

Hospital-acquired infections (nosocomial infection)

Definition

A hospital-acquired infection, also called a nosocomial infection, is an infection that first appears between 48 hours and four days after a patient is admitted to a hospital or other health-care facility.

Description

About 5–10% of patients admitted to acute care hospitals and long-term care facilities in the United States develop a hospital-acquired, or nosocomial, infection, with an annual total of more than one million people. Hospital-acquired infections are usually related to a procedure or treatment used to diagnose or treat the patient's initial illness or injury. The Centers for Disease Control (CDC) of the U.S. Department of Health and Human Services has shown that about 36% of these infections are preventable through the adherence to strict guidelines by health care workers when caring for patients. What can make these infections so troublesome is that they occur in people whose health is already compromised by the condition for which they were first hospitalized.

Hospital-acquired infections can be caused by bacteria, viruses, fungi, or parasites. These microorganisms may already be present in the patient's body or may come from the environment, contaminated hospital equipment, health care workers, or other patients. Depending on the causal agents involved, an infection may start in any part of the body. A localized infection is limited to a specific part of the body and has local symptoms. For example, if a surgical wound in the abdomen becomes infected, the area around the wound becomes red, hot, and painful. A generalized infection is one that enters the bloodstream and causes systemic symptoms such as fever, chills, low blood pressure, or mental confusion. This can lead to sepsis, a serious, rapidly progressive multiorgan infection, sometimes called blood poisoning that can result in death.

Hospital-acquired infections may develop from the performance of surgical procedures; from the insertion of catheters (tubes) into the urinary tract, nose, mouth, or blood vessels; or from material from the nose or mouth that is aspirated (inhaled) into the lungs. The most common types of hospital-acquired infections are urinary tract infections (UTIs), ventilator-associated pneumonia, and surgical wound infections. Catheters going into the body allow bacteria to walk along the outside of the tube into the body where they find their way into the bloodstream. A study in the journal *Infection Control and Hospital Epidemiology* shows that about 24% of patients with catheters will develop catheter related infections, of which 5.2% will become bloodstream infections. Death has been shown to occur in 4–20% of catheter-related infections.

Causes

All hospitalized patients are at risk of acquiring an infection from their treatment or surgery. Some patients are at greater risk than others, especially young children, the elderly, and persons with compromised immune systems.

The CDC shows that the overall infection rate among children in intensive care is 6.1%, with the primary causes being venous catheters and ventilator-associated pneumonia. The risk factors for hospital-acquired infections in children include parenteral nutrition (tube or intravenous feeding), the use of antibiotics for more than 10 days, use of invasive devices, poor postoperative status, and immune system dysfunction. ***Other risk factors that increase the opportunity for hospitalized adults and children to acquire infections are:***

- A prolonged hospital stay
- Severity of underlying illness
- compromised nutritional or immune status
- Use of indwelling catheters
- Failure of health care workers to wash their hands between patients or before procedures
- Prevalence of antibiotic-resistant bacteria from the overuse of antibiotics

Any type of invasive (enters the body) procedure can expose a patient to the possibility of infection. Some common procedures that increase the risk of hospital-acquired infections include:

- Urinary bladder catheterization
- Respiratory procedures such as intubation or mechanical ventilation
- Surgery and the dressing or drainage of surgical wounds
- Gastric drainage tubes into the stomach through the nose or mouth
- Intravenous (IV) procedures for delivery of medication, transfusion , or nutrition

Urinary tract infection (UTI) is the most common type of hospital-acquired infection and has been shown to occur after urinary catheterization. Catheterization is the placement of a catheter through the urethra into the urinary bladder to empty urine from the bladder; or to deliver medication, relieve pressure, or measure urine in the bladder; or for other medical reasons. Normally, a healthy urinary bladder is sterile, with no harmful bacteria or other microorganisms present. Although bacteria may be in or around the urethra, they normally cannot enter the bladder. A catheter, however, can pick up bacteria from the urethra and give them an easy route into the bladder, causing infection. Bacteria from the intestinal tract are the most common type to cause UTIs. Patients with poorly functioning immune systems or who are taking antibiotics are also at increased risk for UTI caused by a fungus called *Candida* . The prolonged use of antibiotics, which may reduce the effectiveness of the patient's own immune system, has been shown to create favorable conditions for the growth of this fungal organism.

Pneumonia is the second most common type of hospital-acquired infection. Bacteria and other microorganisms are easily introduced into the throat by treatment procedures performed to treat respiratory illnesses. Patients with chronic obstructive lung disease, for example, are especially susceptible to infection because of frequent and prolonged antibiotic therapy and long-term mechanical ventilation used in their treatment. The infecting microorganisms can come from contaminated equipment or the hands of health care workers

as procedures are conducted such as respiratory intubation, suctioning of material from the throat and mouth, and mechanical ventilation. Once introduced through the nose and mouth, microorganisms quickly colonize the throat area. This means that they grow and form a colony, but have not yet caused an infection. Once the throat is colonized, it is easy for a patient to aspirate the microorganisms into the lungs, where infection develops that leads to pneumonia.

