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The Diphtheria Disease

Muekara Friday Dugbor

Medicine, Texila American University

Nigeria

ABSTRACT

*This study, 'The Diphtheria Disease' explored the historical significance, etiology, symptoms, transmission, and preventive measures related to diphtheria. The study adopted a qualitative meta-analysis approach. The objectives were threefold, which included to ascertain the cause(s) of diphtheria, to investigate potential cures, and to determine the efficacy of treatments. The narrative unfolded through an examination of historical outbreaks, breakthroughs, and contemporary challenges. The study focused on respiratory, cutaneous, nasal, laryngeal, and pharyngeal diphtheria types, detailing symptoms, and transmission modes. Treatment involves diphtheria antitoxin, antibiotics, and supportive care, with emphasis on early intervention and vaccination. The efficacy of the cure was explored, highlighting the importance of timely diagnosis and treatment, antitoxin administration, antibiotic therapy, supportive care, vaccination, isolation, and public health measures. It was found in the study that diphtheria disease was caused by the bacterium Corynebacterium diphtheriae, the antitoxin, derived from the serum of horses could neutralize the circulating diphtheria t*oxin, and this cure is effective.

Keywords: Corynebacterium diphtheriae, Etiology, Symptoms, Transmission, Preventive measures,

1. INTRODUCTION

In the vast realm of infectious diseases that have plagued humanity throughout history, diphtheria stands out as a formidable adversary. This insidious and potentially fatal illness, caused by the bacterium Corynebacterium diphtheriae, has left an indelible mark on communities worldwide. Despite considerable progress in medical science, diphtheria remains a global concern, with sporadic outbreaks reminding us of its tenacious presence.

This article will delve into the depths of subjects relating to diphtheria, unraveling the intricacies of its etiology, symptoms, transmission, and preventive measures. As the author embarks on this exploration, the aim will be, not only to impart knowledge, but also to raise awareness about the gravity of this disease and the importance of vaccination in its prevention.

The article will reveal the historical outbreaks that shaped public health policies to contemporary challenges posed by the disease, and will navigate through the annals of diphtheria, shedding light on the latest research, breakthroughs, and the ongoing efforts to combat its resurgence. This article will unravel the layers of diphtheria. It is hopeful that readers will gain a comprehensive understanding of the disease, empowering them to make informed decisions about their health and contribute to the collective efforts in the global fight against this ancient menace.

2. OBJECTIVES OF THE ARTICLE

In the relentless pursuit of unraveling the mysteries surrounding diphtheria, this article embarks on a threefold mission. With a keen focus on ascertaining the cause(s) of diphtheria, investigating potential cures, and determining

their effectiveness, we delve into the depths of this ancient and persistent threat to human health. The following are contextually the objectives of the study:

1. Ascertaining of the Cause(s) of Diphtheria.
2. Investigating Potential Cures for Diphtheria.
3. Determining the Efficacy of Cures for Diphtheria

3. OBJECTIVES IN NARRATION

Diphtheria, caused by the bacterium Corynebacterium diphtheriae, has long posed challenges to medical science. Our first objective is to meticulously examine the intricacies of diphtheria's etiology. Through a comprehensive exploration of how the bacterium infiltrates and affects the human body, the author aims to uncover the root causes and mechanisms behind the disease. This foundational understanding is crucial for developing targeted interventions and strategies to prevent the onset and transmission of diphtheria.

The quest for effective treatments against diphtheria is a paramount aspect of our study. We meticulously explore existing medical interventions, historical treatments, and contemporary research to ascertain if there are viable cures for diphtheria. By analyzing the spectrum of therapeutic options, from conventional antibiotics to innovative approaches, our objective is to provide a comprehensive overview of the current state of diphtheria treatment modalities.

Building upon the investigation of potential cures, our third objective is to rigorously assess the efficacy of these treatments. We scrutinize clinical outcomes, success rates, and challenges associated with various therapeutic interventions. Through this critical analysis, the author aims to identify the most promising avenues for diphtheria treatment and shed light on areas where further research and development are warranted. The author’s goal is to contribute valuable insights that will inform medical practitioners, policymakers, and researchers in the ongoing battle against diphtheria.

While embarking on this comprehensive exploration of diphtheria, the author’s commitment is to deliver insights that will not only enhance readers’ understanding of the disease but also pave the way for more effective prevention and treatment strategies.

