

PREVENTING PNEUMONIA

KEY CONCEPTS you will learn in this chapter include:

- What type of medical or surgical procedures are most often associated with nosocomial pneumonia
- Importance of cross-contamination (patient to patient or staff to patient) in causing nosocomial pneumonia
- How to minimize the risk of developing nosocomial pneumonia
- How to clean and disinfect respiratory therapy equipment

BACKGROUND

In the US, nosocomial pneumonia is the second most common site of hospital-acquired infections, accounting for 18%. Only nosocomial urinary tract infections are more frequent (Emori and Gaynes 1993). Nosocomial pneumonia also is the infection most likely to be fatal, with mortality rates exceeding 30%, and is the most expensive to treat. Moreover, patients on mechanical ventilators develop pneumonia more frequently and are more likely to have a fatal outcome than those not requiring assisted respiration (Lynch et al 1997). In large part, these findings reflect the severity of the underlying disease.

Most nosocomial pneumonias occur by aspiration of bacteria growing in the back of the throat (oropharynx) or stomach. Intubation and mechanical ventilation greatly increase the risk of infection because they:

- block the normal body defense mechanisms—coughing, sneezing and the gag reflex;
- prevent the washing action of the hair (cilia) and mucus-secreting cells lining the upper respiratory system; and
- provide a direct pathway for microorganisms to get into the lungs.

Other procedures that may increase the risk of infection include oxygen therapy, intermittent positive pressure breathing (IPPB) treatment and endotracheal suctioning.

EPIDEMIOLOGY AND MICROBIOLOGY

Pneumonia is a complex infection that is often difficult to distinguish from other lung diseases, especially adult respiratory distress syndrome, bronchitis, emphysema and congestive heart failure. Most commonly accepted criteria for nosocomial pneumonia include fever, cough,

decreased breath sounds or dullness in a specific area of the lungs and production of purulent (infected) sputum in combination with X-ray evidence suggestive of an infection. If laboratory services are available, typically a gram-stained sputum sample will have many white blood cells (WBCs), bacteria and few epithelial cells but may not be helpful in making the diagnosis. In many countries, additional diagnostic testing (e.g., sputum cultures) is often not available. (Even though specimens from bronchoscopy yield more specific results, bronchoscopy is invasive and the potential complications may outweigh the advantages.)

Half of all nosocomial pneumonias occur after surgery, especially if mechanical ventilation is needed postoperatively. Patients on ventilators, for example, have a 6- to 21-fold greater risk of getting nosocomial pneumonia than do patients not on ventilators (Schaefer et al 1996). While with surgical patients the main reason for mechanical ventilation is the type of operation, for medical patients it usually is related to the patient's illness. Not surprisingly, the risk of postoperative nosocomial bacterial pneumonia is 38 times greater for heart and lung operations (e.g., heart bypass and pulmonary resections) than for surgery at any other site (CDC 1994).

Microbiology

Remember: Handwashing, or use of a waterless, alcohol-based handrub, is an effective way to prevent cross-contamination.

Most reported nosocomial pneumonias are due to bacteria. Early onset pneumonia is likely to involve the patient's own flora, especially streptococcus and haemophilus species. When pneumonia occurs later on during the hospitalization, it is more likely to be due to gram-negative organisms from the hospital environment. The combination of severe illness, presence of multiple invasive devices (IVs, urinary catheters and mechanical ventilators) and frequent contact with the hands of personnel often leads to cross-contamination. For example, in one study by Weinstein (1991), 20–40% of nosocomial pneumonias were due to cross-contamination of organisms from one patient to another, most likely from the hands of hospital staff.

RISK FACTORS

Many risk factors for nosocomial pneumonias are not alterable (e.g., age over 70, chronic lung disease, severe head injuries with loss of consciousness, other serious medical conditions, such as end stage renal disease or cirrhosis). Other risk factors are not alterable during the hospitalization (e.g., cigarette smoking, alcoholism, obesity, major cardiovascular or pulmonary surgery and patients with endotracheal tubes or on ventilators). Although it is impossible to change these risk factors, knowing about them is valuable in terms of anticipating problems and limiting the use of invasive devices (e.g., intravenous lines and urinary catheters) as much as possible. Unfortunately, if the underlying medical or surgical condition is serious, treatment of nosocomial pneumonia may not be successful.

