occur each year due to cholera disease. The two strains O1 and O139 cause an outbreak in Bangladesh, Kenya [4]. Cholera can spread by drinking contaminated water or food with the feces of the infected person, lack of hygienic conditions, reduced sanitation, and in congested areas. In 2015 due to cholera 28,800 deaths occurred worldwide. Globally cholera spread in 50 countries of the world including Africa, Asia and Karbala, and so on the first outburst of cholera occurred in India in the region of Bengal, then from India, this disease spread in different countries of the world like Asia, Europe. In the past, it was thought that cholera occurred due to contaminated air but scientist Jhon Snow showed that cholera occurred due to contaminated water because the bacterial agent *Vibrio cholerae* lived in water conditions Fig. (**12**), and he proved this statistically during the epidemic of cholera in London in the 19th century [5].

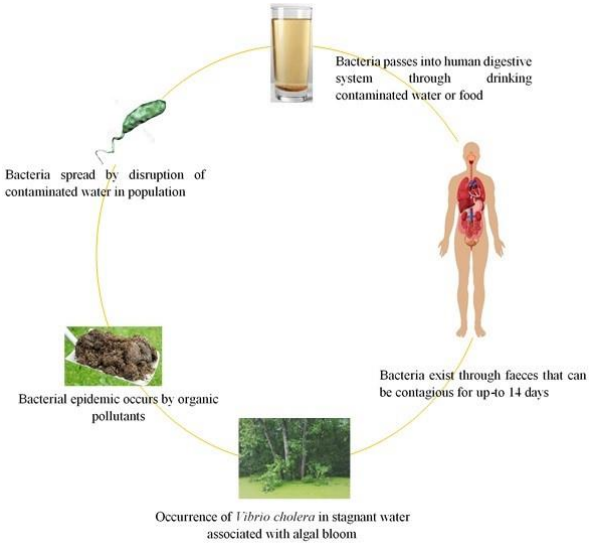

Fig. (12). The life cycle of *Vibrio cholerae*.

SYMPTOMS

Different symptoms appeared during cholera and different tests are used to diagnose cholera and different medicines and vaccines are used to control that disease and some preventive measures are used to prevent the disease. There are some common symptoms and some acute cholera cases. Cholera can cause a large amount of diarrhea which can cause loss of a large amount of water from the body, vomiting, cramping of muscles, and severe conditions that cause dehydration and imbalance of pH of the body. The symptoms of the disease appeared after 2 to 5 days to the exposure of bacterial strain and the duration of the disease is a few days [6].

DIAGNOSIS

Different tests are used for the diagnosis of cholera; cholera is diagnosed by a stool test by collecting the fecal sample of cholera patients. The colour and quality of the fecal sample of the patient help to diagnose cholera by visual testing. Malabsorption of fats in the feces and pH of the fecal sample used to diagnose cholera by different chemical tests. Microbiological tests are also used for diagnosis.

Dipstick Test for Diagnosis of Cholera

To diagnose cholera a crystal VC dipstick test is performed. In this test, the fresh sample of faces of the cholera patients is collected and two drops of the stool sample which is in liquid form supplemented in the vial and mixed well then few drops of the sample which is processed mixed and added in the test tube. Then the strip which is crystal VC dipped into the sample in the test tube and then the test results were analyzed [7].

Cholkit Test

In this test stool sample is used in liquid form, 5 drops of a stool sample were mixed with Tris- sodium chloride-tween and the ratio of both the samples 1:1 and mixed well both of these samples in a microcentrifuge and a cholkit is dipped in the tube for 15 minutes and on the kit, a control line and test line appeared simultaneously in red after test which shows positive results for *Vibrio cholerae* strain O1 and just one line appeared like a control line this means the negative results for the *V. cholerae* strain O1 [7].

Slide Agglutination Test

In this test a monoclonal antibody which is ICL-33 used for the detection of O1 strain of *Vibrio cholera* by the use of an agglutination slide TTGA to grow the

CHAPTER 29

Impetigo: A Skin Infection Caused by *Streptococci* and *Staphylococci*

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Abstract: Impetigo is a skin infection which is caused by a bacterial strain of *Streptococcus* and *Staphylococcus*. Impetigo has two types, bullous impetigo, and non-bullous impetigo. Impetigo is more common in children however it can affect any age. It begins with a small pimple and ends with blisters which break the skin and thus cause infection. Treatment of impetigo includes topical antibiotics in which fusidic acid and mupirocin have used cream and can be applied on site of infection. Oral antibiotics include erythromycin, penicillin, and flucloxacillin. But the oral antibiotics are not as effective as topical antibiotics. But when the topical antibiotics show no results then oral antibiotic is used.

Keywords: Diagnosis, Impetigo, Treatment, Types.

INTRODUCTION

Impetigo is a bacterial skin infection which is due to two strains of bacteria named *Streptococcus* and *Staphylococcus*. These two bacteria release a toxin that breakdown the skin forming pustules. This disease is more common in children than in adults. These are two forms of impetigo non-bullous impetigo, bullous impetigo [1].

PREVALENCE

Impetigo is usually spread by direct contact. In the United Kingdom, the annual spreading of impetigo was 2.8% in the children at the age of 4 years and 1.6% at the age of 5 to 15 years. Almost 70% of cases were nonbullous impetigo and patients transmitted this disease further to themselves and others by damage an infected area [2]. Thus the infection is spread mostly through schools and daycare

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centers. The infection is occurring mostly in poor hygiene, crowded environment, and mostly in summer [3].

DIAGNOSIS

Non-bullous Impetigo

It is due to *Streptococcus pyogenes* or by both staph and strep .5-10% is usually due to strap bacteria alone. Red spots are formed on the skin around nose and mouth and in this way small pustules are formed which in the form of clusters spread on the other area of skin then this pustule rapture and formed a yellow crust on the skin they are not painful but fretful. When they recover they look like a red spot they leave a trauma on the skin. It is usually in the age of 2 years children [4].

Ecthyma

It is due to either *Streptococcus pyogenes* or *Staphylococcus aureus* or both types of bacteria. In this small pus-filled sores are formed which have a thicker crust, it is more severe than the other type of impetigo because the sore can go deep into the skin. The sore becomes large and deep and thus formed a reddish-purple skin at the site of infection. Mostly occur around buttocks, thighs, legs, ankles, and feet. If non-bullous and bullous impetigo leaves untreated they formed ecthyma which recovers slowly and thus left a trauma on the skin [5].

Bullous Impetigo

It is due to *S. aureus* bacteria which form larger pustules that further form a bullae and this bullae is filled with fluid. When they split yellow crust with ejaculation results. It mostly occurs around moist areas, for example, diaper area, axillae, and neck fold. Symptoms may include fever, weakness, and diarrhea [6].

TREATMENT

The basic aim of treatment includes preventing the further transmission of infection within the patients and others. Treatment should have limited side effects, inexpensive and effective. Topical antibodies have advantages over the oral antibiotic but some patients are more susceptible to these antibodies [7].

TOPICAL ANTIBIOTICS

For the treatment of impetigo, three studies concluded that topical antibodies are more effective than oral antibiotics because they can apply on skin anywhere and

do not cause any adverse effects. Mupirocin and fusidic acid are effective and well-tolerated against them. Adverse effects of topical antibodies were uncommon and mild when present [8].

Fusidic Acid

It is more effective against the strains of *S. aureus* bacteria because it penetrates the skin. It is less effective against Streptococcus. Gram-negative bacteria have resistance to fusidic acid. It is a steroid antibiotic often given in forms of cream, tablets, eye drops, or injections [9].

Mupirocin

It is topical antibiotics and used as a cream. It is effective against *S. aureus* and also effective against methicillin which causes impetigo or folliculitis. It contains benzyl alcohol, cetyl alcohol, and stearyl alcohol. The patients who are sensitive to these ambient are recommended to use emollient. Both fusidic acid and mupirocin are effective as compared to oral antibiotics [10].