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4. DIPHTHERIA CONCEPTUAL FRAMEWORK FOR CONCEPT DEVELOPMENT

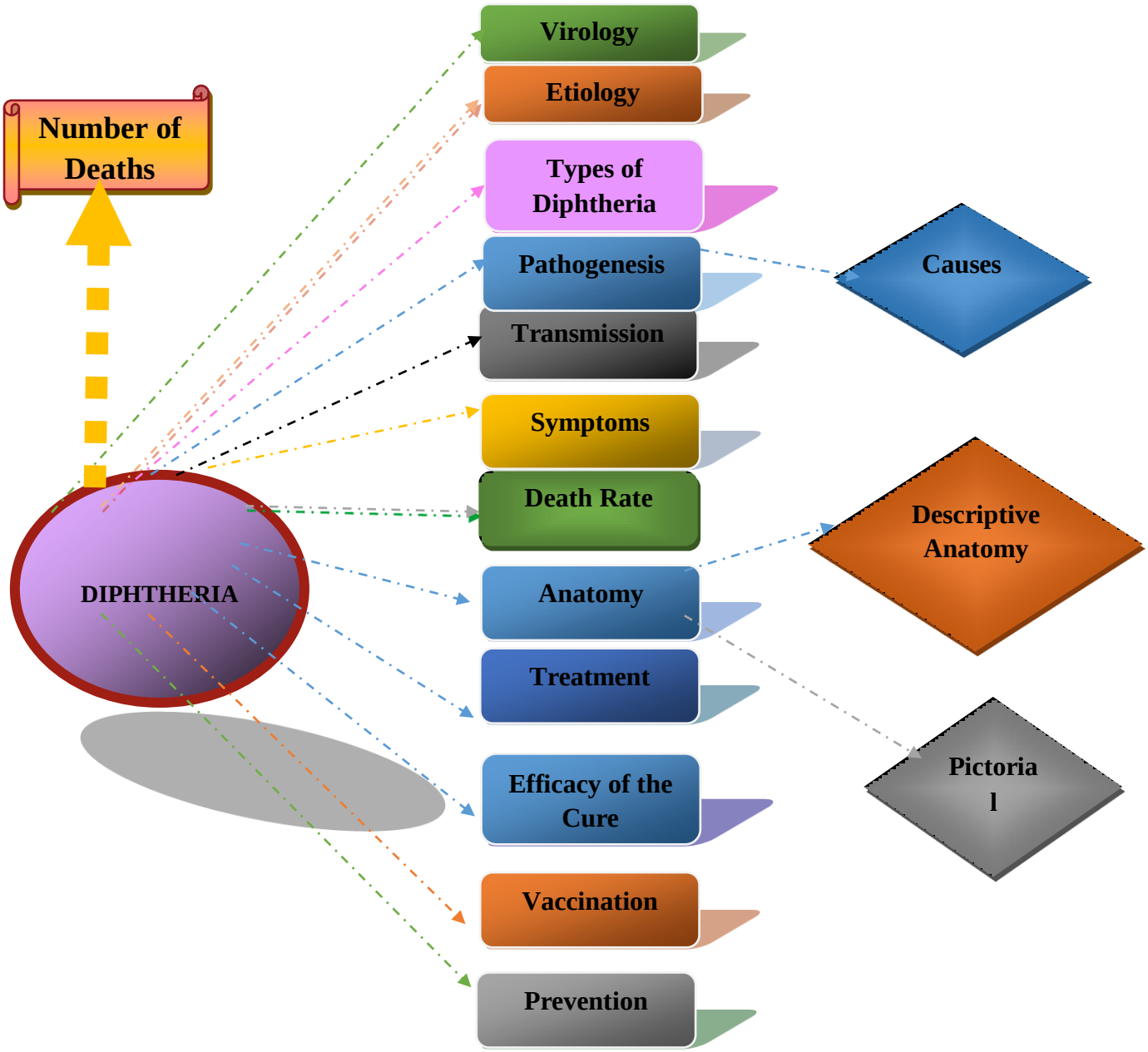

Figure 1 Diphtheria Conceptual Framework

Source: Author's Conceptual Framework, 2024

5. VIROLOGY OF DIPHTHERIA

Diphtheria has an amoebic definition. Seventeen different authorities defined diphtheria in eighteen slightly diverse ways, but the common denomination in its definition is that it is an infectious disease. According to the National Institute of Public Health and the Ministry of Health (NIPH & MOH) [1], diphtheria is described as a highly contagious infection caused by a specific bacterium. The transmission can occur through coughing or direct contact. Better Health [2] characterizes diphtheria as a severe bacterial disease that results in inflammation of the nose, throat, and trachea. They note its rarity in developed nations like Australia due to the widespread adoption of the diphtheria vaccine. The National Health Service (NHS) [3] defines diphtheria as a highly contagious infection affecting the nose, throat, and occasionally the skin. Similarly, the National Foundation for Infectious Diseases (NFID) [4] portrays diphtheria as an acute bacterial disease primarily impacting the tonsils, throat, nose, and skin. Elana [5] 2023 (1)

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provides a straightforward definition, labeling diphtheria as a bacterial infection. Mount Sinai [6] offers a nuanced perspective, specifying that diphtheria is an acute infection caused by the bacterium Corynebacterium diphtheriae. Similarly, Rene [7] defined diphtheria as a bacterial infection caused by Corynebacterium diphtheriae. In the same tone, CDC [8] – 2022 defined diphtheria as an acute, bacterial disease caused by toxin-producing strains of Corynebacterium diphtheriae. In an article written by Guinea Ministry of Health [9], it defined d

Elana [12] 2023 (2),

in anotherplace defined diphtheria as WHO [14] defines diphtheria as a highly contagious vaccine-preventable disease caused by the bacteria Corynebacterium diphtheriae. In another place WHO added that diphtheria is a vaccine-preventable disease caused by exotoxin-producing Corynebacterium diphtheriae but also by Corynebacterium ulcerans. Just as other authorities defined diphtheria, Amarachi [18], diphtheria is a serious infection caused by strains of a bacteria called Corynebacterium diphtheriae that produce toxins.

a French medical

pioneer, named Pierre Bretonneau, bestowed a name upon a menacing disease he called diphtérite. Drawing inspiration from the Greek word diphtheriae, meaning leather, he aptly captured the ailment's defining characteristic—a thick, leathery accumulation of dead tissue in the throat, creating a harrowing challenge for afflicted individuals to breathe or swallow, often rendering these actions impossible. The vulnerability of children, with their comparably diminutive airways, heightened the severity of the threat. This was how the name ‘diphtheria came to being.

