Epidemiology of Diphtheria

By:
Dr.Yossra K.Al-Robaiaay
Assistant professor
FICMS (FM)

Definition:

- **Diphtheria is an acute, toxin-mediated disease caused by toxigenic *Corynebacterium diphtheriae***
- **It's a very contagious and potentially life-threatening bacterial disease.**
- **It's an infectious disease, which usually attacks the throat and nose mucous membrane.**

Diphtheria

- Greek diphtheria (leather)
- Recognized by Hippocrates in 5th century
- Epidemics described in 6th century
- C. diphtheriae described by Klebs in 1883
- Toxoid developed in 1920s

Etiology:

- *C. diphtheriae* is an **aerobic gram-positive bacillus.**
  - Pleomorphic, club-end
  - Non-spore-forming
  - Non-acid-fast
  - Non-motile

Infectious agent:

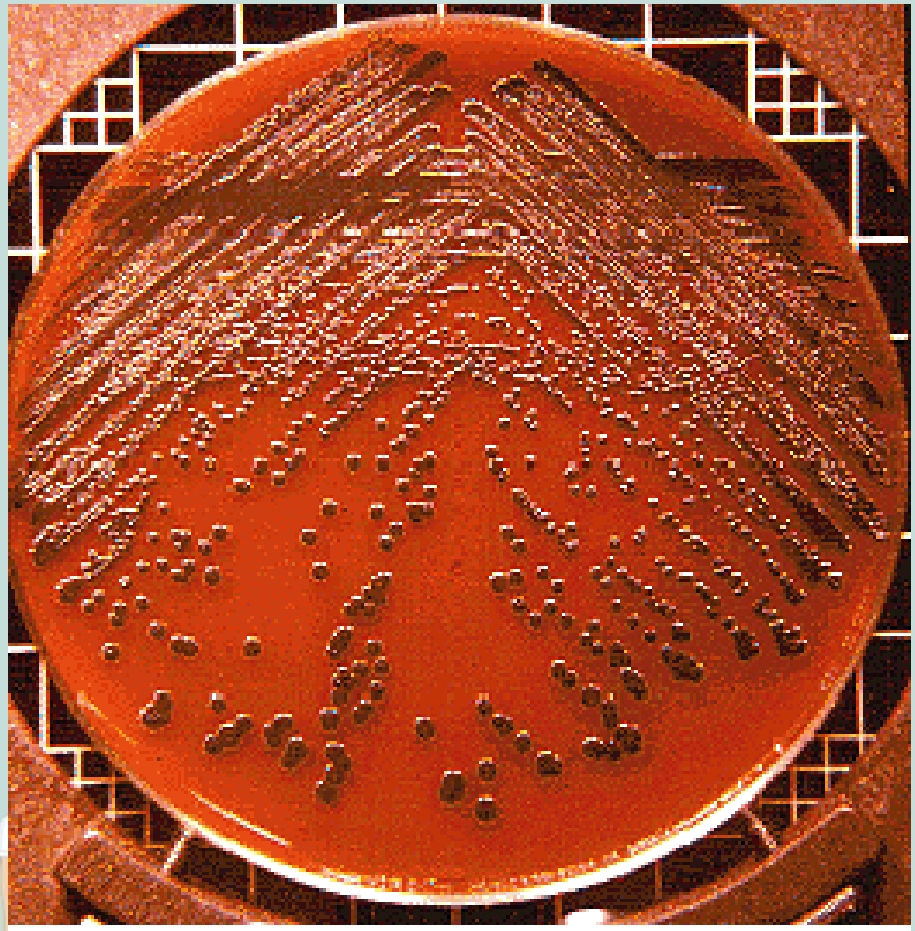
- Toxin production (toxigenicity) occurs **only** when the **bacillus is itself infected** (lysogenized) **by a specific virus** (bacteriophage) carrying the genetic information for the toxin (toxogene).

- **C. diphtheriae** has four biotypes—gravis, intermedius, mitis and belfanti.

