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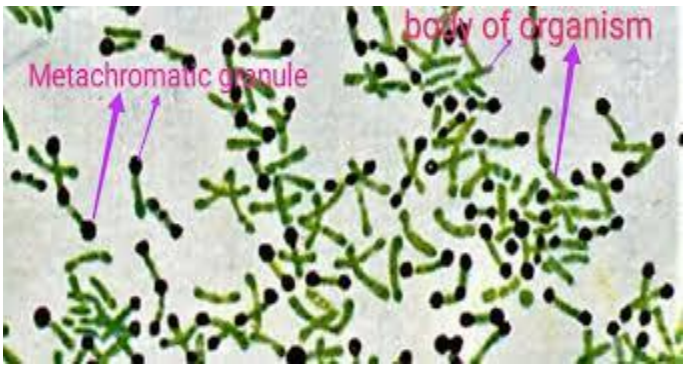
Gram-positive Rods

Corynebacteria

The genus corynebacterium contain many species that are widely distributed in nature .These small, slender, pleomorphic, gram-positive rods of distinctive morphology that tend to stain unevenly. They are non -motile, non-capsulated, and do not form spores. In common with Mycobacterium and Nocardia spp.,they have a cell wall structure containing mycolic acid .Corynebacterium is a large genus of diverse habitat. Most species are facultative anaerobes, and those found associated with humans, including the pathogen *C. diphtheriae*, grow aerobically on standard laboratory media such as blood agar.



Pathogenic Corynebacterial Species

1 -*Corynebacterium diphtheriae* :- cause respiratory and cutaneous diphtheria.

2 -*Corynebacterium jeikeium* :-Is pathogenic, typically causing an opportunistic infection seen most frequently in bone marrow transplant patients.

3 -*Corynebacterium urealyticum*:- It has been reported as an opportunistic nosocomial pathogen and important isolate when found in conjunction with a urinary tract infection.

Corynebacterium diphtheria

Diphtheria, caused by *C. diphtheriae*, is an acute respiratory or cutaneous disease and may be a life-threatening illness. The development of effective vaccination protocols and widespread immunization beginning in early childhood has made the disease rare in developed countries. Thus, few present-day American clinicians have seen a case of the disease. However, diphtheria is a serious disease throughout the world, particularly in those countries where the population has not been immunized.

General characters of genus Corynebacterium *diphtheria*

1 -Aerobic or facultatively anaerobic .

2 .Small, pleomorphic (club-shaped), gram-positive bacilli that appear in short chains ("V" or "Y" configurations) or in clumps resembling "Chinese letters" .

3 .Cells contain metachromatic granules (visualize with methylene blue stain &albert stain) .

4 .Lipid-rich cell wall and short-chain mycolic acids .

5 -Diphtheria toxin encoded by tox gene introduced by lysogenic bacteriophage (prophage) .

6 -Prototype A-B exotoxin acts systemically .Toxoid in DPT **Diphtheria, whooping cough (pertussis), tetanus, and TD vaccines**

and TD vaccines

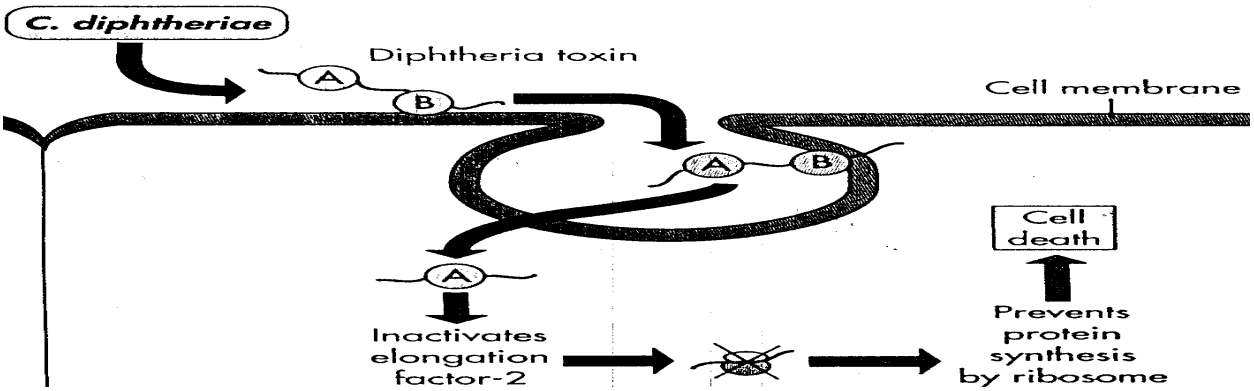
7-Respiratory diphtheria (pseudomembrane on pharynx) and cutaneous diphtheria.