Prior to Pierre giving the deadly disease its name – diphtérite, at Kingston, a New-Hampshire town nestled in a low plain, in 1735, there epidemic popularly called the 'throat distemper,' which emerged during a damp and cold season, proving to be exceptionally malignant and surpassing any previous fatality known in the region. Even the linguistic virtuoso Noah Webster found himself at a loss for words in describing a dreadful malady. In his work, "A Brief History of Epidemic and Pestilential Diseases," he recounted an ominous occurrence of this disease.

Webster meticulously chronicled the symptoms, which included general weakness and a swelling of the neck. The insidious disease traversed the colonies, progressing southward and leaving a trail of devastation in its wake. Webster poignantly described it as the "plague among children," recounting how families were decimated, losing three or four children, and, in some tragic cases, all of them. Moreover, those fortunate enough to survive often succumbed to premature death, as the "throat distemper" had left an enduring mark, weakening their bodies, as observed from Webster's perspective over half a century later.

Diphtheria, throughout the 18th and 19th centuries, cast a grim shadow over the medical profession, presenting a nightmarish scenario of children suffocating and succumbing to its clutches. It spared neither the affluent nor the destitute, afflicting both renowned families and those dwelling in anonymity. A poignant example unfolded in 1878 when Princess Alice, the daughter of Queen Victoria, succumbed to diphtheria at the age of thirty-five. The disease also took a toll on five of Alice's offspring and her husband, the Grand Duke of Hesse-Darmstadt, resulting in the tragic loss of their youngest child.

Frederick [20] revealed that the discovery of the bacterium responsible for causing diphtheria is credited to Edwin Klebs, a German-Swiss pathologist. In 1883, Klebs, along with Friedrich Loeffler, identified and isolated the bacterium that causes diphtheria, naming it Corynebacterium diphtheriae. This breakthrough in understanding the microbial cause of the disease was a crucial step in the development of preventive measures and treatments for diphtheria. Klebs made significant contributions to the field of microbiology, and his work on diphtheria paved the way for subsequent research and the development of the diphtheria vaccine. The collaborative efforts of Klebs and Loeffler laid the foundation for a better understanding of infectious diseases and contributed to advancements in medical science. The history of diphtheria is a tale of medical discovery, scientific breakthroughs, and public health interventions. The disease, caused by the bacterium Corynebacterium diphtheriae, has left its mark on human populations for centuries. Diphtheria plagued communities long before it was recognized. Historical records and writings hint at its existence, describing mysterious ailments affecting the respiratory system. However, it was not until the 19th century that the disease attracted significant attention.

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Around the same time as Klebs and Friedrich, another milestone emerged with the development of diphtheria antitoxin. German bacteriologist Emil von Behring, along with his colleagues, successfully developed and assessed a serum containing antibodies against the diphtheria toxin. This marked the birth of specific treatment for diphtheria. The history of diphtheria reflects the triumphs of medical research, the development of vaccines, and the tireless efforts of public health initiatives in combating a once-deadly disease. Currently, in the 21st century, diphtheria is controlled in many countries due to routine vaccination programs. However, the threat persists in areas with inadequate vaccination coverage, and ongoing efforts are essential to prevent outbreaks and maintain global health.

6. TYPES OF DIPHTHERIA

There is no single point agreement on how many types of diphtheria there are.

classical respiratory diphtheria, laryngeal diphtheria, nasal diphtheria, and cutaneous diphtheria. On their part, the CDC]8] asserted that there are five types of diphtheria – Respiratory diphtheria, Nasal diphtheria, Pharyngeal and tonsillar diphtheria, Laryngeal diphtheria, and Cutaneous diphtheria. These types are explained as follows:

Respiratory Diphtheria: - This is a form of diphtheria, an infectious disease caused by the bacterium Corynebacterium diphtheriae. Diphtheria can manifest in different forms, and respiratory diphtheria specifically affects the respiratory system. The disease is characterized by the development of a thick, grayish membrane in the throat and upper respiratory tract, which can lead to difficulty breathing and other severe complications.

Cutaneous Diphtheria: - This is a form of diphtheria that primarily affects the skin. It is caused by the bacterium Corynebacterium diphtheriae, the same bacterium responsible for respiratory diphtheria. While respiratory diphtheria involves the upper respiratory tract, cutaneous diphtheria occurs when the bacteria infect the skin. Cutaneous diphtheria is rare in countries with high vaccination coverage, but it can still occur in populations with suboptimal vaccination rates or in areas with challenging living conditions. It is important to recognize and promptly treat cases of cutaneous diphtheria to prevent complications and further transmission. If you suspect cutaneous diphtheria or are in an area where the disease is prevalent, seek medical attention for appropriate diagnosis and treatment.