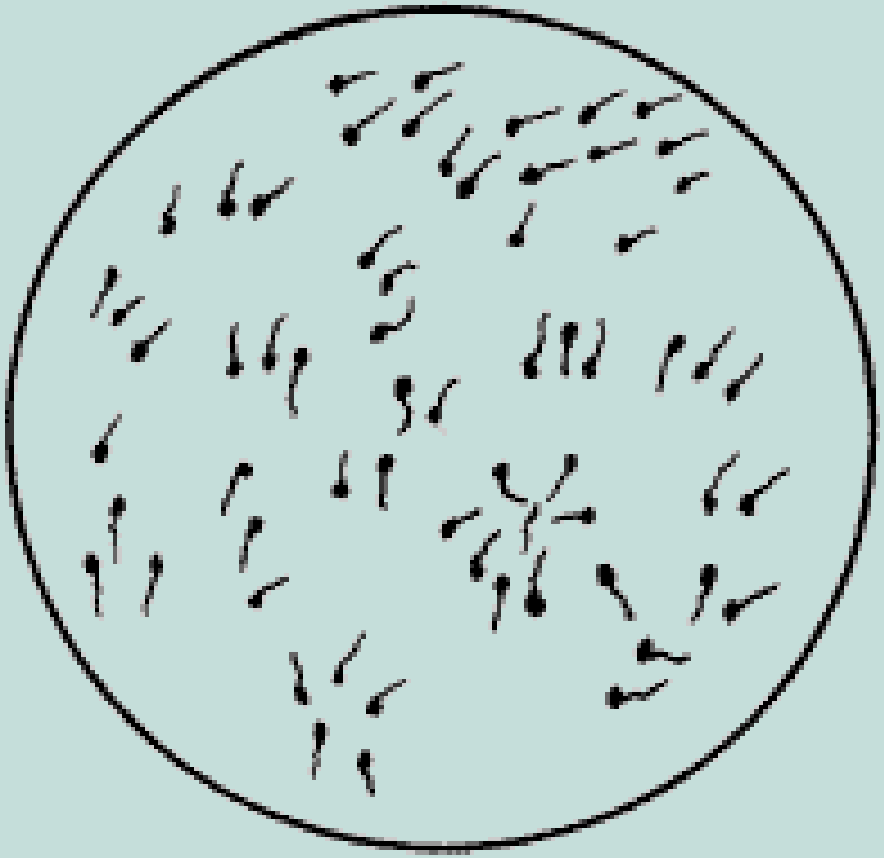
- All strains may produce toxin and can cause severe disease.

- All isolates of **C. diphtheriae** should be tested for toxigenicity.

Gram +ve Bacilli and Colonies



Corynebacterium diphtheriae, mitis
Chocolate tellurite agar



Pathogenesis and pathology:

- **Susceptible persons** may acquire toxigenic diphtheria bacilli in the nasopharynx, middle ear or anterior nares ,skin.
- The organism produces a toxin that **inhibits cellular protein synthesis** and is responsible for local tissue destruction and **pseudomembrane formation.**

Pathogenesis and pathology:

- **The pseudomembrane** consists of **coagulated fibrin, inflammatory cells, destructed mucous tissues and bacteria.**
- The pseudomembrane in **larynx, trachea or bronchi** may have the potential for **airway obstruction.**
- The toxin is responsible for the **major complications** of **myocarditis** and **neuritis**, and can also cause low platelet counts (**thrombocytopenia**) and protein in the urine (**proteinuria**).

EPIDEMIOLOGY

Occurrence:

- Diphtheria occurs **worldwide** and is more prevalent in **winter** months in **temperate** zones.
- It was eradicated from most of the developed world by mass vaccination in the mid-20th century.
- However, it's still **common** in developing countries where immunizations aren't given.

