

Pseudomonas aeruginosa

What is *Pseudomonas aeruginosa*?

Pseudomonas aeruginosa is a gram-negative, motile, rod shaped bacterium. The bacterium is capable of both aerobic and anaerobic growth. It is abundant in various types of moist environments and can adapt to numerous others. This opportunistic pathogen is commonly associated with hospital-acquired infection, most notably in immunocompromised individuals.

Pseudomonas aeruginosa accounts for 10% of all hospital-acquired infections.

Specifically, this bacterium is the second most frequently recovered pathogen from intensive care unit (ICU) patients.



Where is *Pseudomonas aeruginosa* found?

Pseudomonas aeruginosa can be found in the following:

- Moist environments such as soil and water
- Lakes, streams, rivers, and other fresh waters
- Potable water sources such as sinks and showers
- Fresh fruits and vegetables
- Hot tubs
- Respiratory therapy equipment
- Catheters, dialysis tubing, and respiratory devices

How is *Pseudomonas aeruginosa* transmitted?

Exogenous from the environment: Contaminated water in a hospital setting can transmit *Pseudomonas aeruginosa* to patients through the following ways:

- Direct contact with the water, either through ingesting or bathing
- Inhalation of aerosols
- Medical devices rinsed with the contaminated water
- Indirect contact from contaminated surfaces via health worker's hands

Notably, *Pseudomonas aeruginosa* can survive from six hours to 16 months on dry, inanimate surfaces in hospitals.

Endogenous from the gastrointestinal tract of the patient: *Pseudomonas aeruginosa* can be a commensal in the intestinal tract after eating uncooked vegetables and fruit. Fresh vegetables often contain large amounts of *Pseudomonas aeruginosa* on its external surface, probably via soil contamination.

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Who is at risk for *Pseudomonas aeruginosa* infections?

Pseudomonas aeruginosa is an opportunistic pathogen and individuals with suppressed immune systems, especially those with neutropenia (low white blood cell count), are most susceptible.

Patients who are hospitalized and have catheters or other medical devices within them may become infected when these devices are contaminated. Pneumonia is a common infection in the ICU setting because *Pseudomonas aeruginosa* can easily colonize the human respiratory tract.

Receipt of antibiotics predisposes to colonization since *Pseudomonas aeruginosa* is relatively antibiotic-resistant. *Pseudomonas aeruginosa* can be found in the patient's stool and then transmitted to the skin and respiratory tract of the patient.

Pseudomonas aeruginosa rarely causes disease in healthy individuals. But a healthy individual can acquire an infection if:

- Trauma with a break in the epithelium has occurred in the presence of the bacterium, allowing the bacterium to enter the bloodstream
- The bacterium is present in sufficiently large numbers

What are the clinical manifestations of infection?

Pseudomonas aeruginosa causes infections in healthy individuals and those who are hospitalized or have a compromised immune system as a result of other diseases. A variety of human infections are commonly associated with this bacterium:

- Urinary tract infections
- Ventilator-associated pneumonia
- Surgical site infection
- Respiratory infections
- Ocular infections
- Ear infections (external otitis, malignant external otitis)
- Skin and soft tissue infections, including hot tub folliculitis, and osteomyelitis
- Burn sepsis

Individuals with compromising conditions, such as HIV/AIDS, cystic fibrosis, chemotherapy-related neutropenia, and diabetes have an increased risk of acquiring an infection and developing complications.

How is *Pseudomonas aeruginosa* infection diagnosed?

The presence of this bacterium does not automatically indicate an infection. Infection is confirmed by consistent isolation of the organism from normally-sterile sites such as blood. Confirming infection is sometimes difficult, however, because *Pseudomonas aeruginosa* can be normal flora in the gastrointestinal tract, and it has the propensity to colonize the respiratory tract.

Pseudomonas aeruginosa can be biochemically differentiated from species in the genus and from other gram-negative rods. Specifically, *Pseudomonas aeruginosa* can be identified by the fluorescent green colonies it forms on solid media between 20- 42°C.

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What is the treatment for *Pseudomonas* infection, and why is it often difficult to treat?

Pseudomonas aeruginosa is resistant to commonly used antimicrobial agents. Treatment includes the antimicrobial agents below. Unfortunately, a few *Pseudomonas aeruginosa* are resistant to all of these antibiotics, and most *Pseudomonas aeruginosa* are resistant to at least one of the classes of drugs below.

- Ceftazidime, a third generation cephalosporin
- Cefepime, a fourth generation cephalosporin
- Carbapenems: imipenem, meropenem
- Aminoglycosides: amikacin, tobramycin, gentamicin
- Fluoroquinolones: ciprofloxacin, levofloxacin
- Extended-spectrum penicillins: piperacillin, ticarcillin

What can be done to prevent infection?

Prevention of *Pseudomonas aeruginosa* infection includes:

- Prevent exposure through water testing and disinfection. This is a new approach to prevention and is under evaluation.
- Maintaining good hygiene and hand-washing practice
- Minimizing unnecessary antibiotic use
- Using sterile medicated solutions
- Minimizing the use of medical devices
- Avoiding uncooked vegetables in the diet of neutropenic patients and burn unit patients.

Sources:

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