Laryngeal Diphtheria: - This is a specific form of diphtheria that affects the larynx, which is the part of the respiratory system containing the vocal cords. Diphtheria, in general, is caused by the bacterium Corynebacterium diphtheriae, and it can manifest in various forms depending on the site of infection. Laryngeal diphtheria specifically involves the infection and formation of a characteristic membrane in the larynx. Laryngeal diphtheria is a serious condition that requires prompt intervention. While the incidence of diphtheria has significantly decreased in regions with widespread vaccination, it remains a concern in areas with lower vaccination coverage. Public health efforts to maintain high vaccination rates and prompt medical treatment for suspected cases are essential for preventing the spread of this potentially life-threatening disease.

Nasal Diphtheria: - This is a form of diphtheria that specifically affects the nasal passages. Diphtheria is an infectious disease caused by the bacterium Corynebacterium diphtheriae. Nasal diphtheria occurs when the bacteria infect the mucous membranes of the nasal cavity, leading to the development of symptoms in that region. Nasal diphtheria is rare in regions with high vaccination coverage, as routine immunization programs have been successful in reducing the incidence of the disease. However, in areas with lower vaccination rates or in populations with limited access to healthcare, nasal diphtheria and other forms of the disease can still occur. Public health efforts, including vaccination campaigns and awareness programs, are critical for preventing the spread of diphtheria and its potential complications.

7. PATHOGENESIS OF DIPHTHERIA

Medically, the pathogenesis of diphtheria involves the bacterium Corynebacterium diphtheriae and the production of a potent exotoxin known as the diphtheria toxin. The author would take the analysis of the pathogenesis of diphtheria thus:

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Bacterial Infection:

Diphtheria is caused by the bacterium Corynebacterium diphtheriae, which is primarily transmitted through respiratory droplets or by direct contact with respiratory secretions.

Colonization of Respiratory Tract:

The bacteria typically colonize the mucous membranes of the upper respiratory tract, including the throat, nasal passages, and larynx.

Toxin Production:
Once colonized, C. diphtheriae could produce the diphtheria toxin, a potent exotoxin. The genes responsible for toxin production are executed a bacteriophage (a virus that infects bacteria), which can integrate into the bacterial genome.

Diphtheria Toxin:
The diphtheria toxin is a single protein composed of two subunits: the A subunit, responsible for the toxic effects, and the B subunit, responsible for binding to host cells. The toxin interferes with protein synthesis in the host cells by inhibiting a component of the protein synthesis machinery known as elongation factor 2 (EF-2). Two of the toxigenic C. diphtheriae cases presented with cutaneous symptoms while the third was an asymptomatic carrier in the household of one of the cases. Isolates from all 3 cases belonged to the same biovar (gravis) and Sequence Type (ST25) by multi-locus sequence typing (MLST) as a previous cluster in the same geographical area - UK Health Security Agency [10]

Tissue Damage and Pseudomembrane Formation:
The diphtheria toxin causes damage to the host's tissues, leading to inflammation and the formation of a thick, grayish membrane on the affected mucous membranes. This pseudomembrane is composed of dead tissue, bacteria, and inflammatory cells. It can form in various locations, such as the throat (pharynx), nasal passages, larynx, and other respiratory structures.
Systemic Effects:

If diphtheria toxin enters the bloodstream, it can cause systemic effects affecting organs such as the heart, kidneys, and nerves. Cardiac complications are particularly concerning and can result in myocarditis and heart failure.

Host Immune Response:
The host's immune system responds to bacterial infection and toxins, leading to the activation of immune cells and the production of antibodies. The development of immunity, either through natural infection or vaccination, is essential for protection against future infections.

8. TRANSMISSION OF DIPHTHERIA

Diphtheria disease is caused by the bacterium Corynebacterium diphtheriae. While its incidence has significantly declined in regions with robust vaccination programs, understanding the modes of transmission remains crucial for preventing outbreaks and protecting public health.

Modes of Transmission are:

Respiratory Droplets: - The primary mode of diphtheria transmission is through respiratory droplets. Infected individuals, especially those with respiratory forms of the disease, expel tiny droplets containing the bacterium into the air when they cough, sneeze, or talk. Close contact with an infected person in confined spaces facilitates the transmission of respiratory droplets.

Direct Contact: - Diphtheria can also spread through direct contact with an infected person or their belongings. Touching surfaces contaminated with respiratory secretions, such as hands or personal items, can lead to transmission. Proper hand hygiene is critical in preventing the spread of the bacterium – NFID [4]

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Asymptomatic Carriers: - Some individuals, known as carriers, may harbor the bacteria without showing symptoms of the disease. Carriers can still transmit the bacterium to susceptible individuals. Identifying and managing carriers is a challenge in controlling the spread of diphtheria.

9. SYMPTOMS OF DIPHTHERIA DISEASE

The symptoms of diphtheria can vary depending on the form of the disease (respiratory, cutaneous, or nasal) and the severity of the infection. Here are the common symptoms associated with diphtheria:

For Respiratory Diphtheria:
Sore Throat: - The infection often starts with a sore throat, which may initially resemble a common respiratory infection.

Fever: Patients may experience an elevated body temperature as part of the body's immune response to the infection.

Difficulty Swallowing: - Swallowing may become painful and difficult due to inflammation of the throat.

Grayish Membrane: - One of the hallmark features is the formation of a thick, grayish membrane in the larynx of the throat and/or nasal passages, which can lead to airway obstruction. This membrane can obstruct the airway and contribute to respiratory distress.