- In 1993 and 1994, thousands cases were reported during a serious **outbreak of diphtheria** in countries of the former Soviet Union.
- The epidemic has **declined** after **a peak in 1995** ,it was responsible for over **140 000 cases** and over **4000 deaths.**
- Over **70%** of cases were aged 15 years or older.

Transmission:

- Transmission is most often **person-to-person spread** from the respiratory tract (by small droplet when coughing or sneezing).
- Rarely, transmission may occur from **skin lesions** or **articles soiled with discharges** from lesions of infected persons.

Source of infection:

Patients and **asymptomatic carriers**

Reservoir:

Humans are the usual **reservoir** and **carriers** are usually **asymptomatic.**

Incubation period:

usually **2–5 days** , occasionally longer **(1–10 days).**

Period of communicability:

- Transmission may occur as long as virulent bacilli are present in discharges and lesions.
- The time is **variable** but is usually **two weeks** or less and seldom more than **four weeks** without antibiotics.
- **Appropriate antibiotic** therapy promptly terminates shedding. The **rare** chronic carrier may shed organisms for **six months or more.**

Period of communicability:

- Transmission may occur as long as virulent bacilli are present in discharges and lesions.
- The time is **variable** but is usually **two weeks** or less and seldom more than **four weeks** without antibiotics.
- **Appropriate antibiotic** therapy promptly terminates shedding.

Susceptibility and resistance:

- Infants born of immune mothers are relatively immune, but passive immunity is usually lost by six months of age.
- **Lifelong immunity** is usually, but not always, acquired after disease or inapparent infection.
- **A primary course of toxoid vaccination** provides long lasting but **not** lifelong immunity.
- Vaccinated individuals may become colonised by *C. diphtheriae* in the nasopharynx while still being protected from clinical disease.

Susceptibility and resistance:

- Infants born of immune mothers are relatively immune, but passive immunity is usually lost by six months of age.
- **Lifelong immunity** is usually, but not always, acquired after disease or inapparent infection.
- **A primary course of toxoid vaccination** provides long lasting but **not** lifelong immunity.

Risk factors

1. Children under 5 and adults over 60 years old are particularly at risk.
2. People living in crowded or unclean conditions (low socio-economic status).
3. Undernutrition.
4. Children and adults who don't have up-to-date immunizations.

Clinical Features:

- Disease can involve almost any mucous membrane.
- For clinical purposes, it is convenient to classify diphtheria into a number of manifestations, **depending on the anatomical site of disease.**

Clinical features of diphtheria

Acute infection

- Nasal infection
- Pharyngotonsillar infection
- Laryngeal infection
- Skin/wound/conjunctival infection (rare)