REDUCING THE RISK OF NOSOCOMIAL PNEUMONIA

Preoperative Pulmonary Care

Numerous studies have shown that preoperatively teaching patients about how to prevent postoperative pulmonary problems (e.g., deep breathing, moving in bed, frequent coughing) combined with early movement (sitting up and walking) and limited use of narcotic analgesics for a short duration can reduce the risk of nosocomial pneumonia. The greatest opportunities for prevention of nosocomial pneumonia are in those surgical patients not anticipated to need postoperative ventilation.

Preventing Colonization and Infections with New Organisms

Transfer of organisms among hospitalized patients occurs frequently. Several studies have shown marked reductions in nosocomial colonization and infections when health workers were required to put on clean gloves (new examination or reprocessed high-level surgical gloves) prior to contact with the mucous membranes and nonintact skin of patients (Lynch et al 1990). Therefore, when caring for patients on mechanical ventilators or receiving IPPB treatment, especially those following heart or lung surgery, it is important to prevent cross-contamination (from staff to patient).

Respiratory Therapy Equipment

To minimize cross-contamination when suctioning patients on ventilators:

- Wash hands or use an alcohol-based antiseptic handrub before putting on gloves.
- Wear clean examination gloves, or reused surgical gloves that have been high-level disinfected, and a protective face shield or mask.
- Remove gloves immediately after therapy is completed and discard them in a plastic bag or leakproof, covered waste container.
- Wash hands or use an alcohol-based antiseptic handrub after removing gloves.

Note: Mechanical ventilation should be used only when necessary and only for as long as necessary.

Suction catheters should be decontaminated, cleaned and high-level disinfected by boiling or steaming between uses. In addition, use of large containers of saline or other fluids for instillation or rinsing the suction catheter should be avoided. If possible, only small containers of sterile solutions or boiled water, which can be used only once and then replaced, should be used.

Remember: Do not touch other items in the room or the patient after suctioning and while still wearing gloves.

To reduce the risk of contamination and possible infection from mechanical respirators and other equipment, the following are suggested:

- Prevent condensed fluid in the ventilator tubing from refluxing into the patient because it contains large numbers of organisms. (Any fluid in the tubing should be drained and discarded, taking care not to allow the fluid to drain toward the patient.)

Remember: Wash hands, or use an antiseptic handrub after handling the tubing.

Note: To prevent small volume nebulizer bulbs from becoming contaminated, they should be cleaned and dried between uses, reprocessed daily (decontaminated, cleaned and high-level disinfected by steaming or boiling) and used only with sterile fluids or boiled water.

- Use only small nebulizer bulbs because nebulizers produce aerosols that can penetrate deep into the lungs. (Contaminated large-volume nebulizers have been associated with gram-negative pneumonia and should not be used.)
- Contaminated humidifiers for oxygen administration and ventilator humidifiers are unlikely to cause nosocomial pneumonia because they do not generate aerosols. These humidifiers can, however, be a source of cross-contamination, so they should be cleaned and disinfected between patients.
- Although ventilator circuits may become contaminated at the patient end by organisms from the respiratory tract, there is little evidence that pneumonia is associated with this contamination. Therefore, it is not necessary to change the circuits.
- Breathing circuits should be decontaminated, cleaned and high-level disinfected by steaming or soaking in a chemical high-level disinfectant.
- Resuscitation devices, such as Ambu bags, are difficult to decontaminate, clean, high-level disinfect and dry between uses. For example, if not thoroughly disinfected and dried, fluids left inside the bag or face piece can be aerosolized during the next use. To prevent this, a good system for prompt reprocessing and return to use is necessary.

Preventing Gastric Reflux

Even short-term (a few days) use of nasal feeding tubes increases the risk of aspiration. Feeding small, frequent amounts rather than large amounts may be less risky. Also, raising the head of the bed, so that the patient is more or less in a sitting position, makes reflux less likely.

Postoperative Management

As mentioned above, surgical patients should be taught how to prevent postoperative pulmonary problems, such as fluid in lungs and/or poorly air-filled areas (atelectasis), preoperatively. Surgical units should have effective plans for:

- optimizing the use of pain medication to keep the patient comfortable enough to cough effectively,
- regularly moving and exercising patients, and
- encouraging deep breathing in the immediate postoperative period and for the next few days.

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