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Mycology

A cluster of mucormycosis infections in hematology patients: challenges in investigation and control of invasive mold infections in high-risk patient populations☆,☆☆,★,★★

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Abstract

Mucormycosis has been reported to be occurring more frequently in hematopoietic stem cell transplant (HSCT) recipients in recent years. We investigated a hospital cluster of mucormycosis cases among patients with hematologic disorders. Case-patients were identified through hospital microbiology and pathology database searches and compared to randomly selected controls matched on underlying disease and hospital discharge date using conditional logistic regression. Environmental assessments, including collection of samples for fungal cultures, were performed. Of 11 case-patients, 6 (55%) had acute myelogenous leukemia and 3 (27%) were allogeneic HSCT recipients. Five case-patients (45%) died. In univariate analysis, case-patients were more likely than controls to have refractory hematologic disease (odds ratio [OR], 13.75; 95% confidence interval [CI], 1.31–689); neutropenia >14 days (OR, 11.50; 95% CI, 1.27–558) or to have received voriconazole prophylaxis (OR, 11.26; 95% CI, 1.11–infinity). A point source was not identified. Factors such as underlying disease state and antifungal prophylaxis type may identify hematology patients at highest risk for mucormycosis. Our investigation highlighted critical

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knowledge gaps, including strain typing methods, the role of the hospital environment in mucormycosis outbreaks, and hospital environmental infection control measures most likely to reduce exposure of immunosuppressed persons to mucormycetes.
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1. Introduction

Mucormycosis, also known as zygomycosis, is increasingly recognized as an important cause of morbidity and mortality among immunosuppressed persons. Although there are no recent population-based estimates of mucormycosis incidence, some investigators have reported increases in the incidence or number of cases occurring in hematopoietic stem cell transplant (HSCT) recipients and patients with hematologic malignancies over the past 2 decades (Imhof et al., 2004; Kontoyiannis et al., 2000; Kontoyiannis et al., 2005; Marr et al., 2002; Marty et al., 2004; Roden et al., 2005; Siwek et al., 2004; Vigouroux et al., 2005). Advances in cancer treatment and supportive care have likely increased the lifespan of patients with active but stable cancer; persons with hematologic malignancies treated in recent years may therefore be at risk for longer periods of time for the development of a variety of opportunistic infections, including mucormycosis, due to treatment- and disease-related immunosuppression.

Mucormycosis may be acquired in community or health care settings. Published guidelines (CDC, 2000; CDC, 2003; Yokoe et al., 2009) and facility design standards for units housing HSCT recipients (American Institute of Architects and Facilities Guidelines Institute, 2006) provide recommendations for reducing health care setting-related mold exposure of high-risk patients. These guidelines recommend that allogeneic HSCT recipients be housed in Protective Environment inpatient rooms, with high-efficiency particulate air (HEPA) filtration, room air exchange rates of ≥12 air changes per hour (ACH), and positive pressure of ≥2.5 Pa with respect to the corridor (CDC, 2000; CDC, 2003; Yokoe et al., 2009). These recommendations are applicable to facilities that are newly constructed or undergoing renovation (American Institute of Architects and Facilities Guidelines Institute, 2006; CDC, 2003), while older facilities not undergoing renovation are advised to remain compliant with guidelines in existence at the time of original construction (CDC, 2003).

In September 2007, clinical personnel at Hospital A in Georgia noted an increase in invasive mold infections (IMIs), particularly mucormycosis, among patients with hematologic disorders. Hospital A and the Georgia Division of Public Health requested assistance from the CDC to determine the extent of the cluster, identify factors associated with mucormycosis, and develop recommendations to prevent further infections.

2. Methods

2.1. Case definitions and identification

IMIs were defined according to criteria consistent with the European Organization for Research and Treatment of Cancer and Mycoses Study Group criteria for proven and probable invasive fungal infection (De Pauw et al., 2008). Possible IMIs were not included. The IMI index date was defined as the date on which the first IMI diagnostic specimen was collected.

A case-patient was defined as a hematology service patient with laboratory-confirmed mucormycosis diagnosed from January 1, 2006 to September 30, 2007 (later extended to October 31, 2007). Infections diagnosed on the basis of pathology evidence without accompanying culture data were categorized as mucormycosis only if the pathology report stated that fungal hyphae had characteristic mucormycete morphology; otherwise, such infections were categorized as unspecified IMI.

Mucormycosis cases were defined as hospital-associated (HAM) if 1) the mucormycosis diagnostic specimen was obtained ≥14 days after hospital admission or within 14 days after discharge; and 2) the patient had ≥14 inpatient days in Hospital A during the 30 days before diagnosis.

Cases were identified using key word searches of electronic microbiology and pathology databases, and medical records of each potential case were reviewed. To establish baseline IMI frequencies in hematology patients, we extended our search back to January 1, 2005, for IMI other than mucormycosis and to January 1, 2003, for mucormycosis. Hospital personnel utilized the same methods to identify cases occurring after the cluster period, from November 1, 2007, to December 31, 2008.

2.2. Environmental assessment and clinical practices

Interviews were conducted with hospital staff, facility work order logs were reviewed, and visual inspections of the hematology units were performed. Surface and water samples were obtained from hematology unit locations, including kitchen areas and the unit laundry facility. Hematology unit room air exchange data were reviewed, and air pressure mapping was performed using a digital pressure gauge (The Energy Conservatory, Minneapolis, MN).

2.3. Case-control analyses

Case-patients were compared to controls matched on underlying hematologic disease and hospital discharge date within 30 days of the case-patient's index date. To better