

Unit 2: Bacteriology

Lecture 4 – Pseudomonads, Acinetobacter & Uncommon gram negative bacteria

Pseudomonads

General characteristics:

Gram negative, motile, aerobic rods, some of which produce water-soluble pigments. Habitat: soil, water, plant, and animals. Small No. found in the normal intestinal flora and on the skin of humans.

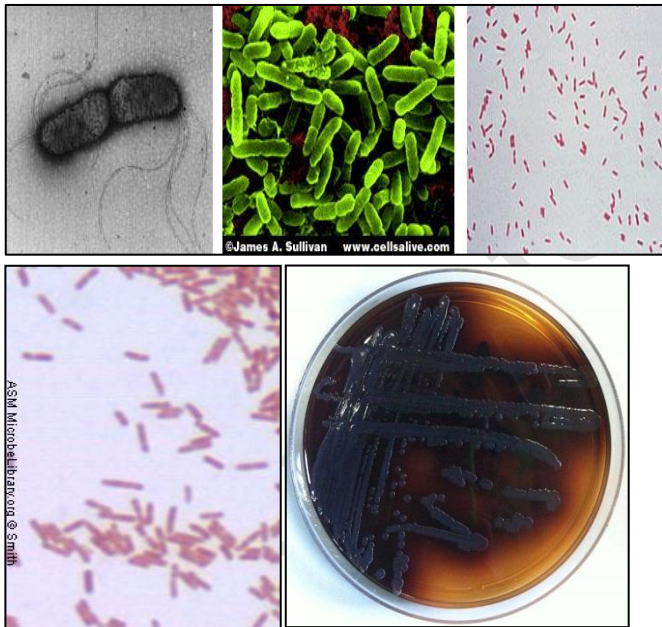
Medically important Pseudomonas:

1. Pseudomonas aeruginosa

Widely distributed and is present in moist environments in hospitals and in the normal intestinal flora.. An important nosocomial pathogen.

Morphology:

Gram negative rods, motile with polar flagellum, as a single, pairs and short chains.



Three looks at *Pseudomonas*, the head of the Gram-negative aerobic rods. A. Electron micrograph, negative stain. B. Scanning electron micrograph. C. Gram stain.

Culture:

- Grows on many types of media, obligate aerobe, sometimes producing a sweet or grape-like odor. Some strains hemolysis blood.
- It forms smooth round colonies with:
 - a fluorescent greenish pigment (Pyoverdine)

- or non-fluorescent bluish pigment (Pyocyanin) or dark red pigment (Pyomelanin).
- Grows well at 37-42 C°, 42 C° helps in differentiation *P.aeruginosa* from other spp., oxidase +, catalase +, does not ferment carbohydrates, but many strains oxidize glucose, does not ferment lactose → pale colonies on MacConkey's agar.

Antigenic Structure & Toxins:

- 1) **Pili** (attachment to host epithelial cells).
- 2) **Polysaccharide capsule** (mucoid colonies in culture from patients with cystic fibrosis).
- 3) **LPS** (endotoxin).
- 4) **Pyocin** (bacteriocin).
- 5) **Extracellular enzymes** (elastases, proteases, and 2 type of hemolysins: a heat-labile phospholipase C and a heat-stable glycolipid).
- 6) **Exotoxin A** (causes tissue necrosis by blocks protein synthesis).

Pathogenesis:

- It is pathogenic only when there is abnormal host defenses (mucous membranes & skin are disrupted by direct damage, I.V. or urinary catheters are used or neutropenia as in cancer therapy). The bacterium attaches & colonizes the mucous membrane, invades locally and produces systemic disease. These processes are promoted by the pili, enzymes, & toxins described above.
- LPS (endotoxin) causing fever, shock, oliguria, leukocytosis, leukopenia & DIC & adult respiratory distress syndrome. *Pseudomonas* are resistance to many antimicrobial agents → important when the normal flora are suppressed.