8-Selective media: cysteine-tellurite; serum tellurite; Loeffler's .C. diphtheriae can be isolated most easily from a selective medium(tellurite agar) which contains potassium tellurite, an inhibitor of other respiratory flora, and on which the organism produces several distinctive black colonies with brown halos **(reaction between H_2S produced by bacteria and potassium tellurite in medium).**

Epidemiology

C. diphtheriae is found in the throat and nasopharynx of carriers and in patients with diphtheria. This disease is a local infection, usually of the throat. Therefore, the organism is primarily spread by respiratory droplets, usually by convalescent or asymptomatic carriers. It is less frequently spread by direct contact with an infected individual or a contaminated fomite.

Pathogenesis: Diphtheria is caused by the local and systemic effects of a single exotoxin that inhibits eukaryotic protein synthesis. The toxin molecule is a heat-labile polypeptide that is composed of two fragments, A and B. Fragment B binds to susceptible cell membranes and mediates the delivery of fragment A to its target. Inside the cell, fragment A separates from fragment B, and catalyzes a reaction between nicotine adenine dinucleotide (NAD^+) and the eukaryotic polypeptide chain elongation factor, EF-2[1].

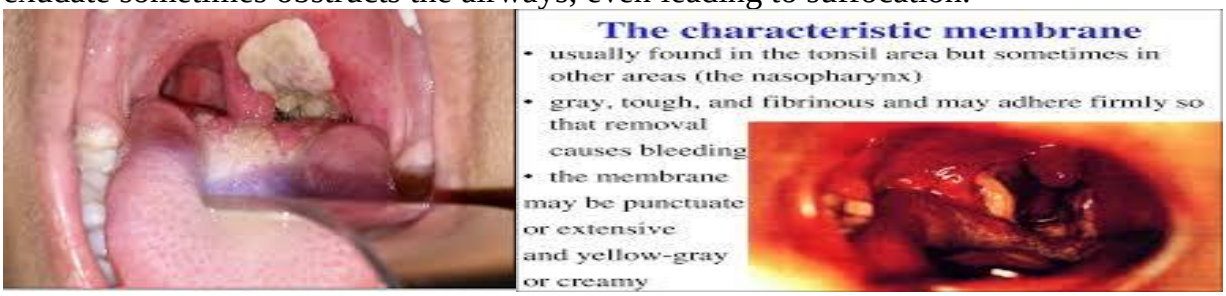


Clinical significance

Infection may result in clinical disease which has two forms (respiratory and cutaneous) or in an asymptomatic carrier state.

Upper respiratory tract infection: Although inhaled air contains many particles, including microorganisms, the host defense mechanisms in the respiratory tract frequently prevent infection. However, if there are large numbers of pathogenic organisms within the inspired air or if the host defenses are compromised, then infection may occur.

Diphtheria consists of a strictly local infection, usually of the throat. The infection produces a distinctive thick, grayish, adherent exudate (pseudomembrane) that is composed of cell debris from the mucosa and inflammatory products . It coats the throat, and may extend into the nasal passages or downward in the respiratory tract, where the exudate sometimes obstructs the airways, even leading to suffocation.



As the disease progresses, generalized symptoms occur caused by production and absorption of toxin . Although all human cells are sensitive to diphtheria toxin, the major clinical effects involve the heart and peripheral nerves. Cardiac conduction defects and myocarditis may lead to congestive heart failure and permanent heart damage. Neuritis of cranial nerves and paralysis of muscle groups, such as those that control movement of the palate or the eye, are seen late in the disease. There are a professional invaders which can infect healthy respiratory addition, there are a secondary invaders which only infect if the host defenses are weakened, for example Pneumocystis in AIDS patients.

Respiratory tract infections may be caused by bacteria, viruses, protozoa, or fungi and are important in dentistry because the causative agents may be spread through respiratory and oral fluids. Thus, both patients and the dental team are exposed to these microbes during treatment.