ORAL ANTIBIOTICS

When topical antibodies do not show results then oral antibodies are used. For example, erythromycin, penicillin, and flucloxacillin. These antibiotics are used in the past but due to their replacement with drug resistance, they are not used routinely. Resistance rates vary regionally so it is recommended to check the resistance pattern of appropriate antibiotics [7].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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CHAPTER 30

Lyme Disease: A *Borrelia Burgdorferi* Infection

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Abstract: Lyme disease is an infection that is caused by ticks and strains of bacteria *Borrelia burgdorferi*. The disease is transmitted to humans and also to the livestock and pets through ticks. Symptoms of this disease are headache, fever, and other skin infections. Diagnosis of this disease is difficult but can be diagnosed by ELISA and western blot tests. Different types of antibiotics are used for the treatment of Lyme disease. Through drugs and antibiotics, recovery begins sooner.

Keywords: Causes, Lyme disease, Symptoms, Treatment.

INTRODUCTION

Lyme disease is the infection that is caused by the bite of the deer tick. Several strains of bacteria also cause this disease. The main cause of this disease is *Borrelia burgdorferi*. Lyme disease was first discovered and recognized in 1874 and it occurs mostly in the children. It is the vector-borne disease and most common in the US. It is transmitted to humans when the ticks bite them. It is transmitted only when the ticks came in contact with humans. It is not transmitted from person to person. Multiple organs are disturbed due to this infection [1]. The disease is rare but fatal.

SYMPTOMS

Erythema Migrans

It is the first symptom of the disease. The skin becomes red or red rash appears on the area where tick bites. The rash area became more highlighted with time if not treated with antibiotics. The most common symptoms accompanied headache, fever, fatigue [2].

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Arthritis

If the disease left untreated after the bite of a tick, the infection may spread to joints. The joints became swollen and more painful and this pain lasts for weeks or even months.

Heart Problem

Irregular heartbeat and dizziness occur if the disease is not treated.

Neurological and Other Symptoms

The symptoms are changes in sleeping habits, fatigue. Other symptoms are the inflammation of eyes and joints pain and hepatitis.

DIAGNOSIS

Its diagnosis is difficult sometimes. Doctors may ask for genetic reports. Lab test identifies bacteria responsible for the disease. Ticks are important clues for diagnosis [3].

They test includes:

- ELISA detects antibodies. Sometimes, false-positive results occur.
- Western blot testing is also helpful. A positive test confirms the diagnosis [4].

TREATMENT

For treatment, antibiotics are used:

- Intravenous antibiotics are used but they can cause side effects leading to diarrhea [5]. When few doses of these antibiotics are given, the disease is recovered but it may still have many symptoms.
- The FDA warns against the use of bismacine. Bismacine, also known as chromacine, shave bismuth-containing its toxic level. Bismacine can cause bismuth poisoning, which may lead to heart and kidney failure.
- Oral antibiotics are also used.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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CHAPTER 31

Peptic Ulcer: A *Helicobacter Pylori* Infection

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Abstract: *Helicobacter pylori* infection which is a constantly occurring disease causes damage to normal regulation and function of gastric acid. It was estimated that peptic ulcer infection was developed in about only 15% of persons that were infected with *Helicobacter pylori*. Burning, epigastric pain, and nocturnal pain after food intake are typical symptoms. Urea breath test, stool antigen test, or an endoscopic biopsy and ELISA may be performed as a diagnostic test for confirmation of occurrence of *Helicobacter pylori infection* in peptic ulcer patients. Management for peptic ulcer infection includes drug treatment and surgery.

Keywords: Diagnosis Test, *H. pylori*, Managements, Peptic Ulcer.

INTRODUCTION

Peptic ulcer infection occurs in the gastrointestinal tract that initially damages mucus secretion, then damages pepsin and gastric enzyme secretion. In the stomach and duodenum, it is commonly present and it is less commonly occurs in the lower esophagus. Gastric acid secretion initiates the process of digestion in the body and plays a unique role as the first line of defense against many microorganisms such as food-borne microbes. *Helicobacter pylori* infection which is a constantly occurring disease causes damage to normal regulation and function of gastric acid. The successful culture of *Campylobacter pylori* was first examined with its taxonomic features in detail. Due to minor differences in features with other campylobacter and its exceptional features, *C. pylori* was named *Helicobacter pylori.* The person with peptic ulcer harbors the organism only in gastric epithelium. *H. pylori* cluster around cells and are not found in the blood. In the study, it was concluded that there is a high risk of gastric cancer for patients with gastric ulcers infected by *Helicobacter pylori* [1].

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PREVALENCE AND CAUSES

The major cause of peptic ulcers includes *H. pylori* infection and the other one is non-steroidal anti-inflammatory drugs (NSAIDs). It was estimated that peptic ulcer infection was developed in about only 10 to 15 percent of people that were infected due to *H. pylori*. Elimination of residing *H. pylori* lowers the risk of ulcer formation from fifty-nine to four percent in patients with peptic ulcer. Peptic ulcer infection occurs at the age between 25 and 64 years in 70 percent of patients. The estimation of annual health care cost of the disease is about $ 10 billion in the United States but through maximum use of proton pump inhibitors minimizes the rate of *H. pylori* infection directly or indirectly. Hepatic cirrhosis, tuberculosis, chronic renal failure, Crohn's disease, sarcoidosis, cytomegalovirus, and myeloproliferative disorder are risk factors associated with peptic ulcer disease [2].

SYMPTOMS

Specific findings for peptic ulcer helpful in the diagnosis are ITS distinctive symptoms of peptic ulcer disease include burning epigastric pain; pain occurring on an empty stomach or two to five hours after meals; and nocturnal pain after food intake. Less common features observed as peptic ulcer symptoms include vomiting, intolerance of fatty foods, heartburn, indigestion, loss of appetite, and positive family history. The physical diagnosis is also helpful to reduce the possibility of the occurrence of ulcers.

Symptoms of peptic ulcer infection vary among individual populations. Abdominal pain is absent in older patients with peptic ulcers. Fear of food intake leads to weight loss is characteristic of gastric ulcers [3].

DIAGNOSIS

For the diagnosis of peptic ulcer, proper physical examination of the patient is required to perform. The person with age younger than 55 years comes under less risk level of peptic infection. Recommended tests for peptic ulcer disease should be based on symptoms of patients. Enzyme-linked immunosorbent assay (ELISA), urea breath test, stool antigen test, or an endoscopic biopsy performed as a diagnostic test for confirmation of the presence of *H. pylori* in peptic ulcer patient.

ELISA is useful for initial infection diagnosis and diagnosis in large population surveys. The stool antigen test is highly accurate in specificity and sensitivity like the urea breath test. However, the urea breath test is not cheaper and convenient in equipment like the stool antigen test. Though, both tests performed to confirm

suppression of *H. pylori.* Endoscopy is preferred if a patient of 55 years or more showing continuous symptoms of peptic ulcer infection. The therapy eradicates the ulcer formation within one or two weeks of endoscopy [4].

MANAGEMENT

Management for peptic ulcer infection includes treatment and surgery. Eradication of *Helicobacter pylori*, histamine H2 blockers, proton pump inhibitors is used as a treatment for the management of peptic ulcer disease. Eradication therapy is recommended for about 10 to 14 days and 1, 5, and 7 days for short duration treatment. The rate of eradication is eighty to ninety percent or more. Histamine H2 blockers are administrated for duodenal ulcers and after four weeks, the healing rate is 70 to 80 percent and 87 to 94 percent healing after eight weeks of administration. Treatment duration of proton pump inhibitor for duodenal ulcer is 4 weeks and the healing rate is 80 to 100 percent.

Surgery is recommended for the patient who had multiple medications. The patients who are not affecting with medication with no response and those at complications with high risk are also recommended for surgery. Surgery for duodenal ulcers includes highly selective vagotomy, truncal vagotomy, partial gastrectomy, and selective vagotomy. Partial gastrectomy with gastroduodenal anastomosis is recommended for gastric ulcers [5].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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CHAPTER 32

Toxic Shock Syndrome: A Condition Caused by Endotoxin Produced by *Staphylococcus Aureus*

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Abstract: Toxic shock syndrome is an uncommon but life-threatening disease which is caused by the poisonous endotoxin (TSS-1) produced by *Staphylococcus aureus* bacteria. Toxic shock syndrome was first described in children in the l976. This disease is more common in women than in men. Infection is caused due to the entrance of bacteria in the body through skin opening such as cuts or wounds or due to poorly conducted skin surgery, skin-burn, and skin infection. Prevalence of *S.aureus* colonization and antibodies by age, geographical area there was no significant difference found in the rate of toxigenicity and colonization while the population study prevalence was found to be 26%. Symptoms of TSS were skin rashes, headache, fever, vomiting, diarrhea, including neurological disturbance and the central nervous system disturbance along with organ failure. The diagnosis was done using Cole and Shakespeare's criteria proposed for toxic shock syndrome it can be also diagnosis from body fluids test and urine test. Management includes seven R's which are very important for managing the toxic shock syndrome.