Swollen Neck Glands: - Swelling of the neck glands (enlarged lymph nodes) is common in respiratory diphtheria.

Hoarseness and Changes in Voice: - In cases where the larynx is affected, individuals may experience hoarseness and changes in their voice.

For Cutaneous Diphtheria:

Skin Lesions: - Cutaneous diphtheria presents with skin sores or lesions that may be painful and develop a grayish membrane.

Swelling and Redness: - The affected skin area may show signs of swelling and redness.

For Nasal Diphtheria:
Nasal Congestion: - It is characterized by nasal congestion and discharge, which causes respiratory distress and potential difficulty breathing

Grayish Membrane in Nasal Passages: - Like respiratory diphtheria, a grayish membrane may form in the nasal passages. Under Systemic Complications and Systemic Effects, which could result in severe cases, the diphtheria toxin may enter the bloodstream, leading to systemic effects. Complications can include damage to the heart (myocarditis), nerves (neuritis), and kidneys.

Asymptomatic Carriers: - Some individuals may carry the bacterium without showing symptoms (asymptomatic carriers). These carriers can still transmit the bacterium to others.

Note that diphtheria symptoms can progress rapidly, and severe cases require immediate medical attention. The hallmark grayish membrane is a key diagnostic feature, but not all cases may exhibit this symptom. Complications of diphtheria, such as airway obstruction and systemic effects, can be life-threatening.

10. ANATOMY OF DIPHTHERIA

Descriptive Anatomy

The clinical presentation of diphtheria can vary depending on the form of the disease (respiratory, cutaneous, or nasal) and the severity of the infection. Here are some characteristics that may help recognize diphtheria:

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1. Pseudomembrane Formation:

Key Feature: - One of the distinctive features of diphtheria is the formation of a thick, grayish membrane on mucous membranes.

Location: - The pseudomembrane often develops in the throat (pharynx), nasal passages, larynx, or other respiratory structures.

Appearance: - It has a grayish color and may adhere to the affected mucous membranes. The anatomy of diphtheria refers to the key features of the bacterium, its mode of infection, and the specific effects it has on the human body. Here is an overview of the anatomy of diphtheria:

1. Causative Agent:

Bacterium: - Corynebacterium diphtheriae is a gram-positive, rod-shaped bacterium that causes diphtheria. It is known for its club-shaped appearance and may form characteristic arrangements.

2. Infection Sites: - Mucous Membranes: - Corynebacterium diphtheriae tends to colonize mucous membranes, primarily in the upper respiratory tract, including the throat, nasal passages, and larynx.

3. Diphtheria Toxin:

Exotoxin Production: - One of the key features of diphtheria is the production of a potent exotoxin known as the diphtheria toxin.

Genetic Origin: - The genes responsible for diphtheria toxin production are executed a bacteriophage, a virus that infects bacteria. This genetic element can integrate into the bacterial genome, leading to the production of the toxin.

4. Diphtheria Toxin Structure: - A-B Toxin: The diphtheria toxin is composed of two subunits: the A subunit (toxic component) and the B subunit (binding component).

Mechanism of Action: - The A subunit interferes with protein synthesis in host cells by inhibiting elongation factor 2 (EF-2), leading to cell damage and tissue necrosis.

5. Pseudomembrane Formation: - Tissue Response: In response to the infection and toxin production, the host's tissues may develop inflammation and a pseudomembrane.

Location: - The pseudomembrane is often found in the throat, nasal passages, and other respiratory structures. It is composed of dead tissue, bacteria, and inflammatory cells.

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Pictorial Anatomy

Figure 2 **Diphtheria in the Mouth at the Roof of the Upper Jaw**

Figure 3 Diphtheria on the Neck

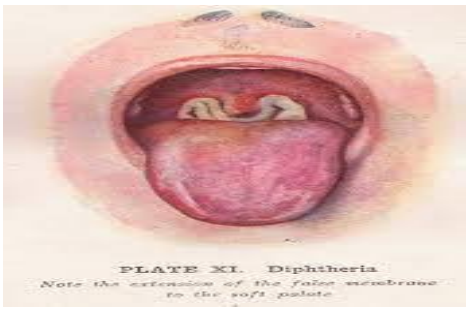

Figure 4 Diphtheria at the roof of the mouth

Figure 5 Diphtheria in the eye

Figure 6 **Diphtheria in the Mouth**

Figure 7 Diphtheria in the eye

Figure 8 & 9 **Diphtheria at the back of the tongue and Knee**

Source: https://punchng.com/how-to-end-diphtheria-spread-expert/

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11. TREATMENT OF DIPHTHERIA DISEASE

According to NYSDOH [15], WHO [14], the treatment of diphtheria involves a combination of antitoxin administration, antibiotics, and supportive care. Early administration is essential to limit the progression of the disease. Early and prompt intervention is crucial to prevent complications and reduce the severity of the disease. Here are the key components of diphtheria treatment:

11. 1. Diphtheria Antitoxin:

Purpose: - Diphtheria antitoxin, derived from horse serum, is a critical component of treatment.

Mechanism: - The antitoxin neutralizes the circulating diphtheria toxin, preventing further damage to the host's tissues.

