



INTERNATIONAL
SOCIETY
FOR INFECTIOUS
DISEASES

GUIDE TO INFECTION CONTROL IN THE HEALTHCARE SETTING

Pseudomonas aeruginosa

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KEY ISSUE

Pseudomonas aeruginosa is an important nosocomial pathogen that causes serious nosocomial infections and contributes significantly to morbidity and mortality. Antimicrobial resistance including carbapenem- and multidrug-resistance (MDR) also continues to increase, further limiting therapeutic options.

KNOWN FACTS

- *P. aeruginosa* is an aerobic Gram-negative rod that can be isolated from soil, water, plants, animals, and humans, where it is uncommonly encountered as part of the normal transient flora. Human colonization occurs mostly at moist sites such as perineum, axilla, and ear. High concentrations of *P. aeruginosa*, among other pathogens, may also be found in the subungual areas of the hands.
- Even though colonization in healthy individuals outside the hospital is rare, colonization rates may exceed 50% in patients with severe burns (skin), on mechanical ventilation (lower respiratory tract), receiving chemotherapy (GI-tract) or antimicrobial agents (any site) and the prevalence rates of *P. aeruginosa* have been on the rise in recent years.
- Minimal nutritional requirements, the ability to grow in distilled water, and tolerance against a wide range of physical conditions contribute to the success of this opportunistic pathogen. Hospital reservoirs are predominantly moisture-associated and include sinks, showers, respiratory equipment, IV fluids, disinfectants, food mixers, and vegetables. Outbreaks have been traced to a variety of sources including respiratory therapy equipment, endoscopes, contaminated mattresses, disinfectants, contaminated water supplies, IV solutions,

and environmental sources such pools used for physical therapy or hydrotherapy.

- *P. aeruginosa* is the overall fifth most common nosocomial pathogen, with a crude mortality ranging from 28% (ward) to 48% (ICU) in patients with nosocomial bloodstream infection. Clinical manifestations include mostly nosocomial or healthcare-associated infections such as pneumonia (second most common cause of nosocomial pneumonia), urinary tract infections (UTI, third), wound infections (surgical, third), bone and joint infections, and bloodstream infection (BSI, seventh), but also infections that are usually community-acquired such as gastrointestinal infections, skin and soft tissue infections, bacterial keratitis, or (“malignant”) otitis externa. A different clinical entity is lower respiratory tract infection in cystic fibrosis (CF) patients. Increasing resistance of *P. aeruginosa* to many commonly used antimicrobial agents leading to MDR strains is a cause for concern. In contrast to Gram-positive MDR-pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), there are still very few therapeutic options available to treat these MDR pathogens. Repeated susceptibility testing during therapy is warranted, due to the potentially rapid development of resistance to certain antimicrobial agents.
- This organism is also a major cause of infection in highly compromised patients especially patients with cystic fibrosis, neutropenia (and other immunosuppressive conditions), or severe burns.

Controversial Issues

Data on the impact of common environmental sources or patient-to-patient transmission on morbidity due to *P. aeruginosa* are still limited. The original source of the organism and the mode of transmission are often difficult to assess in an outbreak situation.

SUGGESTED PRACTICE IN ALL SETTINGS

- Adherence to standard infection control guidelines should limit the spread of *P. aeruginosa*. However, special attention is warranted in risk-patients and hospital environments with endemic *P. aeruginosa*. Measures include:
 - Hand disinfection between patient contacts using antiseptic agents (e.g., chlorhexidine or alcohol-based disinfectants).
 - Wearing gloves when attending a patient, especially in ventilated patients, patients with severe burns and patients known to be colonized with *P. aeruginosa*.
 - Mechanical cleaning of all medical equipment before sterilization, especially equipment used for mechanical ventilation, and endoscopes.
 - Proper sterilization of all respiratory therapy equipment including nebulizers and resuscitation bags.
 - Using sterile fluids for nebulizers and preventing contamination of medication nebulizers and humidifiers.
 - Using sterile water instead of tap water to rinse tracheal suction catheters.
 - Avoiding the use of stock solutions for preparation of IV fluids.
 - Avoiding the reuse of a previously opened vial of water or sodium chloride solution for injection.
 - Appropriate handling and storage of medical solutions.
 - Surveillance, i.e., monitoring the prevalence of *P. aeruginosa*, especially of MDR strains.
 - Detecting and eliminating potential reservoirs of cross-transmission.
 - If a cluster of infections due to *P. aeruginosa* is detected, potential reservoirs including all medical solutions such as IV fluids and sterile water should be screened in order to quickly detect and eliminate a

potential reservoir. High-risk patients such as burn patients and immunocompromised patients should be monitored closely so that appropriate infection control measures can be implemented early.

SUMMARY

- *P. aeruginosa* is a major cause of nosocomial infections that affects all patient populations and contributes significantly to morbidity and mortality. Antimicrobial resistance including carbapenem- and multidrug-resistance (MDR) is increasing. Colonization usually precedes manifest clinical infection. *P. aeruginosa* has been found to be an independent predictor of mortality in some studies of nosocomial bloodstream infection.
- Outbreaks have been traced to contaminated solutions (tracheal irrigate, mouthwash, IV fluids), water, disinfectants, and inadequately disinfected or sterilized endoscopes, ventilators or contaminated mesh grafts in burn patients, but have also been linked to direct transmission via the hands of hospital personnel. Important measures of prevention include the detection and elimination of potential reservoirs, especially moist areas, the appropriate storage and handling of medical solutions, the monitoring of high-risk patients such as ICU or burn patients, and the immediate investigation of detected clusters of infections due to *P. aeruginosa*.

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