Keywords: Cole and Shakespeare, Endotoxin, Management, Shock, Skin-Burn, "*Staphylococcus aureus"*, Toxigenicity, Toxin, TSS-1.

INTRODUCTION

Toxic shock syndrome is a life-threatening disease that is caused due to the toxins produced in response to group A *Staphylococcus* infection or *staphylococcus* aureus. It is also known as *Staphylococcus* pyogenes. It is further characterized by fever, skin rash, hypotension, and failure of more than one organ after acute "illness" including diarrhea, vomiting. The toxic syndrome was first described in children in the late 19th century *i.e.* 1976. This disease is commonly found in women [1].

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Infection is caused when bacteria enter into the body through open skin such as sore, cuts, or any other wounds. Risk factors for becoming susceptible to this disease are skin infection, burn, or surgery [2].

Prevalence of *S. aureus* colonization and antibodies by geographical location, age, there were no significant differences found in the rate of colony-forming and toxigenicity according to the geographical area that was found, while the prevalence for a population study was found to be 26% of subjects [3].

SYMPTOMS

Toxic shock syndrome shows a variety of symptoms which are followed by vomiting, diarrhea, hypotension, and cold sweats, dizziness, unconscious, and later is continued by the clinical manifestation of staphylococcal TSS, myalgia, high fever and skin, and the mucous membrane is involved early. Rashes appear on the skin which resembles suntan like appearances. After a few days "desquamation" occurs on the face, palm, and extreme areas. Mucous involvement occurs as a sore throat and a strawberry tongue. Gastrointestinal abnormalities may also develop in early illness. Cardiac and renal abnormalities can be also found in this disease [4].

DIAGNOSIS

Studies conducted by [5] in which 13 children were selected and their conditions were examined, it was concluded that all children were presented with the signs of pyrexia and septic shock and rash appeared in 11 out of 13 youngsters and 85% shows the signs of central nervous system disturbance such as drowsiness and unconsciousness on further investigation 10 children were hyponatremic and 9 were lymphopaenic at the time of diagnosis. The diagnosis was done using Cole and Shakespeare's criteria for TSS.

MANAGEMENT

The management of toxic shock syndrome includes seven R's of management which are recognition which is followed by resuscitation, removal of the source of infection, rational choice of antibiotics, the role of adjuvant management: including clindamycin, intervenous immunoglobin, review progress and the reduction of risk of secondary cases in close contacts [6]. Currently, the research done for the therapy of the "toxic shock syndrome" monoclonal antibodies are developed which can neutralize the TSST-1 and the other antigen produced, the use of ligands TLR2 and fixed antibodies which have high affinity to extract the endotoxin are being directed.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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CHAPTER 33

Scarlet Fever: An Infection Symptomized by Red Rash All Over the Body with High Fever

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Abstract: Scarlet fever is a bacterial disease caused by the *streptococcus* family. *streptococcus* pyogenes is an infectious agent in this disease. This bacteria produces streptococcal pyrogenic endotoxins SPEs that causes a red rash and high fever. Common symptoms seen in patients suffering from scarlet fever are swollen tonsils, high fever, red folding in arms, and elbows. Scarlet fever mostly occurs in children and sometimes it also affects adults. In past decades, the mortality rate due to scarlet fever was 10-25 percent but now it is reduced to 1% due to antibiotics. Diagnosis against scarlet fever is done by different methods like throat swab specimen detection and antigen screening method. For the treatment of scarlet fever, no vaccines are present. Antibiotics and hygienic lifestyle are recommended to lower the severity of scarlet fever.

Keywords: Antibiotics, Endotoxins, High Fever, Scarlet Fever, *streptococcus* pyogenes.

INTRODUCTION

Scarlatina or scarlet fever is an infectious disease that causes a red rash all over the body with a high fever. Scarlet fever is caused by the group A *streptococcus* (GAS) bacteria that is present in our nasal cavity and throat. The same bacterial strains of GAS also causes strep throat disease in individuals. The group A *streptococcus* bacteria includes several bacterial strains but *streptococcus* pyogenes is more dangerous besides all others. This is a *Gram*+ve bacteria that produce streptococcal pyrogenic exotoxins SPEs. This endotoxin causes a red rash all over the body, strawberry-like tongue appearance with swollen papillae, red rash folding at the elbow, and pits is a sign of scarlet fever [1]. Common symptoms seen after 1 to 4 days in scarlet fever includes flushed face, strawberry tongue, fever above 101^0F, swollen tonsils, red lines around the elbow, swollen

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lymph nodes, chill, headache followed by nausea. The rash starts from the stomach and chest then spreads all over the body. This lasts for 2 - 7 days if complete treatment is used [2]. *streptococcus* pyogenes also give rise to several diseases like tonsils, pharyngitis, toxic shock, and rheumatic fever and heart diseases. It mainly affects children between the ages of 5 to 10 years. Scarlet fever was a common disease in recent past years. It is a toxin-mediated disease that has been deadly affecting the entire world. Scarlet fever disease was pandemic in Asia. The incidence rate of scarlet fever has been increasing in different countries due to the resistance of infectious agents against antibiotics. In South Korean from 2008 to 2015 disease rate suddenly increased from 0.3 to 13.7 cases per 10,0000 [3]. It was reported that a higher disease rate in South Korea is due to resistance against tetracycline antibiotics. Scarlet fever was first reported in Scotland and England in 1661. Genomic analysis was performed to check the statics of scarlet fever in correspondence to invasive diseases of the Group A streptococcal strains [4]. The worldwide occurrence of scarlet fever within the past 20 years has declined due to the emergence of new generations of antibiotics and medicine with a high spectrum range against group A *streptococcus* bacterial strains. The occurrence of scarlet fever depends upon the *emm* type that is an adhesion fimbriae protein transcribed by special gene sequences. Higher genetic variations in *emm* make it resistant towards a class of antibiotics. Different *emm* types dominate in different parts of the world. Scarlet fever 12 clones of *emm* especially ICE_*emm* 12 that is tetracycline resistance and ICE_HKU 397 are commonly present two elements of emm12 in China. It was the common disease of childhood in past decades that also affects adults. Now a day's recent advancement in antibiotics has made it less dangerous. Up till now only compromised antibiotics are used for scarlet fever, no vaccines are available against this disease.

CAUSES AND SYMPTOMS

Scarlet fever is caused by group A *streptococcus* (GAS) bacteria. Among these GAS bacteria, *streptococcus* pyogenes are most common that produce all signs of scarlet fever especially rashes and high fever. *streptococcus* pyogenes bacteria produces "streptococcal pyrogenic endotoxins" (SPEs) that circulate with bloodstreams and causes flushed cheeks with pale lips, rash on chest and trunk, swollen tonsils and fever above 100 ^{0}F. Proteins produced by *streptococcus* pyogenes were first termed as erythrogenic toxins but nowadays more accurately known as pyrogenic endotoxins. Each bacterial strain produces more than 2 to 3 different types of endotoxins. Eleven such endotoxins have been identified in different case studies, while in scarlet fever, a mixture of endotoxin SpeA, streptococcal pyrogenic endotoxin C and SSA are mostly present. These SPEs are seen to play a role in toxic shock syndrome, rheumatic fever, and pharyngitis [5].

