INTERNATIONAL SOCIETY FOR INFECTIOUS DISEASES

GUIDE TO INFECTION CONTROL IN THE HOSPITAL

CHAPTER NUMBER 53:

Fungi

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KEY ISSUE

The incidence of healthcare associated fungal infections has increased in recent years, and the population of immunocompromised hosts at risk of these infections has also increased.

KNOWN FACTS

- *Candida* bloodstream infections (BSIs) are the third to fourth most common cause of healthcare-associated BSIs.
- The incidence of candidemia is higher in critical-care units than in other parts of the hospital.
- The overall incidence of nosocomial fungemia has increased, with most cases involving *Candida* species, and many such infections are related to the use of intravascular catheters.
- Most cases of nosocomial fungemia found in intensive care unit patients are not associated with recognized immune defense defects.
- Fungemia is associated with a high short-term mortality rate.
- It is already well documented that *Candida* infections, even candidemia, can be transmitted on the hands of colonized healthcare personnel.
- The evidence for cross infection by *Candida,* particularly in intensive care units (ICUs), has increased in the literature.
- The incidence of *Candida* non-albicans infections is increasing, and they tend to be more resistant to azoles than *C. albicans* strains.
- There is a strong relationship between *C. parapsilosis* fungemia or systemic infection and hyperalimentation using intravascular devices.
- *C. glabrata* has emerged as an important cause of candidemia, especially among neutropenic patients who have received fluconazole prophylaxis.
- *C. auris* is an emerging multidrug-resistant pathogen associated with high morbidity and mortality.

- Invasive candidiasis is usually caused by dissemination of endogenous *Candida* species that have colonized a patient's gastrointestinal tract.
- Up to 25% of episodes in the ICU of catheter-related urinary tract infections (UTIs) are caused by different species of *Candida*. Candiduria is especially common in patients receiving prolonged urinary catheterization and broad-spectrum systemic antimicrobial agents.
- In breakthrough candidemia, the same risk factors seen in de novo candidemia are encountered, although more frequently. *C. glabrata* and *C. krusei* are the leading causes of breakthrough candidemia in patients with cancer.
- Hospital construction and renovation have been associated with an increased risk for healthcare-associated fungal infections, particularly aspergillosis, among severely immunocompromised patients.
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CONTROVERSIAL ISSUES

- The role of susceptibility testing as a guide to selecting appropriate therapy for all of these infections is still incompletely defined.
- The ideal population of ICU patients who would benefit from antifungal prophylaxis. In part, the existing endemic rate of candidemia is important in decision-making.
- The efficacy of antibiotic prophylaxis for patients who demonstrate colonization with *Candida* is undocumented.
- No antimicrobial regimen has been reported to be clearly effective in preventing aspergillosis. Further studies are needed to determine the optimal strategy for aspergillosis prevention.

- Whether the hospital water-distribution system could be a reservoir for airborne molds that leads to secondary aerosolization of these molds in patient shower facilities.

SUGGESTED PRACTICE

- Proper use of antibiotics and strict protocols for invasive procedures.
- Define therapy based on yeast identification.
- The most important infection control measures for the prevention of fungal colonization of indwelling intravascular catheters are quite similar to those recommended for bacterial infections. Standard practice in the treatment of candidiasis is to remove existing intravascular catheters for patients with candidemia or acute hematogenously disseminated candidiasis, especially in non-neutropenic patients.
- Antifungal therapy is necessary in all cases of vascular catheter-related candidemia.
- Tunneled central venous catheters (CVCs) or implantable devices should be removed in the presence of documented catheter-related fungemia.
- The removal of all central venous catheters from all patients with candidemia is considered to be standard care.
- Bone marrow allogeneic recipients should be administered antifungal prophylaxis to prevent invasive disease with *Candida* species during neutropenia. The choice of drug will depend on the level of fluconazole resistance and the risk of exposure to *Aspergillus*.
- Hospital construction or renovation areas should have negative air pressure relative to that in adjacent patient care areas, if no contraindications exist for such pressure differential.
- Patients with fungal infections of their catheters should be monitored for dissemination.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

- Assess risk for fungal infections in immunocompromised patients.
- If a patient is deemed to be at high risk for invasive fungal disease, active prophylaxis is recommended.
- Use of HEPA filter has been shown to be effective at reducing invasive fungal diseases and is recommended for all high-risk wards such as hematology and stem cell transplant wards.
- For planned construction and renovation works, it is recommended that air filtration and supply be thoroughly reviewed prior to commencing construction, and to consider using enhanced surveillance for invasive fungal disease, and dust remediation strategies.

SUMMARY

Candida and *Aspergillus* are responsible for most healthcare-acquired fungal infections. However, several other species may cause infection in debilitated hospitalized patients, such as *Trichosporum*, *Fusarium*, etc. Fungemia is associated with a high short-term mortality rate. The crude mortality is 40%. The attributable mortality due to nosocomial candidemia has been estimated to be half or more of the crude mortality.

Several studies have identified risk factors for the development of hospital-acquired fungemia. Among the clinical characteristics that most consistently increase this risk are neutropenia, use of wide-spectrum antibiotics, bone marrow or solid organ transplant, diabetes, severe burns, premature birth, hyperalimentation, antecedent surgery (especially abdominal surgery), and indwelling catheters. Candidemia generally occurs in patients who are debilitated; other risk factors are renal impairment, and multisite candidal colonization, all of which are common in ICU patients.

It has been well documented that transmission of *Candida* can occur via the hands of colonized healthcare personnel. Hence, suboptimal hand hygiene practice may lead to candidemia outbreaks. There is a strong relationship between *C. parapsilosis* fungemia, or systemic infection, and hyperalimentation using intravascular devices. In fact, the adherence of *C. parapsilosis* to plastic materials exceeds that of *C. albicans*.

There is increased variation in the proportion of cases due to *C. albicans* relative to those caused by non-albicans species. As is the case with antibacterial agents, the increased use of antifungal agents has led to the development of antifungal resistance. The impact of fluconazole use in the ICUs has resulted in selective pressure favoring the appearance of more resistant species such as *C. glabrata* and *C. krusei*.

Despite significant advances in the management of immunosuppressed patients, invasive aspergillosis remains an important life-threatening complication. In the past two decades, the incidence of invasive aspergillosis in this population has continued to increase. Factors that predispose patients to invasive aspergillosis include prolonged granulocytopenia, the development of graft-versus-host disease, immunosuppressive therapy, the use of adrenal corticosteroids, and the prolonged impairment of host defenses associated with diseases such as chronic granulomatous disease. Environmental factors also play a key part in the pathogenesis of invasive aspergillosis. Hence, infection prevention measures play a critical role in reducing exposure of hospitalized patients to *Aspergillus,* especially in associated with construction and renovation. The use of an infection control risk assessment matrix to guide appropriate preventive measures will help towards reducing risk for acquisition (details available at http://www.ashe.org/advocacy/organizations/CDC/pdfs/assessment_icra.pdf).

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