• *aeruginosa* infections are:

- 1) Wounds & burns infection (with blue green pus).
- 2) Meningitis (contamination due to lumbar puncture).
- 3) UTIs (by catheters).
- 4) RTIs (by respirators).
- 5) Otitis externa (in swimmers) & malignant otitis externa (in diabetic patients).
- 6) Eye infection (after injury or surgical procedures).
- 7) Fatal sepsis (in infants or debilitated persons).

• The symptoms are nonspecific & related to the organ involved

- **Veroglobulin**: a breakdown product of hemoglobin, a fluorescence pigment can be detected in wounds and burns or urine.
- **Ecthyma gangrenosum**: a hemorrhagic necrosis lesion of skin occurs in sepsis due to *P. aeruginosa* surrounded by erythema without pus.

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Diagnostic Lab. Test:

- **Specimens:** skin lesions, pus, urine, blood, c.s.f., sputum & other materials.
- **Culture:** the specific test for diagnosis of *P. aeruginosa* infections.

Treatment:

- Should not be treated with single-drug, because success rate is low and the bacteria can rapidly develop resistance when single drugs are used.
- penicillin combination with aminoglycosides.
- others: aztreonam, imipenem, ciprofloxacin, newer cephalosporines

2. Burkholderia pseudomallei:

- Causes melioidosis, an endemic glanders-like disease of animals and humans, as acute, subacute, or chronic infection. A localized suppurative infection can occur at the inoculation site such as break in the skin, this may lead to acute septicemic infection with involvement of many organs.
- The most commons of melioidosis is pulmonary infection (pneumonitis).
- May develop chronic suppurative infection with abscesses in skin, brain, lung, myocardium, liver, bone and other sites.
- **Treatment:** Susceptible to tetracycline, sulfonamides, chloramphenicol, amoxicillin & 3ed. Generation cephalosporines.

3. Burkholderia mallei:

- Cause glanders, a disease of horses and donkeys transmissible to humans, may be fatal. Begins as ulcer of the skin or mucous membranes followed by lymphangitis (lymphatic thickening with nodules), & sepsis.
- Inhalation of organisms may lead to primary pneumonia, can be treated with tetracyclines plus aminoglycosides.

4. B.cepacia:

slow growth (may take 3 days for colonies are visible), multidrug-resistant, causes necrotizing pneumonia and bacteremia in patients with cystic fibrosis. In hospitals, it has been isolated from a variety of water and environmental sources from which it can be transmitted to patients and from one cystic fibrosis patients to another by close contact.

Acinetobacter & Uncommon gram -ve bacteria

- **Acinetobacter:** coccobacillary or coccid (diplococci forms, resemble neisseriae in smears, also recovered from female genital tract has been mistaken for *N.gonorrhoeae* and recovered from meningitis and sepsis has been mistaken for *N.meningitis*). Commensal but causes nosocomial infections & as opportunistic pathogen & cause sepsis (isolated from blood, sputum, skin, pleural fluid & urine). -Resistant to antimicrobial agents. Therapy: difficult, but responded to gentamicin, amikacin, tobramycin & newer penicillins or cephalosporines.
- **Actinobacillus:** causes severe periodontal disease in adolescents, endocarditis, abscesses, osteomyelitis and others. Treatable with tetracycline or chloramphenicol and penicillin G, ampicillin or erythromycin.
- **Alcaligenes:** as normal human flora, isolated from respirators, nebulizers & renal dialysis systems & from urine, blood, c.s.f., wounds & abscesses.
- **Capnocytophaga:** as oral human flora, causes bacteremia and severe systemic disease in immunocompromised patients and associated with wound infections from dog or cat bites or scratches.
- **Cardiobacterium:** normal flora of upper R. T. & bowel causes endocarditis.
- **Chromobacterium:** found in subtropical climates in soil & water. Infects humans through breaks in the skin or via the gut, cause abscesses, diarrhea, sepsis (many deaths).