DIAGNOSIS

Diagnosis of scarlet fever depends upon scoring system that is designed to enhance accuracy in the identification of *streptococcus* pyogenes and SPEs. Scoring depends upon the occurrence or absence of fever, rashes, swollen tonsils, and lymph nodes. The best scoring also involves patients' age and previous medical records. A golden method for diagnosis of scarlet fever is “throat swab specimen”. Rapid antigen detection test and throat culture are commonly used now a day to evaluate the presence of an infectious agent that causes this disease. The first one is highly specific but it is not completely sensitive for the infectious agent and provides false-negative results. The golden standard that provides accurate results in the diagnosis of scarlet fever, is the throat swab culture. Other testing methods like serologic testing were also used for a short time but it does not provide clear results as the body takes approximately 2 to 3 weeks to develop antibodies against this infectious agent after the onset of infection [6].

MANAGEMENT

Scarlet fever is mostly treated as a self-limited illness, but the use of antibiotics lowers the severity and complexity of this disease by making a remarkable change in therapy. The use of antibiotic penicillin shortens the duration of fever up to one day, minimizes the chances of suffering from the worst condition of rheumatic fever [7]. The use of antibiotics prevents further complications of scarlet fever by reducing the chances of secondary infections. No vaccination is available against scarlet fever. Antibiotics like penicillin (oral), amoxicillin (oral), benzathine penicillin G (intramuscular), and for individuals with penicillin allergies cephalexin (oral) cephalosporin and cefadroxil are mostly recommended during this duration depending upon the condition of the patient. Penicillin due to its low cost, high efficiency, and best clinical guideline practices are commonly used that lowers the severity of fever and throat soreness.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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CHAPTER 34

Listeriosis: A Foodborne Disease Caused by *Listeria*

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Abstract: Listeriosis is a foodborne disease. Bacteria of genus Listeria are responsible for this disease, especially *Listeria monocytogenes* which is a gram-positive bacterium and is active in the conditions needed to preserve food. The Mortality rate of listeriosis is 24%. Listeriosis is a serious threat to pregnant women and persons who are Immuno deficient. Symptoms of listeriosis are fever, flu, brain abscess, the tremor, Cranial nerve deficits, respiratory distress, jaundice, rash, or lethargy, *etc.* Diagnosis is done by culturing the organism from the blood and in the treatment, many antibiotics are given alone or sometimes in combination with two or more. Treatment of trimethoprim/sulfamethoxazole (TMP/SMX) is given as alternate to patients who have allergies with using penicillin.

Keywords: Antibiotics, Foodborne Disease, *Listeria monocytogenes*Listeriosis..

INTRODUCTION

Listeriosis is a food poisoning disease caused by bacterium *Listeria* that contaminates the food. Listeriosis is a human and animal disease. In humans, it is a foodborne disease. Pathogenic bacteria are responsible for this disease which belongs to the genus *Listeria.* Seven species of genus Listeria are found. And among seven species of this genus, only two are considered as the pathogenic [1]. Listeriosis is a serious threat, especially to immunodeficient persons. Almost 99% of cases of listeriosis in humans are caused by unhealthy and contaminated food [2]. In pregnancy, *Listeriosis* occurs at all stages [3].

Listeria monocytogenes is a gram-positive bacterium. It is an intracellular pathogen and is non-spore forming which is commonly found in our environment and a causative organism of many foodborne diseases. Listeria species can grow in vast range and their growing conditions, including the temperature between 1-

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46 degrees Celsius, Salt concentrations up to 9-10%, and pH 4.3-9.6. These are the conditions that are used to preserve food and the bacteria are active and living in such conditions so it is a serious problem to the food. The mortality rate of listeriosis is 24%. Listeriosis is mostly found in pregnant women (in the fetus), also found in Immunodeficient persons, *Listeria* has an intracellular life cycle is intracellular, which makes it a unique pathogen. When we ingest contaminated food, *Listeria* is phagocytosed by the gastrointestinal cells and then it enters the host without upsetting the gastrointestinal tract [4]. When it reaches the cytoplasm of the host, it frequently divides and adjacent cells then may ingest it. *Listeria* can spread and multiply by these steps without exposing them to antibodies like neutrophils. That's why maternal *Listeria* can be of any sort like mild or dangerous. Cell-mediated immunity is the host's defense response against *Listeria* is the cell-mediated immunity, and many conditions reduce this immunity like pregnancy can cause early listerial infection [3].

SYMPTOMS

In many cases, mild maternal illness is reported and sometimes it can be severe. Some common symptoms of *Listeriosis* are:

Fever, 2nd most common symptom is Flu and white blood cells range from 3900 to 33,800cells/mm^3. Others include Brain abscess, Tremor, Cranial nerve deficits, and seizures are the symptoms of listerial infection in the Central nervous system. 20-50% of the fatality rate of listeriosis has been reported in persons whose immune system is compromised. Neonatal Listeria causes sepsis, pneumonia, meningitis, fever, respiratory distress, jaundice, rash, or lethargy. The symptoms of listeriosis in pregnancy are abortion, septicemia, neonatal death, and meningitis [5].

Patients who take steroids or are suffering from HIV or diabetes are at more risk of infection. Corticosteroids using or Immuno-suppressed pregnant women experience a greater risk of listeriosis as compared with normal pregnant women. Severe maternal illness is caused by an infection in patients with co-morbidities [6].

DIAGNOSIS

Culturing the organism from blood, spinal fluid or amniotic fluid is the way to diagnose infection of Listeria. In diagnosis cultures such as stool and vagina are not useful because some patients do not have the clinical disease and are carriers of the disease [6]. About 1% to 15% population of Listeria has fecal carriage. 33% of cases of Gram stain are helpful because it is intracellular and it resembles diphtheroids, pneumococcal or *Haemophilus* species.

MANAGEMENT

Many antibiotics are active against the organism, ampicillin can be used alone or it can be given in combination with gentamycin. Some patients are given alternative therapies due to allergic reasons or disease state. Secondly, after penicillin, fluoroquinolones, trimethoprim/ sulfamethoxazole, vancomycin, and erythromycin are used. Cephalosporins are not active in the treatment or against Listeria [7]. MIC determination is often used as the basis to predict the efficacy of antibiotics. *Listeria* is *in vitro* susceptible to many antibiotics except the two which are fosfomycin and Cephalosporin. However, a poor clinical outcome is reported. This can occur because the bactericidal mechanisms are refractory for *Listeriae* of many antibiotics, especially ampicillin-amoxicillin. By adding gentamycin a synergism can occur [8]. Some *Listeriae* reside and multiply in the host cells and protected from antibiotics, while some Listeriae penetrates and reaches the cytosol. Most Listeriae remain outside the cell and are easily accessible to the antibiotics which can cross the blood-CSF barrier. In the murine model, Listeria monocytogenes are found in parenchyma cells of liver and spleen and are not easily accessible to many drugs, like gentamycin and penicillin. The effectiveness and therapeutic success of the drugs are dependent upon the models which are being used. Thus, for example, the synergistic effect of gentamycin+ampicillin is found in the model of rabbit meningitis but is not found in the model of the mouse. In the Immuno-compromised host, therapy with antibiotics is not such satisfactory because 30% of deaths are reported with listeriosis [9]. Other alternatives must be used for prevention of the infection and therapy. Defensins are endogenous antibiotics and highly susceptible to *Listeria*. Bacteriocins are bactericidal and are produced by bacterial species, such as enterococci and lactobacilli. However, the use of these alternative measures is not yet feasible. Antibiotics are mainly used in the treatment of Listeriosis which includes: Amoxicillin Penicillin, and Ampicillin [10]. These drugs cannot penetrate intracellularly and they block many PBRs. Under natural conditions, *Listeria* resistance to penicillin is not yet found [10]. For placenta and umbilical cord penetration usually, high doses are used for the surety. In treatment regimens, synergistic effects are found when gentamycin is added and is suggested by *in vitro* studies and animals did not show synergetic effect. Treatment of trimethoprim/sulfamethoxazole (TMP/SMX) is given as alternate to patients who have allergies with using penicillin. Vancomycin is also used for listerial infection. In pregnancy, erythromycin is used to treat listeriosis. Erythromycin rifampin, linezolid, and meropenem are the antibiotics that can also be used in the treatment of listeriosis [10].

