Diptheria

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Diphtheria

- Greek *diphthera* (leather hide)
- Caused by Aerobic Gram +ve rods
- *Corynebacterium diphtheriae*
- Exotoxin production only if infected by virus phage infected carrying toxin gene
Gram +ve Bacilli and Colonies

*Corynebacterium diphtheriae, mitis*
*Chocolate tellurite agar*
Etiology

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

- Culture of the organism requires selective media, tellurite agar or Loeffler’ serum slants under aerobic conditions.
• If isolated, the organism must be distinguished in the laboratory from other *Corynebacterium* species that normally inhabit the nasopharynx and skin (*e.g.*, diphtheroids).
Etiology

- The major virulence determinant is an exotoxin, diphtheria toxin. After binding to the host cells, the active subunit will interrupt the protein synthesis of the target host cell and results in cell death.
- Toxoid made from diphtheria toxin can be used as vaccine.
Etiology

- The bacteria can be killed by mild heating (58°C for 10 minutes) and sensitive to UV or sunlight.
- Resistance to damage from drying, be cultured from the floor dust for 5 weeks or longer, once the floor dust was contaminated.
Case-fatality rate
The Seattle Outbreak

- 1971-82
- 72 cases, nine deaths (four from obstruction)
- Total cost in $millions
Back in the (former) USSR

- Outbreak began in 1990 in Russia
- All NIS affected by 1994
- >50,000 cases and 1,500 deaths in 1995
- Adults predominant
- Exported to Europe and UK
## Diphtheria Epidemiology

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>Reservoir</td>
<td>Human carriers</td>
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<tr>
<td></td>
<td>Usually asymptomatic</td>
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<tr>
<td>Transmission</td>
<td>Respiratory</td>
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<td></td>
<td>Skin and fomites rarely</td>
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<tr>
<td>Temporal pattern</td>
<td>Winter and spring</td>
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<tr>
<td>Communicability</td>
<td>Up to several weeks without antibiotics</td>
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Diphtheria Clinical Features

- Incubation period 2-5 days (range, 1-10 days)
- May involve any mucous membrane
- Classified based on site of infection
  - anterior nasal
  - pharyngeal and tonsillar
  - laryngeal
  - cutaneous
  - ocular
  - genital
Diptheria

- Characteristic of organism in diptheric membrane and organism produced exotoxin that will cause widespread damage to myocardium, nervous system and kidney.

- Transmission is by direct contact or by sneezing or coughing
Clinical Features

- Insidious onset
- Mild to moderate fever
- Mild sore throat and dysphagia
- Patient looks pale and ill
- Enlarged tonsils
- Pharynx inflamed and oedematous
- Membrane can spread beyond tonsils to fauces, soft palate, lateral pharyngeal wall to involve larynx
- Gradual onset of stridor, hoarseness and weakness of voice - airway obstruction - tracheostomy
- Enlarged cervical lymph node
- Soft tissue swelling of the neck “bull neck appearance”
Pharyngeal and Tonsillar Diphtheria

- Insidious onset of exudative pharyngitis
- Exudate spreads within 2-3 days and may form adherent pseudo membrane
- Membrane may cause respiratory obstruction
- Fever usually not high but patient appears toxic
Clinical Features

3. Disease
   - Pharyngeal diphtheria
   - Pharyngitis
   - Hypoxia - pseudomembrane obstruction
   - Fever
   - Lymphadenitis
   - Cutaneous diphtheria
   - Systemic complications
     - Toxic peripheral neuropathy
     - Toxic myocarditis and congestive heart failure

1. Entry
2. Spread - bacteria rarely become disseminated but toxin becomes blood borne
4. Exit
Pharyngeal diphtheria

- Insidious onset of exudative pharyngitis
- Exudate spreads to form adherent “pseudomembrane”
  - can lead to respiratory obstruction and death by asphyxiation
- Fever not high, but patient appears toxic
Pharyngeal Diphtheria:
Local Features
Pharyngeal Diphtheria: Distant Complications

- **Myocarditis**
  - Cardiac arrhythmias in acute phase
  - Sudden death
  - Prolonged damage and arrhythmia

- **Neuropathy**
  - Motor neuropathy
  - Paralysis of soft palate from 3rd week
  - Eye muscles, limbs, diaphragm after 5th week
  - Spontaneous resolution
Thick Membrane
Pseudo membrane
‘Bull Neck’

10 y/o boy with severe diphtheria
- conjunctivitis
- pharyngeal membrane
- bull neck
- severe myocarditis
- all vaccines contraindicated
Skin Lesions
Diphtheria Complications

- Mostly attributable to toxin
- Severity generally related to extent of local disease
- Most common complications are myocarditis and toxic neuritis with palsy
- Death occurs in 5%-10% for respiratory disease
Diphtheria Antitoxin (DAT)

- Produced in horses
- First used in the U.S. in 1891
- Used only for treatment of diphtheria
- Neutralizes only unbound toxin
Diagnosis

- Culture the organisms- throat swab from edge of membrane and ulcerated area
- Test for toxin required
Treatment & Prophylaxis

- Penicillin G or erythromycin should be administered for 14/7
- 2 consecutive negative cultures after completion antibiotic

- Close contacts should receive antibiotic
  a) benzathine penicillin – 0.6 mega unit for 6 years & younger
  - 1.2 megaunit for 6 years and above
  b) 7 day course of erythromycin (40 mg /kg/day)

- No booster required if recent booster dose within the last five years
Treatment

- Diphtheria anti-toxin is given as a shot into a muscle or through an IV. The infection is then treated with antibiotics, such as penicillin or erythromycin.
- People with diphtheria may need to stay in the hospital while the anti-toxin is being received. Other treatment may include:

1- Fluids by IV             2- Oxygen
3- Bed rest                4- Heart monitoring
5- Insertion of a breathing tube   6- Correction of airway blockages

- Anyone who has come into contact with the infected person should receive an immunization or booster shots against diphtheria. Protective immunity lasts only 10 years from the time of vaccination, so it is important for adults to get a booster of tetanus-diphtheria (Td) vaccine every 10 years.
Management

- **Medical & Public Health Emergency!**
  - Clinical diagnosis
  - Seek expert advice
  - Antitoxin & Antibiotics

- **Contacts & Carriers**
  - Antibiotics & Toxoid booster
  - Surveillance, screening and isolation
  - Antitoxin only if symptomatic
Diphtheria Antitoxin
Prevention

- Vaccination with toxoid
  - Childhood DTPx3
  - Adult boosters?

- Toxoid vaccination prevents disease, not carriage
  - Healthy vaccinated people may still carry and transmit toxigenic *C. diphtheriae*