Invasive surgical procedures increase a patient's risk of getting an infection by giving bacteria a route into normally sterile areas of the body. An infection can be acquired from contaminated surgical equipment or from the hands of health care workers. Following surgery, the surgical wound can become infected from contaminated dressings or the hands of health-care workers who change the dressing. Other wounds can also become easily infected, such as those caused by trauma, burns, or pressure sores that result from prolonged bed rest or wheel chair use.

Many hospitalized patients need continuous medications, transfusions, or nutrients delivered into their bloodstream. An intravenous (IV) catheter is placed in a vein and the medications, blood components, or liquid nutritional are infused into the vein. Bacteria from the surroundings, contaminated equipment, or health care workers' hands can enter the body at the site of catheter insertion. A local infection may develop in the skin around the catheter. The bacteria can also enter the blood through the vein and cause a generalized infection. The longer a catheter is in place, the greater the risk of infection.

Other hospital procedures that may put patients at risk for nosocomial infection are gastrointestinal procedures, obstetric procedures, and kidney dialysis .

Symptoms

Fever is often the first sign of infection. Other symptoms and signs of infection are rapid breathing, mental confusion, low blood pressure, reduced urine output, and a high white blood cell count. Patients with a UTI may have pain when urinating and blood in the urine. Symptoms of pneumonia may include difficulty breathing and inability to cough. A localized infection begins with swelling, redness, and tenderness on the skin or around a surgical wound or other open wound, which can progress rapidly to the destruction of deeper layers of muscle tissue, and eventually sepsis.

Diagnosis

An infection is suspected any time a hospitalized patient develops a fever that cannot be explained by the underlying illness. Some patients, especially the elderly, may not develop a fever. In these patients, the first signs of infection may be rapid breathing or mental confusion.

Diagnosis of a hospital-acquired infection is determined by:

- Evaluation of symptoms and signs of infection
- Examination of wounds and catheter entry sites for redness, swelling, or the presence of pus or an abscess
- A complete physical examination and review of underlying illness
- Laboratory tests, including complete blood count (CBC) especially to look for an increase in infection fighting white cells; urinalysis , looking for

white cells or evidence of blood in the urinary tract; cultures of the infected area, blood, sputum, urine, or other body fluids or tissue to find the causative organism

- Chest x ray may be done when pneumonia is suspected.
- Review of all procedures performed that might have led to infection

Treatment

Cultures of blood, urine, sputum, other body fluids, or tissue are especially important in order to identify the bacteria, fungi, virus, or other microorganism causing the infection. Once the organism has been identified, it will be tested again for sensitivity to a range of antibiotics so that the patient can be treated quickly and effectively with an appropriate medicine to which the causative organism will respond. While waiting for these test results, treatment may begin with common broad-spectrum antibiotics such as penicillin, cephalosporins, tetracyclines, or erythromycin. More and more often, some types of bacteria are becoming resistant to these standard antibiotic treatments, especially when patients with chronic illnesses are frequently given antibiotic therapy for long periods of time. When this happens, a different, more powerful, and more specific antibiotic must be used to which the specific organism has been shown to respond. Two strong antibiotics that have been effective against resistant bacteria are vancomycin and imipenem, although some bacteria are developing resistance to these antibiotics as well. The prolonged use of antibiotics is also known to reduce the effectiveness of the patient's own immune system, sometimes becoming a factor in the development of infection.

Fungal infections are treated with antifungal medications. Examples of these are amphotericin B, nystatin, ketoconazole, itraconazole, and fluconazole. Viruses do not respond to antibiotics. A number of antiviral drugs have been developed that slow the growth or reproduction of viruses, such as acyclovir, ganciclovir, and amantadine.

Prevention

Hospitals take a variety of steps to prevent nosocomial infections, including:

- Adopt an infection control program such as the one sponsored مدعوم by the U.S. Centers for Disease Control (CDC), which includes quality control of procedures known to lead to infection, and a monitoring program to track infection rates to see if they go up or down.
- Employ an infection control practitioner for every 200 beds.
- Identify high-risk procedures and other possible sources of infection.
- Strict adherence to hand-washing rules by health care workers and visitors to avoid passing infectious microorganisms to or between hospitalized patients.
- Strict attention to aseptic (sterile) technique in the performance of procedures, including use of sterile gowns, gloves, masks, and barriers.
- Sterilization of all reusable equipment such as ventilators, humidifiers, and any devices that come in contact with the respiratory tract.
- Frequent changing of dressings for wounds and use of antibacterial ointments under dressings.
- Remove nasogastric and endotracheal tubes as soon as possible.

- Use of an antibacterial-coated venous catheter that destroys bacteria before they can get into the blood stream.
- Prevent contact between respiratory secretions and health care providers by using barriers and masks as needed.
- Use of silver alloy-coated urinary catheters that destroy bacteria before they can migrate up into the bladder.
- Limitations on the use and duration of high-risk procedures such as urinary catheterization.
- Isolation of patients with known infections.
- Sterilization of medical instruments and equipment to prevent contamination.
- Reductions in the general use of antibiotics to encourage better immune response in patients and reduce the cultivation ^{الزراعة} of resistant bacteria.