CHAPTER 35

Bacterial Meningitis: An Inflammation of Meninges by Bacteria

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Abstract: Meningitis is the inflammation of the membrane of meninges that is caused by a different microorganism. Bacterial meningitis is a lethal disease with the mortality rate in older adults is <20%. The bacteria start to replicate in the cerebrospinal fluid CSF and meninges and then infection takes place. It causes fever, headache, nausea, photophobia, vomiting, nuchal rigidity with complications of arthritis and hydrocephalus. *Streptococcus pneumoniae* is the main cause of bacterial meningitis in older children. Different laboratory diagnosis like antigen screening, gram staining is used to test bacterial meningitis and antibiotics like chloramphenicol, gentamicin, tobramycin, second and third-generation cephalosporin, metronidazole, and rifampin are used against different bacterial microorganisms. Vaccines are available for 23 serotypes of *Streptococcus pneumoniae*.

Keywords: Antibiotics, Bacterial meningitis, Inflammation of CSF, *Streptococcus pneumoniae*.

INTRODUCTION

Meningitis is a disease that causes infection in the cerebrospinal fluid (CSF) in which the membrane surrounding the brain and spinal cord get inflamed. It is mainly caused by several bacteria, fungi, and viruses. In neonates, the fatality rate is high as compared to infants [1]. Bacteria from *group B streptococci* cause meningitis in premature babies and this disease starts to appear in the second week of life. Gram-negative bacteria including *E. coli* are also responsible for bacterial meningitis in newborn babies in developing countries [2]. In older children, meningitis is caused by the *Streptococcus pneumoniae* and *Neisseria meningitides*. *Streptococcus pneumoniae* contains 84 serotypes of which 1, 3, 4, 7-11 serotypes are responsible for most of the diseases. Tuberculosis meningitis is more prevalent in people with a high risk of tuberculosis [3, 4]. Other causes of

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viral meningitis include mumps virus, the varicella-zoster virus, enterovirus, and HIV. The Herpes simplex virus is responsible to cause Mollaret's meningitis [5]. Meningitis caused by fungi contains *Candida* species, *Coccidioides immitis* [6]. According to the Centre for Disease Control and Prevention (CDC) study bacterial meningitis is increased by *Listeria monocytogenes*, gram-negative bacilli, *Streptococcus pneumoniae*, and *Streptococcus agalactiae.*

Bacterial pathogens enter into the CSF and meninges *via* local invasion and hematogenous spread. Bacterial starts to replicate rapidly once it gains entry to the CSF or meninges and it activates the inflammatory response that leads to neuronal apoptosis, vasogenic edema, and high intracranial pressure that results in cerebral infarction, cortical vein thrombosis, and empyema leading to stroke syndromes, coma, and death [7].

SYMPTOMS

The symptoms of the bacterial meningitis are fever and chills, confusion, photophobia, nuchal rigidity (stiffness of the neck), headache, consciousness level changes, swelling of the eyes (papilledema), petechial rashes on the skin, nausea, and vomiting leading to complication like central nervous system CNS with the increased WBC count, arthritis and hydrocephalus [8 - 11].

LABORATORY DIAGNOSIS

For the diagnosis of bacterial meningitis, CSF must be examined thoroughly. Cultures of the CFS are used. Lumbar puncture (LP) is used for the diagnosis of bacterial meningitis. LP assesses red blood cell, white blood cell WBC count, glucose, opening pressure, and proteins. But with herniation LP is not suitable to use. Computerized tomography CT scan is used before LP. Abnormal CT scan shows abnormal visual fields, aphasia, abnormal consciousness level, leg and arm drift, confusion in giving answers. As well as Gram staining is also used. In the untreated bacterial meningitis, the gram stain result is positive. Bacterial meningitis causes increased WBC count, hypoglycorrhachia, neutrophilic predominance. Bacterial antigen testing is also available for *E. coli*, *S. pneumoniae, H. influenza*. Polymerase chain reaction PCR involves bacterial primers that are highly conserved and is under investigation [3, 12].

MANAGEMENT

Bactericidal antibiotics are used to prevent bacterial replication in CSF and meninges. Penicillin G with a dose of 20-24 million units is used for *S. pneumoniae*. Ampicillin 12g with gentamicin, tobramycin 5mg/kg is used against *Listeria monocytogenes*. Cefotaxime 8-12g or ceftriaxone 4-6g is used for

Haemophilus influenza, Enterobacteriaceae, and *Streptococcus pneumoniae*. For *Staphylococcus aureus* that is methicillin-sensitive nafcillin 8-12g is used and for methicillin-resistant vancomycin 2g is used [12]. Some antibiotics have excellent penetration into CSF, some have bad penetration according to [12, 13] as described in Table **3**.

Table 3. Penetration of antibiotics in CSF.

Excellent penetration	Good penetration	Negligible penetration
Metronidazole	Penicillin	Tobramycin
Chloramphenicol	Third-generation cephalosporin	Gentamicin
Trimethoprim-sulphamethoxazole	Vancomycin	A most first and second-generation cephalosporin
Rifampin	Cefuroxime	Aminoglycosides

Several bacterial meningitis diseases are caused by *Streptococcus pneumonia* [13]. One-third of the people have received the pneumococcal vaccine and the rate is higher in older adults. There is a reduction seen in the pneumococcal disease when conjugated *Streptococcus pneumoniae* vaccine is given to the recipients. Vaccines are currently available for 23 serotypes of *Streptococcus pneumonia*. An improved pneumococcal vaccine is a major goal. The individuals that have had serious infections with *Neisseria meningitidis*, for those vaccines are recommended [13].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

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CHAPTER 36

Nosocomial Infections: Hospital Acquired Infections

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Abstract: The term nosocomial can apply to that type of a disease that is acquired by a patient when he is under medical care. These types of infections are also known as HAI grow into patients when he stays at the hospital and taken supplementary types of medical facilities. It can be appeared in both cases either during hospitalization or after the time of discharge. Pathogens which are a major basis of such infections are called nosocomial pathogens. Worldwide, in healthcare systems, urinary tract infections are the most common complications. According to recent data, 30% of Nosocomial infections related to UT are caused by gram-negative bacteria.

KeyWords: Hospital-Acquired Infections, UTIs.

INTRODUCTION

"Nosocomial" and "hospital-acquired" are synonymous with each other and this type of infection has been caught in a hospital and most organisms that show resistance to antibiotics are responsible for it and acquired in any healthcare centre when patient management is related to it [1]. In two-third, the cases the origin of Nosocomial infection is acquired by the patients in any healthcare institution which are not present in patients being admitted hospital. After review of literature completed by using the Medical Literature Analysis and PubMed, we can define the nosocomial urinary tract infections as, "An infection in any part of our urinary system *i.e.* kidneys, urethra, bladders, and ureters". The urethra and bladder are a big source of lower urinary tract Nosocomial infection and greater risk of disease in women than men [2].

The second most common UTI is caused by gram-negative bacilli which affect humans throughout their lifetime. Gram-negative bacteria are a major cause of

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wound or surgical sight infection because these bacteria are resistant multi drugs and antibiotics [3]. These bacteria are responsible for nosocomial infections with increasing frequency. The major causes of uti occur when gram-negative bacilli enter the urinary tract urethra and later start to multiply in the bladder.

Currently available antibiotics for increasing pathogenicity of bacterial infections are limited in numbers. This issue is especially for gram-negative nosocomial UTIs "centers for disease control and prevention (CDC)" reveal threats about gram-negative bacilli to develop drug-resistant and scarceness of coming treatments to fight organisms. Most types of nosocomial uti infections gram-negative bacilli may have the capacity to cause infection and a very large number of bacteria responsible for uti. In this way, rehabilitation investigation for the nosocomial infection that is measurable control of Proteus rettgeri, serratia marcescens, and Klebsiella pneumoniae. These three organisms are responsible for seven outbreaks.

