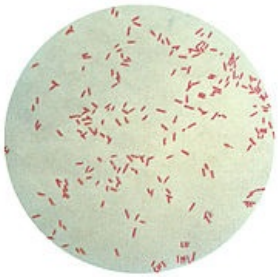
Pseudomonas aeruginosa

Pseudomonas aeruginosa belongs to gram-negative, aerobic, motile, non-fermenting bacteria. *P. aeruginosa* is the most clinically significant of the genus. It is sometimes encased in a mucus layer that is similar to a bacterial sheath.

Occurrence



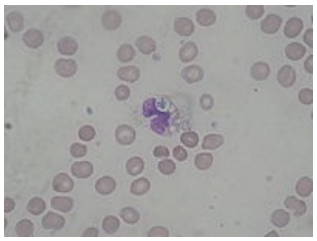
Pseudomonas aeruginosa gram staining

It is most commonly found in wastewater*, on* plants, and in soil. When it comes to healthy individuals, pseudomonads may colonise in heavily contaminated environments, but in this way they can become an important vector for the spread of nosocomial diseases.[1] It mainly colonizes the **mucous membranes of the respiratory and urinary tract**. It is often found in **hospital environments** and contaminates catheters, pulmonary ventilators, etc.

Cultivation

Conditions for cultivation

Pseudomonas aeruginosa is a very undemanding bacterium, it grows well on basic soils at 30-37 °C, but also grows at room temperature.



Phagocytosis *Ps. aeruginosa* neutrophil in a patient with an infection in the bloodstream

Appearance

The colonies are characterised by their typical appearance:

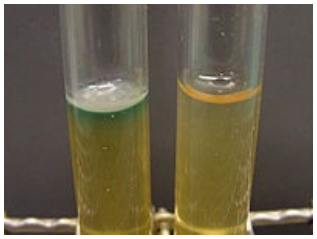
- Beta-hemolysis.
- Pigmentation:

1. teal pigment – pyocyanin (pyo – pus, kyaneos – blue);
2. yellow-green pigment – fluorescein.

- Smell:

1. younger colonies – the scent of jasmine and lime blossom or violet;
2. older colonies – ammonia.

- Pearlescent to metallic sheen.



Pyocyanin production on soft agar. Right tube uninoculated, serving as a control.

Antigenic structure

According to somatic antigens, there are 17 serotypes, as well as pseudomonas self-antigens bound to the flagellum and fimbriae.

Pathogenesis

„*Pathogenicity is determined by the structures bound to the bacterial cell as well as by the formation of various exosubstances.*“[1]

Cellular structures

- Extracellular polysaccharide – alginate:
  - in large numbers of mucosal colonies (especially in cystic fibrosis) – protection against host defence mechanisms.
- Slime layer.
- Lipopolysaccharide complex.

Extracelular products

- Proteolytic enzymes:

1. Cleaves:

1. fibrin;
2. elastine;
3. caseine;
4. collagen.

2. Effects on the organism:

1. capillary defects;
2. development of hemorrhages and necrosis;
3. inhibition of phagocytosis;
4. opsonization arrest (disruption of complement function).

- Hemolysines.
- Toxins:
  - cytotoxins – breaks the membranes.

Pathogenity

It can cause infection of **any organ** or system of the body. The worst prognostic factors include: **burn infections** (60% mortality), **neonatal sepsis**, **osteomyelitis**, **eye infections** (proteolytic enzymes).

Causes infections primarily in persons:

- with compromised immunity;
- with severe underlying disease:

1. hemoblastosis;
2. tumors;
3. diabetes;
4. autoimmune diseases;
5. cystic fibrosis of the lung etc.;

- with burns;
- with immunosuppression – after transplantation;
- taking broad-spectrum ATBs;
- with long-term catheters, cannulas, urinary catheters, etc.

Prevention and therapy

Prevention

Use of **polyvalent vaccines** made from somatic antigens.

Therapy

It is necessary to use a **combination** of two substances:

- Piperacillin;
- Cephalosporins III.;
- Aminoglycosides;
- Carbapenems;
- Monobactams;
- Fluoroquinolones.

Summary video

Links

Related articles

- Otitis externa maligna

Reference

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- HYNIE, Sixtus. *Farmakologie v kostce.* 2. edition. Praha : Triton, 2001. 520 pp. pp. 392. ISBN 80-7254-181-1.