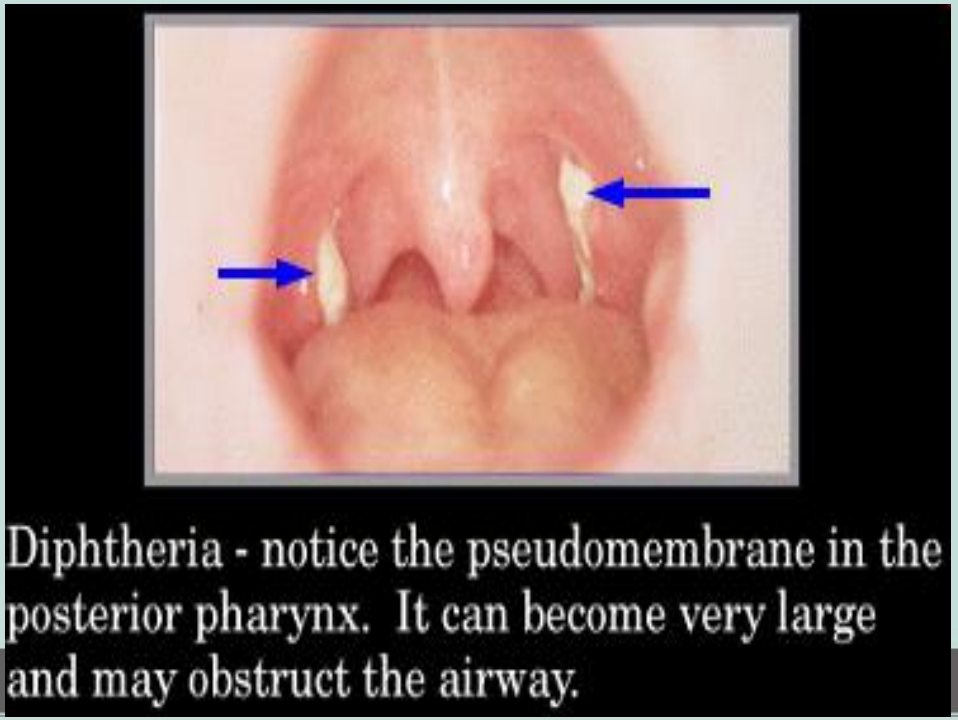
1.Anterior nasal diphtheria

- The onset is **indistinguishable** from that of the common cold and is usually characterized by a **mucopurulent nasal discharge** (containing both mucus and pus) which may become **blood-stained.**
- A white pseudomembrane usually forms on the nasal septum.

2. In pharyngotonsillar diphtheria

- **Insidious** onset of exudative pharyngitis
- Fever not high, but patient appears **toxic**
- Exudate spreads to form adherent "**pseudomembrane"**
- In early stages – whitish membrane which can be wiped off easily over pharynx or tonsils.
- Later it becomes **thick, white- blue to grey –black and adherent.** It is difficult to remove if tried to remove it will result in bleeding.

- Mucosal erythema around the membrane
- Edema of submandibular area
- Bull neck appearance



Pharyngeal Diphtheria: Distant Complications

- Myocarditis
  - Cardiac arrhythmias in acute phase
  - Sudden death
- Neuropathy
  - Motor neuropathy
  - Paralysis of soft palate from 3rd week
  - Eye muslces, limbs, diaprhagm after 5th week.

3. Laryngeal diphtheria

- Laryngeal diphtheria can be either an extension of the pharyngeal form (often) or the only site involved (rarely).
- Symptoms include mild fever (with little absorption of toxin), dyspnea, **hoarseness, and a barking cough**.
- The pseudomembrane can lead to airway obstruction, coma, and death.

Laryngeal diphtheria

4.Cutaneous and Other site diphtheria

- Skin infections are quite common in the **tropics** and are probably responsible for the high levels of **natural immunity** found in these populations.

- Skin infections may be manifested by a **scaling rash** or by **ulcers** with clearly demarcated edges and pseudomembrane.

Cutaneous (skin) diphtheria

10 y/o boy with severe diphtheria

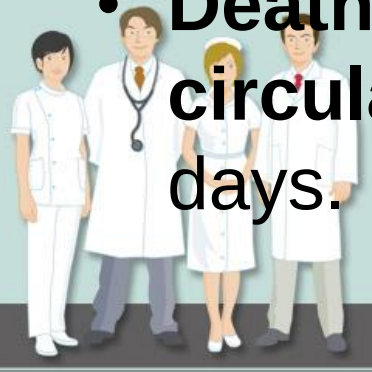
- conjunctivitis
- pharyngeal membrane
- bull neck
- severe myocarditis
- all vaccines contraindicated

CDC

Diphtheria Complications

Most attributable to toxin,severity generally related to extent of local disease

- Most frequent complications are myocarditis About 25% of survivors of the early toxaemia may later develop **myocarditis** with **arrhythmias** or cardiac failure.
- **Neurological involvement** occurs in 75% of cases.
- **Death** occurs in 5-10% .Death from **acute circulatory failure** may occur within the first 10 days.



Differential diagnosis

- Membranous Tonsillitis
- Infectious mononucleosis
- Leukemia
- Aphthous ulcers
- Traumatic ulcer
- Foreign body (Nasal Diphtheria)

Diagnostic tests:

- Specimens for **culture** should be obtained from the nose or throat or any mucosal or cutaneous lesion.
- Material should be obtained from **beneath the membrane** , or a **portion of the membrane itself** should be submitted for culture.