Pseudomonas that mostly causes nosocomial multidrug-resistant infection but here is not investigating any outbreaks. A general acceptance of confrontation to antibiotics is a characteristic of such pathogen that may reflect the capacity of pseudomonas to cause epidemic infrequently although slide variation on a single pattern of antimicrobial sensitivity outbreak. The variation in drug sensitivity serotype and biochemical markers of stains chemicals. For these multi-resistant pathogens hospitalize patients were the primary reservoir. Uti went unrecognized in all of these outbreaks contributed to the reservoir. For these pathogens, not other environmental reservoir thought to be an important source and in any of outbreaks no common source identified was found but medical equipment may culture-positive such as cart tops, sink drains, and bed railings. It is suggested by an epidemiologic investigation that in all seven outbreaks organisms were transmitted from one patient to another patient on the hand of a person. Urinary catheterization and exposure to broad-spectrum antimicrobial therapy multidrug-resistant strain are more common factors that exposed hospitalized patients to urinary infection.

Nosocomial infections are increasing day by day with advancement in antimicrobial agents and life-saving methodologies which expose a patient to the disease. Despite using control health care measurements, nosocomial infections are associated with mortality and morbidity. Several hospital-acquired infections are increase which may respond in adding extra health care expenses and cause an economic crisis. In the hospital environment, this problem becomes more complicated when treating multidrug-resistant (MDR) microorganisms. Mostly in the hospitalized patient, infection is caused by different pathogens.

In most nosocomial infections gram-negative bacteria are responsible *i.e.* gram-negative bacilli. Some extrinsic and intrinsic factors are more common to affect hospitalized patients by these pathogens. Although nosocomial infections uti by gram-negative bacilli are not avoidable the use of hygienic hospital methodology and standard practices may reduce such nosocomial infection at a significant level.

TYPES OF NOSOCOMIAL INFECTION

There are 50 potentially specific infection sites for surveillance out of 13 major types of healthcare-associated infection sites according to clinical and biological criteria. Surgical wounds and other soft tissue infections, urinary tract infection, respiratory infection, gastroenteritis, and meningitis are the most common types of nosocomial infections caused by gram-negative bacteria [4]. Types of nosocomial urinary infections have been changed due to an increased number of invasive procedures for therapeutic and diagnostic purposes [5].

The Anticipation of Gram-Negative Nosocomial Urinary Tract Infection

In health care, everyone including staff and individuals is equally responsible for the prevention of anticipation of gram-negative nosocomial urinary tract infection. For patients and organizations to reduce the risk of infection everyone must work cooperatively. However, all hospital infections are not curable but with the struggle, many uti nosocomial infections can be prevented.

The most common anticipation toward infection is frequent hand washing and to wear gloves, masks, and gown but the cost will be unnecessarily increased due to inappropriate use of these. Although poor hygiene practices are done by the staff in the area of the hospital may be responsible factors for vectors of disease and virulent gram-negative bacilli are spread in their patients and exposed difficulties to control uti infections.

Agents of Nosocomial Urinary Tract Infection

Any microbe could have the capability to cause infection but the specific organism is responsible for a large number of hospital infection in hospitalized patients almost 90 percent nosocomial urinary tract infection are caused by bacteria, some are mycobacterial, fungal or viral but some agents are less commonly involved like protozoal [1]. The most common type of gram-negative bacilli is Pseudomonas (P.) aeruginosa, Legionella, and some other members of the Enterobacteriaceae family *i.e.Escherichia* (*E.coli*), Proteus mirabilis, *Salmonella* spp., Serratia marcescens and Klebsiella pneumonia [6]. *Escherichia* (*E.coli*), S. aureus, and *P. aeruginosa* are the most frequently reported nosocomial

CHAPTER 37

*Campylobacter*iosis: A Food Borne Illness Caused by *Campylobacter*

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Abstract: *Campylobacter*iosis is a foodborne illness caused by *Campylobacter* (*C. jejuni*), gram-negative bacteria, which cause diarrhea and other symptoms like fever pain and cramps. It transmits from food spoilage, untreated water, raw milk containing the bacteria, contact with pets, and farm animals having diarrhea. Person to person transmission is uncommon. It can be diagnosed by different techniques like the culture of bacteria taken from the bloody stool is the way for culture, molecular methods like a polymerase chain reaction, antigen testing, and DNA microarray. It can be managed by taking different precautionary measures, considering various hygienic rules, and through proper medication like antibiotics. But antibiotics are not preferred to those patients having a weak immune system and AIDS.

Keywords: Antibiotics, *Campylobacter*iosis, Culturing, Diarrhea, Molecular Technique.

INTRODUCTION

*Campylobacter*iosis is caused by *Campylobacter* bacterium (*C. jejuni*). It's a foodborne illness. It is the most common bacterial infection in humans. It causes diarrhea and other serious complications like dysentery syndrome, fever, cramp, pain, and sometimes bloody [1]. *Campylobacter* is a gram-negative, non-spore forming bacteria. It is a comma or spiral shape found in swine, cattle, and birds. It mostly causes diarrhea and other complications if left untreated like tissue damage in the gut. It causes cholera and latent autoimmune effects. The infection clears up in 2-8 days. Every year about 1 million people are infected in the United States. Infants and children have more chance of *Campylobacter*iosis infection than adults. But it can infect at any age and its infection is more severe in summer than in winter.

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There are many reasons for the prevalence of this disease. It is caused by eating uncooked food especially uncooked poultry [2]. *Campylobacter* bacteria live in the digestive tract of animals including cattle and poultry, raw milk may have *Campylobacter* bacteria. That bacteria may present in the sewage system and water in developing countries [3], drinking untreated water is the major factor. It can transmit through contact with cats, dogs, and pets with diarrhea. Food from animal origin plays an important role in transmitting *Campylobacter* bacteria to humans. Person to person transmission is not reported. Environmental factors and the wild animal accounts only 3% for this infection and remaining are considered due to chicken and farm animals for meat.

SYMPTOMS

Symptoms include diarrhea, blood in the stool, abdominal pain, cramps, fever, headache, vomit, and malaise. HIV patients are more likely to have severe symptoms like prolonged diarrhea. people may develop Guillain- Barre syndrome in which nerves present between the brain and spinal cord may damage. It only occurs with *C. upsaliensis* and *C. jejuni.*

Some people may not have any symptoms due to the weakened immune system.

DIAGNOSIS

There are various techniques used for the diagnosis of *Campylobacter*iosis.

Culturing Techniques

Obtaining cultures of organisms from a stool sample are always the best way to diagnose this infection. If laboratory facilities are not available then fecal smears dark- field microscopy and gram stain provide the best presumptive diagnosis [4]. The basis of diagnosis is to isolate the bacteria from faeces and basal media are used which include:

- Butzler's media.
- Preston media [5].

The culturing process is carried out at 42˚C.

It can also be diagnosed *via* antigen testing EIA and PCR.

PCR Based Assay

Biochemical tests and bacteriological analysis such as culture media and isolation are mostly used for the analysis of different samples but they are time consuming and laborious as well.

PCR is now extensively used as a molecular method for the detection of *Campylobacter*. The widely used PCR are:

- Multiplex PCR [6].
- Real-time PCR [7].

PCR gives more reliable results within no time and gel electrophoresis is used to isolate and DNA sequencing techniques are now used as a molecular basis. New markers may be suggested, but not extensively in use nowadays.

DNA Microarray

This technique is now using as a diagnostic tool.

MANAGEMENT

*Campylobacter*iosis can be managed by taking certain preventive measures, treatments, and other alternatives.

Prevention

World health organization (WHO) recommends the following.

- Food must be hot and properly cooked when served.
- By using boiled water, it can be controlled.
- After contact with pets and farm animals, the hand should be wash properly and frequently [8].
- Pasteurized milk should be used rather than raw milk.
- Fruits and vegetables should be washed before eating.
- Hygienic rules should be followed during food handling food preservation, professionally and at home.
- Contact with farm animals and pets should be avoided.
- Proper tests and treatments must be taken.
- Broiler chicken should be avoided [9].

CHAPTER 38

Brucellosis: Undulant Fever, Malta Fever, Gibraltar Fever or Bang's Disease

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Abstract: Brucellosis is an infectious disease caused by the species of bacteria *Brucella*. Animals are the primary host for bacteria; they are transferred from animals to humans (secondary host) by eating undercooked meat and unpasteurized dairy products. The symptom for brucellosis varies from mild like simple flu, fever, headache to acute like tissue and dysfunction of organs. Due to its complicated symptoms, the diagnosis of brucellosis is difficult but blood and bone marrow samples are still used for its diagnosis. Different techniques like culturing, molecular methods, and serological tests are used for its diagnosis. Antibiotics are used to prevent relapses and to minimize their symptoms. Antibiotics alone or the combination of two are used for the treatment of brucellosis. Other precautionary measures like safety and hygienic conditions should be considered to prevent disease.