Administration: - It is administered intravenously or intramuscularly as soon as diphtheria is suspected, even before confirmation through laboratory tests.

11. 2. Antibiotic Therapy

Purpose: - Antibiotics are used to eliminate the bacteria Corynebacterium diphtheriae from the body, reducing the source of toxin production. Common Antibiotics: Erythromycin and penicillin are commonly used antibiotics for diphtheria treatment.

Duration: - Antibiotic treatment is typically continued for a minimum of 14 days to ensure complete eradication of the bacteria.

11. 3. Supportive Care

Airway Management: - In cases of respiratory diphtheria where there is airway obstruction, mechanical ventilation or other airway management measures may be necessary.

Fluid and Nutritional Support: - Adequate hydration and nutrition are essential for patients, especially those with severe cases.

11. 4. Isolation and Infection Control

Isolation: Infected individuals should be isolated to prevent the spread of the bacterium to others.

Infection Control Measures: - Strict infection control measures should be implemented, including proper hygiene and protective measures for healthcare workers.

11. 5. Monitoring and Follow-up

Clinical Monitoring: - Patients with diphtheria require close monitoring of their clinical status, including respiratory function and vital signs.

Laboratory Tests: - Follow-up laboratory tests may be conducted to ensure the effectiveness of antibiotic treatment and the resolution of the infection.

Important Considerations: - Early Intervention: Early administration of diphtheria antitoxin and antibiotics is crucial for effective treatment and to prevent complications.
Immunization: - Vaccination remains the most effective strategy for preventing diphtheria. Routine childhood immunization and booster doses for adolescents and adults are essential to maintain immunity.

Public Health Measures: - In the case of a confirmed diphtheria case, public health authorities may implement measures such as contact tracing, vaccination campaigns, and public awareness initiatives to prevent further spread. It is important to note that diphtheria is a medical emergency, and individuals suspected of having the disease should

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seek immediate medical attention. Timely and appropriate treatment significantly improves the chances of a positive outcome and reduces the risk of complications.

12. EFFICACY OF THE CURE OF DIPHTHERIA

The efficacy of the cure for diphtheria is high when appropriate and timely medical interventions are administered. The key components of diphtheria treatment, which include diphtheria antitoxin, antibiotics, and supportive care, have proven to be effective in reducing mortality and preventing complications. Factors that contribute to the efficacy of the cure for diphtheria are:

Early Diagnosis and Treatment: - Early recognition of diphtheria symptoms and prompt initiation of treatment significantly improve the chances of a positive outcome. Early administration of diphtheria antitoxin and antibiotics is critical to stopping the progression of the disease.

Diphtheria Antitoxin: - Diphtheria antitoxin is highly effective in neutralizing the diphtheria toxin circulating in the bloodstream. Early administration of antitoxin helps prevent further damage to the host's tissues.

Antibiotic Therapy: - Antibiotics such as erythromycin and penicillin are effective in eliminating the bacteria Corynebacterium diphtheriae from the body. Adequate and timely antibiotic treatment is essential for preventing the spread of the bacterium and reducing the severity of the infection.

Supportive Care: - Supportive care, including airway management, fluid, and nutritional support, helps manage complications and improve the overall condition of the patient. Addressing respiratory distress and maintaining vital functions contributes to a better prognosis.

Vaccination: - Post-exposure vaccination and booster doses for contacts of confirmed cases contribute to preventing the spread of the disease. Individuals who have been in close contact with a confirmed diphtheria case may receive a booster dose of the diphtheria vaccine to prevent further transmission.

Isolation and Infection Control: - Strict isolation measures and infection control practices help prevent further transmission of the bacterium.

Public Health Measures: - Public health interventions, including contact tracing, vaccination campaigns, and public awareness initiatives, contribute to controlling outbreaks and preventing the recurrence of diphtheria. While the efficacy of the cure is high, individual outcomes can vary based on factors such as the severity of the infection, the presence of complications, and the timeliness of medical intervention. Despite the availability of effective treatments, diphtheria remains a serious disease, and prevention through vaccination remains the primary strategy for controlling its spread. It is important to note that the information provided here is based on general knowledge as of my last update in January 2022. Specific cases and treatment outcomes can be influenced by numerous factors, and the latest medical guidelines and research should be consulted for the most current information.

13. VACCINATION

Vaccine Development is one of the major leaps in diphtheria history, which came with the development of a vaccine. In the 1920s, scientists Albert Calmette and Camille Guérin developed an effective toxoid vaccine. This laid the foundation for widespread vaccination efforts, significantly reducing the incidence of diphtheria in many parts of the world. Diphtheria had a global impact, affecting both developed and developing nations. Through the mid-20th century, vaccination efforts, improved living conditions, and antibiotic treatments further reduced the prevalence of diphtheria in many parts of the world - Diphtheria vaccination has played a significant role in reducing the incidence of the disease globally. It is an integral part of routine immunization schedules in many countries and is considered a cornerstone of public health efforts to control and prevent infectious diseases.

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Diphtheria vaccination is a crucial preventive measure to protect individuals from contracting diphtheria, a potentially serious and life-threatening bacterial infection caused by Corynebacterium diphtheriae. Vaccination against diphtheria is typically administered in combination with other vaccines, providing protection not only against diphtheria but also against other diseases.