Treatment:

- Children and adults with diphtheria are treated in a hospital. After a confirmation of the diagnosis through a throat culture.

- The infected person receives a special anti-toxin, given to neutralize the diphtheria toxin already circulating in the body.

- as well as antibiotics to kill the remaining diphtheria bacteria.

- **Immediate hospitalization and strict isolation with early intervention allow most patients to recover from diphtheria.**
- **After the antibiotics and anti-toxin have taken effect, patient with diphtheria will need bed rest for a while (4 to 6 weeks, or until full recovery).**
- **Bed rest is particularly important if the person's heart has been affected by the disease. (Myocarditis)**

Treatment

- Antibiotic **not useful** in Acute infections.
- Antitoxin is a must.
- Antitoxin obtained from **horse serum**

Mild **20,000 to 40,000 units**

Moderate **40,000 to 60,000 units**

Severe **80,000 to 1,00,000 units**

- Commonly used antibiotics

Penicillin parentrally,

Oral Erythromycin

- Those who have recovered should still receive a full course of the **diphtheria** vaccine to prevent a recurrence.
- because the occurrence of disease doesn't guarantee lifetime immunity.

Prevention:

- Preventing diphtheria depends almost completely on:
- immunizing children with the **diphtheria/pertussis/tetanus** (DPT) vaccine. non-immunized adults with the **diphtheria/tetanus vaccine (DT).**
- Most cases of diphtheria occur in people who haven't received the vaccine at all or haven't received the entire course.

The immunization schedule:

- DPT vaccines at 2, 4, and 6 months of age.
- 1st booster dose given at 12 to 18 months.
- 2nd booster dose given again at 4 to 6 years (pre-school).
- booster shots given every 10 years after that to maintain protection.

Diphtheria Toxoid

- **Formalin-inactivated diphtheria toxin**
- **Schedule** Three doses + 2booster
  Booster shots every 10years
- **Efficacy** Approximately 95%
- **Duration** Approximately 10 years
- **administered with tetanus toxoid .**

Diphtheria and Tetanus Toxoids Adverse Reactions:

- Local reactions (erythema, induration)
- Exaggerated local reactions.
- Fever and systemic symptoms not common.
- Severe systemic reactions are rare.

Diphtheria and Tetanus Toxoids

contraindications and Precautions:

- **Severe allergic reaction to vaccine component following a prior dose.**

- **Moderate or severe acute illness.**

CONTROL MEASURES:

*__Prompt notification__ to the local public health officials.

*__Identification of close contacts__ of a person suspected to have diphtheria .

*For close contact , regardless of their immunization status ,the following measures should be taken :

1- Surveillance for 7 days for evidence of disease.

2-Culture for C. diphtheria.

3- Antimicrobial prophylaxes with oral erythromycin.

Treating Contacts

- All contacts are advised to receive 500 mg

Erythromycin 4 times a day.

Follow up:

- **Pharyngeal culture should be obtained from contacts proven to be carriers at a minimum of 2 weeks after completion of therapy.**
- **If cultures are positive , an additional 10- day therapy of erythromycin should be given .**

Outbreak measures:

- Outbreaks of diphtheria require **immunising the largest possible proportion** of the population involved.
- Emphasising the need for protection of **infants and preschool children.**
- In outbreaks amongst adults immunize groups that are **at high risk.**

- **Repeat** immunisations may be recommended after **one month**.
- Outbreak investigations involve **enhanced case surveillance** with laboratory confirmation of all suspected cases.
- **Identification** and appropriate **management** of close contacts and asymptomatic carriers.

DIPHTHERIA
is deadly-

IMMUNISATION
is the safeguard

ASK AT YOUR LOCAL COUNCIL OFFICES OR WELFARE CENTRE

Issued by the Ministry of Health and the Central Council for Health Education

THANK YOU