Keywords: Antibiotics, Brucella, Culturing & Molecular Techniques, Polymorphonuclear Cells, Lymph Nodes.

INTRODUCTION

Brucellosis is an infectious disease also known as undulant fever, Malta fever, Gibraltar fever, and Bang's disease. It is caused by bacteria brucella which is aerobic, rod-shaped (coccobacillus) gram-negative, non-motile, and non-spore forming bacteria [1]. Brucellosis spread from animals to humans by direct fluid contacts like blood or tissue fluid, eating uncooked meat, unpasteurized milk, and dairy products like cheese [2]. Different types of stains infect different types of animals like cattle is infected by Brucella abortus, sheep and goats infected by *Brucella melitensis*, pigs, sheep, dogs, wood desert rats are infected by Brucella suis, *Brucella ovis*, *Brucella canis*, and *Brucella neotomae* respectively [3]. Brucella infects almost all domestic animals excluding cats which are resistant to

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bacteria brucella. The disease is very old from a Roman era, it is detected in carbonized cheese [4]. The prevalence of brucellosis in Colombia is between 2.4 to 5%, in Tanzania 3.5% and in northern Tanzania 8% [5]. The cases of the prevalence of brucellosis in Asia, Africa, Latin America, and the middle east are 10 per 100 000 population and 100 per 100 000 cases are seen in Saudi Arabia, Jordan, Iraq, middle east, and the Mediterranean rim. The prevalence of brucellosis also depends on factors like the trade of animals, husbandry practices, and preparation of food. Brucella is taken by macrophages and polymorphonuclear cells within which bacteria replicate and survive then they move to blood circulation and lymph nodes and settled into various organs and tissues. According to the world health organization (WHO), a half million people each year in 100 countries were infected by brucellosis. Humans are the secondary and indirect host for this disease, but the primary hosts are domestic animals. Besides a zoonotic problem, it is also bioterrorism of category B.

SYMPTOMS

Its symptoms vary from mild to acute.

- Recurrent fever
- Fatigue
- Headache
- Myalgia
- Weightloss
- Arthralgia
- Anorexia
- Pain in muscles, joints
- Night sweats [2].

Other Complications

In some cases, brucellosis also affects organ systems like:

- Hematological system (causing anemia, leucopenia, and thrombocytopenia)
- Neurological system (causing
- meningitis, neuritis and encephalitis)
- A Genitourinary system (causing orchitis and epididymitis)
- A Pulmonary system (causing bronchitis, empyema and pneumonitis)

Death is very rare in case of brucellosis, only 2% of cases of death are reported in acute conditions [6].

DIAGNOSIS

Human brucellosis, clinical features overlap with many other infectious and noninfectious diseases, therefore its diagnosis is problematic. However, blood samples, bone marrow samples and other body fluids are used for the diagnosis of brucellosis. A Blood test for antibodies detection against *brucella* bacteria is also used. Different techniques are used to test these samples which are molecular-based methods, serological tests and culturing [7].

Molecular Based Methods

- PCR based assays.
- Standard PCR.
- Real-time PCR.
- Nested and semi-nested PCR.
- A Multiple locus VNTR analysis.
- Loop-mediated isothermal amplification assay.

Culturing Techniques

- Conventional culture technique.
- Semi-automated blood culture technique.
- Lysis centrifugation blood culture technique.

Serological Test

- Serum agglutination test.
- Rose Bengal test.
- Lateral flow assay.
- Enzyme-linked immunosorbent assay (ELISA).
- An Immunocapture agglutination test.
- Coombs antiglobulin agglutination test [8].
- Complement fixation test.

TREATMENT

Different types of antibiotics are used for the treatment of brucelloses like rifampicin, chloramphenicol, tetracycline, streptomycin, trimethoprim-sulfamethoxazole, quinolones, doxycycline and gentamicin. They may be used separately or a combination of two may also be used. For patients with acute brucellosis combination of doxycycline along with rifampicin or tetracycline is used [9]. Another method used for the treatment of brucellosis is the addition of hydroxychloroquine with doxycycline and streptomycin this method is very effective because it reduces the relapses of disease and helps improving its

CHAPTER 39

Trench Fever: A *Bartonella Quintana* Infection

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Abstract: Trench fever is an infectious disease for which a specific form of bacteria *Bartonella quintana* is responsible. This infection is characterized by high fever occurring in a single attack or at repeated intervals of 4-5 days, headache, relapses and severe pain in legs and back. It may be diagnosed by culture test, serologic, biopsy, or PCR. Management for this infection is possible in immunologically strong patients by appropriate antibiotics and surgery.

Keywords: *Bartonella quintana*, Doxycycline, Endocarditis, Serologic, Surgery.

INTRODUCTION

Trench fever is an epidemic disease for which the basic reservoir is *Bartonella quintnana*. This infection is also called as 5 days fever. Medical presses of different nations reported a variety of names for trench fever *i.e.* Typhus Mineur and La Fever des Tranches in France, Wolhynian fever in Germany and Gaiter pain fever in Austria. The term trench was given by British forces [1]. Trench fever is an infection transmitted from one person to another person by a body louse containing the responsible agent for it. Bacteria grow in the midgut of lice and transmitted *via* broken skin through crushed lice. Trench fever may be characterized by either a single period of fever or may occur at repeated intervals of 4-5 days.

CAUSES

Initially described etiologic agent for trench fever in 1915 was known as Rickettsia Quintana or *R. Volhynia*. Systematic Bacteriology of Bergey's manual edition 1984 combined all the related forms of this bacteria and after a thorough research Bartonella species were formed [2]. The causative agent for trench fever is a small intracellular, facultative protobacterium *Bartonella quintana* [3].

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B quintana infection was excessively observed during World War I in almost every continent except Antarctica and Australia, in those people who suffered from alcoholism, poverty, or homelessness. But most cases were concerned with alcoholism. There is a critical role of body louse for transmission of infection [4].

PREVALENCE

Initially, a term Febris Volhynia was used for trench fever in Poland and followed by the whole of Europe. From Europe the disease transferred to Mesopotamia, Egypt and infections were also observed among those people being in contact with troops returning to England. Trench fever cases also observed in France and Romani [5]. Now the causative agent of this infection is re-appearing in homeless people of Europe being the reason for endocarditis, asymptomatic bacteremia and bacillary angiomatosis [3].

SYMPTOMS

- High-grade fever [6]
- Headache causing pain behind the eyes.
- Conjunctival infection.
- High rate of pain in legs and back.
- A temporary macular or papular rash and sometimes hepatomegaly, splenomegaly are observed.
- Endocarditis may cause complications in some situations.
- Relapses are commonly observed and have continuously occurred to 10 years after primary attack.

DIAGNOSIS

Culture Test

The victim is identified by culture of blood; however, growth may be of 1-4 weeks. The disease is confirmed by persistent bacteremia during a primary attack, relapses throughout the non-symptomatic periods b/w relapses and in victims with endocarditis.

Serologic

Serologic testing is a commonly used method for trench fever diagnosis. Immunofluorescence is used as a reference method [2].

High titration of 1gG antibodies should elucidate endocarditis.

PCR

PCR tests of blood or tissue samples can be performed. Bartonella infections are usually confirmed by taking DNA samples and performing qPCR [7].

Biopsy

Biopsy of skin, valves of heart, lymph nodes, or other tissues [8].

MANAGEMENT

Now antibiotics are recommended for every type of syndrome associated with *B. quintana* in immunologically strong patients.

Medicine

It has been reported that in initial cases of trench fever quinine was used as a drug for treatment. As it was proved effective against malaria having similar symptoms with this fever, it was considered that it would be equally effective against it but it revealed no effect on the natural way of this disease. So other effective drugs were developed against this infectious disease [1].