There are several types of vaccines used to prevent diphtheria, and they are categorized based on the age group for which they are recommended. The primary types of diphtheria vaccines include:

1. DTP Vaccine (Diphtheria, Tetanus, and Pertussis): - This is administered to infants and young children.

Components of DTP: - DTP combines vaccines against diphtheria, tetanus, and pertussis (whooping cough).

Schedule for the administration of DTP is typically in a series of doses starting at two months of age, with booster doses given at intervals throughout childhood.

2. DTaP Vaccine (Diphtheria, Tetanus, and Acellular Pertussis): - This is a more recent formulation of the vaccine designed to reduce side effects. It is given to infants and young children.

Components of DTaP: - DTaP includes vaccines against diphtheria, tetanus, and pertussis. However, the pertussis component is acellular, which may result in fewer side effects compared to the whole-cell pertussis component in DTP.

Schedule for DTaP Intake: This is administered in a series of doses during infancy and early childhood, with booster doses recommended in later childhood and adolescence.

3. Tdap Vaccine (Tetanus, Diphtheria, and Acellular Pertussis): - Tdap is given as a booster to adolescents and adults.

Components: Tdap includes vaccines against tetanus, diphtheria, and acellular pertussis.

Schedule for Tdap: Recommended as a booster dose for adolescents aged 11–12, with additional boosters for adults, particularly pregnant women, and those in contact with infants.

4. Td Vaccine (Tetanus and Diphtheria): - Td is a booster vaccine for adolescents and adults.

Components: Td includes vaccines against tetanus and diphtheria.

Schedule for Td: Boosters are recommended every ten years throughout adulthood.

5. DT Vaccine (Pediatric Diphtheria and Tetanus): - DT is a variant of the vaccine specifically for children who cannot receive the pertussis component.

Components: DT includes vaccines against diphtheria and tetanus, excluding pertussis.

Schedule for DT: Administered to children who have contraindications to the pertussis component.

Note that high vaccination coverage is crucial for maintaining herd immunity and preventing outbreaks of diphtheria. Booster doses throughout life are essential to ensure ongoing immunity. For pregnancy cases, Tdap is recommended during each pregnancy to protect both the pregnant woman and her newborn against pertussis. Individuals traveling to areas with a higher risk of diphtheria should ensure their vaccinations are up to date. Other vaccines as asserted by

14. PREVENTION

Vaccination with the diphtheria toxoid, often administered as part of combination vaccines, is the primary preventive measure. The vaccine induces an immune response, including the production of antibodies, to protect against diphtheria. The severity of diphtheria can vary, ranging from mild cases with localized effects to severe cases with systemic complications. Prompt medical intervention, including administration of diphtheria antitoxin and antibiotics,

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is crucial for managing the disease and preventing complications. Public health efforts, such as vaccination programs, play a key role in controlling the spread of diphtheria.

According to (NFID) [4], vaccination is the best form of preventing diphtheria. Preventing diphtheria involves a comprehensive approach that includes vaccination, good hygiene practices, and public health measures. The following are ways to prevent diphtheria:

1. Vaccination: - Routine Childhood Immunization: Diphtheria vaccination is typically initiated in infancy as part of routine childhood immunization schedules. The vaccine is often administered in combination with vaccines for tetanus and pertussis (DTP or DTaP).

Booster Shots: Booster doses of diphtheria-containing vaccines are recommended during childhood, adolescence, and adulthood. Tdap (tetanus, diphtheria, and acellular pertussis) and Td (tetanus and diphtheria) boosters are commonly used.

2. Vaccination for Adults: - Adult Booster Shots: Adults who have completed their childhood vaccination series should receive periodic booster shots to maintain immunity. Pregnant Women are recommended to use Tdap vaccination to protect both the mother and the newborn from pertussis.

3. Public Health Vaccination Campaigns: - Catch-Up Campaigns: In regions with lower vaccination coverage or during outbreaks, public health authorities may implement catch-up vaccination campaigns to ensure a higher level of immunity in the population.

4. Maintaining Herd Immunity: - High Vaccination Coverage: Achieving and maintaining high vaccination coverage in the population is crucial for creating herd immunity. This protects those who cannot be vaccinated, such as individuals with certain medical conditions or allergies.

5. Good Hygiene Practices: - Hand Hygiene: Regular handwashing with soap and water helps reduce the risk of acquiring and spreading respiratory infections, including diphtheria. Respiratory Hygiene: Encouraging individuals to cover their mouth and nose when coughing or sneezing and proper disposal of tissues can help prevent the spread of respiratory droplets.

6. Isolation and Infection Control: - Isolation of Cases: Individuals suspected or confirmed to have diphtheria should be promptly isolated to prevent the spread of the bacterium.

Infection Control Measures: Healthcare facilities should implement infection control measures to minimize the risk of healthcare-associated transmission.

7. Monitoring and Surveillance: - Disease Surveillance: Surveillance systems should be in place to monitor and track cases of diphtheria. Early detection allows for rapid response and containment measures.

8. Travel Considerations: - Pre-Travel Vaccination: Individuals traveling to regions where diphtheria is more prevalent should ensure their vaccinations are up to date before travel.

9. Education and Awareness: - Public Awareness Campaigns: Educational campaigns aimed at the public, healthcare professionals, and policymakers can raise awareness about the importance of vaccination and hygiene practices.

