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En-suite bathrooms in protected haematology wards: a source of filamentous fungal contamination?

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SUMMARY

Background: In spite of 25 recently built high-risk haematology rooms with a protected environment and fitted with en-suite bathrooms in our university hospital centre in 2008, sporadic cases of hospital-acquired invasive aspergillosis remained in these wards.
Aim: This study aimed to identify unsuspected environmental sources of filamentous fungal contamination in these rooms.
Methods: Over two months, environmental fungal flora in the air (150 samples) as well as air particle counting and physical environmental parameters (airspeed, temperature, humidity, pressure) were prospectively monitored twice on the sampling day in all 25 protected rooms and en-suite bathrooms in use, and on bathroom surfaces (150 samples).
Findings: In rooms under laminar airflow, in the presence of patients during sampling sessions, fungi were isolated in two samples (4%, 2/50) with a maximum value of 2 cfu/500 L (none was *Aspergillus* sp.). However, 88% of the air samples (44/50) in the bathroom were contaminated with a median range and maximum value of 2 and 16 cfu/500 L. *Aspergillus* spp. were involved in 24% of contaminated samples (12/44) and *A. fumigatus* in 6% (3/44). Bathroom surfaces were contaminated by filamentous fungi in 5% of samples (8/150).
Conclusion: This study highlighted that en-suite bathrooms in protected wards are likely to be a source of fungi. Before considering specific treatment of air in bathrooms, technicians have first corrected the identified deficiencies: replacement of high-efficiency particulate air filters, improvement of air control automation, and restoration of initial technical specifications. Assessment of measure effectiveness is planned.

Introduction

Opportunistic infections are a threat for high-risk patients hospitalized in haematology units.[1,2] Invasive filamentous fungus infections have emerged as important causes of morbidity and excessive mortality in immunocompromised

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patients.[3] The relationship between the degree of environmental fungal contamination and the incidence of infection by filamentous fungi (FF), especially *Aspergillus* spp., is documented.[4–6] The level of FF flora in hospital wards is influenced by both internal (activity, behavioural practices and cleaning work) and outdoor (meteorological parameters and outdoor fungal spores) factors.[6,7] Furthermore, in haematology rooms, positive-pressure ventilation with a high-efficiency particulate air (HEPA) filtration system has proved its effectiveness in substantially decreasing the residual fungal load.[8–12]

In our university hospital centre, 25 protected haematology rooms with fitted en-suite bathrooms were built in 2008. The indoor environment of these rooms was managed by a HEPA filtration system, laminar airflow (LAF), a positive air pressure device, controlled physical environmental parameters, daily appropriate cleaning and behavioural practices.[13] Each month, three out of 25 rooms had been monitored since their construction and no contamination was detected.[14] However, between 2011 and 2013, 28 cases of probable invasive aspergillosis (IA) as defined by the European Organization for Research and Treatment of Cancer/Invasive Fungal Infections Cooperative Group and the National Institute of Allergy and Infectious Diseases Mycoses Study Group (EORTC/MSG) were recorded in these units.[15] Two-thirds of these were classified as possibly hospital-acquired (18/28) by the local Aspergillosis Committee, which prospectively collected and analysed aspergillosis cases.[16,17] The en-suite bathrooms were not usually monitored. The aim of this study was to evaluate the level of FF contamination in these bathrooms.

Methods

The investigations took place in 25 protected rooms in three different units of a French university hospital centre from April 8th to May 27th, 2014.

The wards

The three rooms in the paediatric onco-haematology unit (A) and the eight rooms of the first adult haematology unit (B) were similar in design. Each room of units A and B had a double-door air-lock system, which was systematically closed, and the unit entrance was conventional as for any medical unit. The second adult haematology unit (C) was composed of 14 rooms and the preventive measures were more rigorous: the unit entrance had an additional double-door air-lock system systematically closed, and overshoes and head coverings were mandatory. Under LAF and without human activity, all the 25 rooms followed the recommendations of the ISO-5 standard relative to cleanrooms and associated controlled environments.[18] Each room was equipped with positive air pressure devices, LAF, and HEPA filtration. A room plan is shown in Figure 1. In all these wards, IA high-risk patients had limited visits and selected food, and the patient was only allowed to

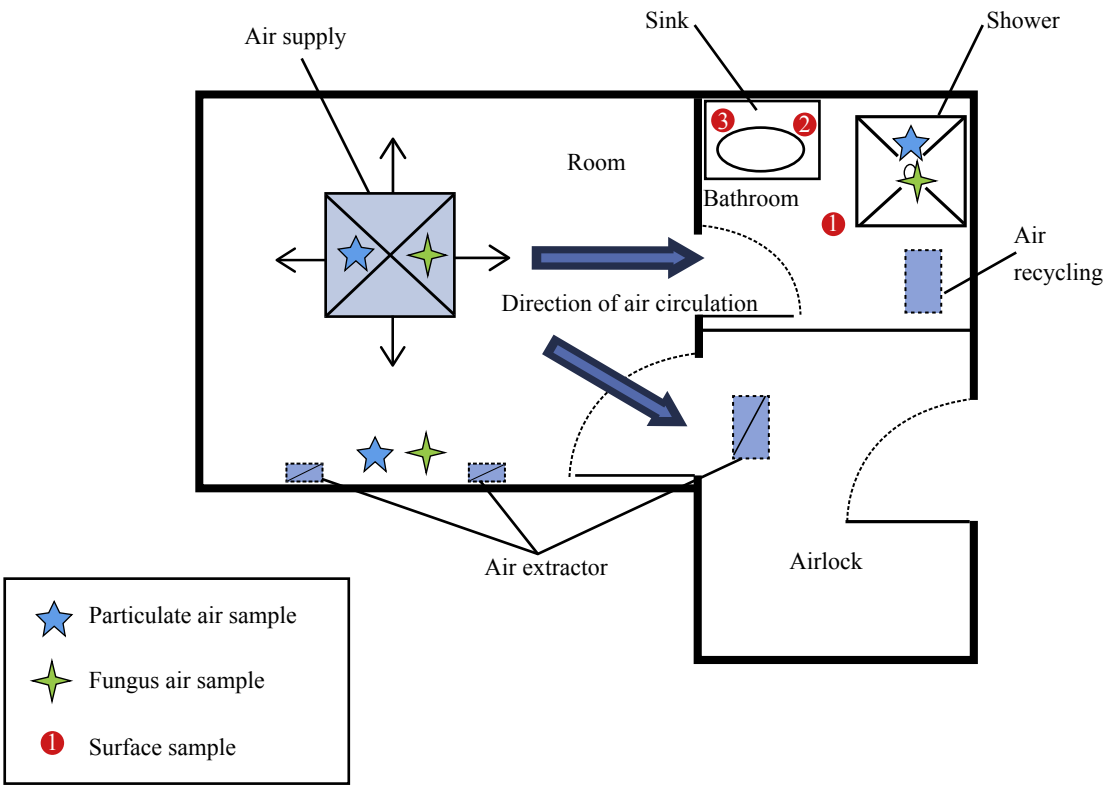

Figure 1. Haematology protected wards: plan of room/bathroom and sampling points. During each sampling session, air filamentous fungal flora and air particle concentrations were measured under laminar airflow (LAF) and outside LAF in the room and in the middle of the bathroom. Three surface samples were taken in the bathroom (floor, sink and top of hand-wiping dispenser). Physical environmental parameters were measured in both the room and bathroom.

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