Doxycycline treatment causes recovery from symptoms in 24-48 hrs. Tetracycline and ceftriaxone (third-generation cephalosporine) are also effective against trench fever. Recovery is mostly complete and mortality is negligible, bacteremia may exist for months after clinical recovery and doxycycline treatment may be required. Patients are given doxycycline 100m e(g/kg/day for 2 weeks of the beginning. Body lice should be controlled. Patients with chronic bacteremia must be monitored for the symptoms of endocarditis. Microbiologic studies accurately predict clinical efficacy as *B. quintana* seems to respond clinically to bacteriostatic agents *i.e.* erythromycin and azithromycin. Only gentamicin is bactericidal *in vitro* because it does not achieve a bactericidal level within human erythrocytes. Gentamicin is not considered to be optimal for monotherapy but it is regularly used in combination with doxycycline [9].

Surgery

Surgical biopsy is possible to manage a proper diagnosis of *B quintana* endocarditis, bacillar angiomatosis or lymphadenitis. In *B quintana* endocarditis situations, valvular heart surgery is required [8].

CHAPTER 40

Urinary Tract Infection: An Infection Caused by Gram-Negative Bacteria especially *E. coli*

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Abstract: Urinary Tract Infection (UTI) occurs due to inflammation of the urinary tract including bladder, urethra and kidneys by invading gram-negative bacteria especially *E. coli*. Signs and symptoms of UTI are fever, vomiting, nausea and irritation during urination. Clinical diagnosis is done by using a nitrite test and microbial culture on Cysteine Lactose Electrolyte Deficient (CLED) media plates. Penicillin, cephalosporin, carbapenem and some other antibiotics are used to cure this infection.

Keywords: Gram-Negative Bacteria, Microbial Culture, Urinary Tract Infection.

INTRODUCTION

Urinary tract infection is more prevalent in our community and also leading to death due to its severity. The urinary tract consists of two ureters, a bladder, two kidneys, and urethra. Inflammation in any part of the urinary tract due to the invading of gram-negative bacteria is called urinary tract infection [1].

E. coli enters into the urinary tract system in two ways as an ascending route in which the bacteria move through the urethra into the bladder and then moves into the ureter and kidneys. Another way is called a hematogenous (blood-borne infection) route in which bacteria enter due to inflammation of kidney parenchyma. The risk factor to cause UTI through the hematogenous route has been reduced to a large extent by gram-negative bacteria as compared to the ascending route. *E. coli* is a more common bacteria that cause UTI in both male and female due to invading in the urinary tract [2]. Other bacteria like *Klebsiella spp* and *Proteus spp* are also responsible to cause this infection. *E. coli* usually

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present in our body as normal flora in the gastrointestinal tract and also a major part of our microbiome [3]. There are different types of UTI as cystitis (infection in the bladder), urethritis (infection in the urethra), pyelonephritis (infection in the kidney), and prostatitis (prostate infection). Urinary tract inflammation is divided into lower tract inflammation (urethritis, cystitis) and upper tract inflammation (pyelonephritis) Fig. (**13**) [4]. Females have more probability to acquire this infection due to the nearest of urethra and anus and small urethra as compared to males [5, 6].

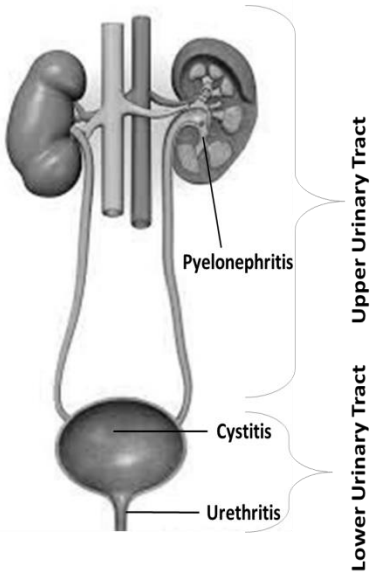

Fig. (13). Sites for urinary tract infection.

SYMPTOMS

Sign and symptom vary from patient to patient due to variation in the site of inflammation and route through which bacteria enter into the urinary tract. Inflammation in different parts results in different symptoms. Fever, dizziness, vomiting and severe pain in the abdomen are observed in kidney disorder [4]. Passing urine continuously with time, blood drainage through urine, and abdomen pain are seen in bladder disorder. Felling discomfort during urination is a major symptom of urethra disorder. Some other symptoms are also observed like urine color is cloudy due to the presence of pus and blood [7]. In the case of asymptomatic bacteriuria, symptoms of UTI are not appeared mostly [8].

DIAGNOSIS

The diagnosis of UTI is done by collecting a urine sample in a sterile urine container. A urine sample is preserved in a refrigerator at 4°C. The sample is preceded within 24 hours otherwise contamination occurs. A nitrite test is performed to check the presence of bacteria in a urine sample. Nitrite test is positive when bacteria are present in urine otherwise negative in the absence of bacteria. After confirmation, the urine sample is inoculated onto the CLED plate by using a disposable plastic wire loop and placed it into the incubator at 37°C for one day. CLED media is used to differentiate between lactose fermenter and non-fermenter. Bacteria grow and pure colonies isolate for the next proceeding [9]. Bacterial colonies are used to perform gram staining for differentiation between gram-positive and negative bacteria. Gram-positive bacteria usually come due to contamination or improper handling of the urine sample. Gram-negative bacteria are used to check which type of bacterial strain cause UTI and performed biochemical test for this purpose. The indole test is used for the detection of *E.coli* which is responsible to cause UTI [10]. *E. coli* shows resistance against antibiotics due to the presence of $bla_{CTX\text{-}M}$ and bla_{TEM} gene [9].

MANAGEMENT

Treatment against UTI is done by using antibiotics against bacteria for two purposes including bactericidal (kill bacteria) and bacteriostatic (stop the multiplication of bacteria). Antibiotics are used to reduce the sign and symptoms of infection. Different types of antibiotics are used according to the sign and symptoms, age, and strain of bacteria causing disease. Mostly nitrofurantoin, fosfomycin, cefotaxime, ceftazidime, ciprofloxacin, cotrimoxazole, levofloxacin, meropenem and imipenem are used [7]. Fluoroquinolones are the choice of drug to cure UTI which is a combination of levofloxacin, ciprofloxacin, and some other antibiotics. These antibiotics are not used in case of mild infection [8]. We should avoid self-medication. Antibiotics are used in the Physician's advice [10].

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Dr. Muhammad Imran Qadir is a scientist in the field of Pharmaceutical Biotechnology. He has been declared as the top pharmaceutical scientist by Pakistan Council for Science and Technology, Ministry of Science and Technology (Pakistan). He received his early education from Shujabad, Multan (Pakistan). Then, he attended Bahauddin Zakariya University, Multan for his B Pharm degree. Later, he received his PhD degree from Quaid-i-Azam University, Islamabad.

Dr. Qadir invented a diagnostic test for cancer named as "Qadir test". His work also includes invention of anti-HIV drugs, Qadirvirtide and Qadir-C34. He has presented that viruses are the cause of cancer, the idea presented as "Qadir theory of cancer etiology". He has also discovered local bacteriophages known as "Qadirphages" to be used as anti-bacterial products. He has worked to evaluate the pharmacological activities of local plants and established the use of many local plants for jaundice/hepatitis, hypertension, diabetes, spasm, ulcer, diarrhea, and infectious diseases of bacterial and fungal origin. He has also identified different biological and pharmacological pathways which are important for diagnosis and management of different diseases. He has published more than 700 research articles with more than 5K citations and 32 h-index. He is also an author of 15 medical books and 38 book chapters by reputed international publishers. An English alphabet should be pronounced exactly as it is pronounced in a word, the innovation known as "Qadir's Pronunciation of alphabets".

Awards and recognition

- Gold Medal, Pakistan Academy of Sciences, Pakistan.
- Best Young Research Scholar, by Higher Education Commission of Pakistan.
- Productive Scientist of Pakistan, by Pakistan Council for Science and Technology, Pakistan.
- Research Productivity Award, by Pakistan Council for Science and Technology, Pakistan.

Fellowships and membership

- Fellow, The Linnean Society of London, UK
- Fellow, Zakarian Federation of Biotechnologists, Pakistan
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