10. Prompt Medical Attention: - Early Diagnosis and Treatment: Individuals with symptoms suggestive of diphtheria should seek prompt medical attention. Early diagnosis and treatment, including administration of diphtheria antitoxin and antibiotics, are crucial for a positive outcome.

15. SYMPTOMS

According to Mount Sinai [6], the following are symptoms of diphtheria disease:

1. Fever and chills

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2. Sore throat, hoarseness
3. Painful swallowing
4. Croup-like (barking) cough
5. Drooling (suggests airway blockage is about to occur)
6. Bluish coloration of the skin
7. Bloody, watery drainage from nose
8. Breathing problems, including difficulty breathing, fast breathing, high-pitched breathing sound (stridor)
9. Skin sores (usually seen in tropical areas

16. DEATH RATES

Diphtheria is not the deadliest disease in the globe, but it is on record that has caused several deaths. According to Frederick [20], the death related to diphtheria was first so separately classified by the Registrar-General of England in 1855; it appeared for the first time in the New York City reports in 1857; and in the Massachusetts registration reports in 1858. In the Annual Report of the City Inspector of New York for the year ending December 31, 1860, the statement was made that "It (diphtheria) is not contagious. Within the antitoxin period in the 19th century, during the identification of the diphtheria toxin by researchers such as Émile Roux and Alexandre Yersin occurred in the late 19th century; also in 1890, when Emil von Behring and Kitasato Shibasaburo developed the concept of antitoxins and successfully produced diphtheria antitoxin, more than 16800 deaths caused by diphtheria disease globally.

Diphtheria still causes more deaths in the United States than whooping cough, measles, or scarlet fever. This disease, therefore, remains a distinct menace to children notwithstanding antitoxin, its specific curative agent. The average annual number of deaths from diphtheria and croup in the United States is approximately 17,000, against 10,000 from whooping-cough, 9,000 from measles and 8,000 from scarlet fever. Guinea Ministry of Health [9], while reporting to W.H.O, asserted “
Diphtheria disease is caused by the bacterium Corynebacterium diphtheriae.

1. The primary mode of diphtheria transmission is through respiratory droplets.
2. Diphtheria can also spread through direct contact with an infected person or their belongings.
3. The antitoxin, derived from the serum of horses for the treatment of diphtheria disease neutralizes the circulating diphtheria toxin, preventing further damage to the host's tissues.
4. Antibiotics are used to eliminate the bacteria Corynebacterium that causes diphtheriae in humans from the body, reducing the source of toxin production.
5. Infected individuals should be isolated to prevent the spread of the bacterium to others.
6. The key components of diphtheria treatment, which include diphtheria antitoxin, antibiotics, and supportive care, have proven to be effective in reducing mortality and preventing complications.
7. Antibiotics such as erythromycin and penicillin are effective in eliminating the bacteria Corynebacterium diphtheriae from the body.
8. Individuals who have been in close contact with a confirmed diphtheria case may receive a booster dose of the diphtheria vaccine to prevent further transmission.
9. Immunization is the best form of prevention from diphtheria disease.

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17. FINDINGS

From the study, the causes, the cure, and the efficacy of the cure of diphtheria disease were ascertained from the following were findings:

10. Diphtheria disease is caused by the bacterium Corynebacterium diphtheriae.
11. The primary mode of diphtheria transmission is through respiratory droplets.
12. Diphtheria can also spread through direct contact with an infected person or their belongings.
13. The antitoxin, derived from the serum of horses for the treatment of diphtheria disease neutralizes the circulating diphtheria toxin, preventing further damage to the host's tissues.
14. Antibiotics are used to eliminate the bacteria Corynebacterium that causes diphtheriae in humans from the body, reducing the source of toxin production.
15. Infected individuals should be isolated to prevent the spread of the bacterium to others.
16. The key components of diphtheria treatment, which include diphtheria antitoxin, antibiotics, and supportive care, have proven to be effective in reducing mortality and preventing complications.
17. Antibiotics such as erythromycin and penicillin are effective in eliminating the bacteria Corynebacterium diphtheriae from the body.
18. Individuals who have been in close contact with a confirmed diphtheria case may receive a booster dose of the diphtheria vaccine to prevent further transmission.
19. Immunization is the best form of prevention from diphtheria disease.

18. CONCLUSION

The study underscored the enduring threat of diphtheria, emphasizing the importance of comprehensive understanding and collective efforts for prevention and treatment. While historical accounts revealed the impact of the disease, breakthroughs in microbiology, such as the identification of Corynebacterium diphtheriae, paved the way for preventive measures like vaccines. Contemporary treatments involved a combination of antitoxin, antibiotics, and supportive care, demonstrating high efficacy when administered early. The article concluded with findings that reinforced the significance of vaccination, timely medical intervention, and public health measures in the ongoing battle against diphtheria.

19. RECOMMENDATION

From the findings of the study, the following recommendations

2. Avoid t the bacterium Corynebacterium diphtheriae, the respiratory droplets of diphtheria and direct contact with an infected person or their belongings. These are ways of preventing catching diphtheria disease.
3. Both children and adults should be immunized against diphtheria disease.
4. If contacted diphtheria disease, go for the antitoxin for a quick cure.

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5. Do not lose hope on the cure of diphtheria disease; it is effective.

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