Cutaneous diphtheria: A puncture wound or cut in the skin can result in introduction of *C. diphtheriae* into the subcutaneous tissue, leading to a chronic, no healing ulcer with a gray membrane. Rarely, exotoxin production leads to tissue degeneration and death.

Immunity:

Diphtheria toxin is antigenic and stimulates the production of antibodies that neutralize the toxin's activity. [Note: Formalin treatment of the toxin produces a toxoid that retains the antigenicity but not the toxicity of the molecule. This is the material used for immunization against the disease .

Laboratory identification

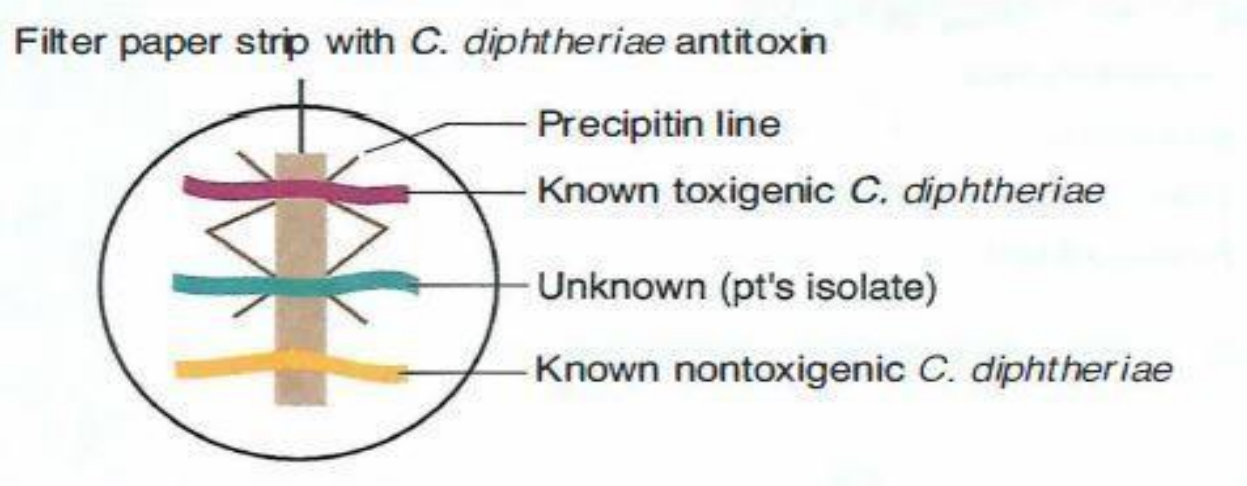
1 -Albert staining to demonstration the chines letter arrangement & metachromatic granules.

2 -throat swab for cultured on lofflers media or Tellurite media .

3 -Eleck test: In vitro it is a double –diffusion test to detection precipitin line of diptheria toxin on agar plate .

ELECK TEST

It is double diffusion test performed directly on surface of agar plate sticking with diphtheria .After paper strip is impregnated with antiserum to toxin . If strain is Toxin producing precipitation of toxin with antitoxin serum will forming precipitation line.



Treatment

The treatment strategy involve combination of antitoxin administration and antibiotics such as penecillin or erythromycin .

Prevention:

The cornerstone of diphtheria prevention is immunization with toxoid, usually administered in the DPT triple vaccine, together with tetanus toxoid and pertussis antigens . The initial series of injections should be started in infancy. Booster injections of diphtheria toxoid (with tetanus toxoid) should be given at approximately ten-year intervals throughout life. The control of an epidemic outbreak of diphtheria involves rigorous immunization and a search for healthy carriers among patient contacts.

Other corynebacteria.

C.ulcerans is responsible for diphtheria-like throat lesions, but it does not cause toxaemia.

Diphtheroids

Several other corynebacterium species that morphologically resemble the type species, C. diphtheriae, are common commensals of the nose, throat, nasopharynx, skin, urinary tract, and conjunctiva. They are therefore called diphtheroids, and are generally unable to produce exotoxin, but a few cause disease in rare circumstances, such as in immunosuppressed individuals.

References:

1- **Essentials of Microbiology for Dental Students. 2006, 2nd Edition.**
2- **Medical microbiology.4th edition.**