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ISOLATION OF FUNGUS FROM HOSPITAL ENVIRONMENT AND EQUIPMENTS IN A TERTIARY CARE HOSPITAL IN EASTERN INDIA

Microbiology

Dhirendra Kumar	Senior Resident, Department of Microbology, AIIMS Patna
Nahid Anjum*	Senior Resident, Department of Microbology, AIIMS Patna *Corresponding Author
Shweta Singh	Tutor, Department of Microbiology, PMCH Patna
Abhishek Sengupta	Demonstrator, Department of Microbiology, R. G. Kar Medical College, Kolkata
Asim Sarfraz	Assistant Professor, Department of Microbiology, AIIMS, Patna
Sayan Bhattacharyya	Assistant Professor, Department of Microbiology, AIIH & PH, Kolkata

ABSTRACT

OBJECTIVES: To assess the degree of fungal contamination in hospital environments.
METHODS: Airborne microbial concentration was monitored in various environments in the hospital. Sampling was performed with a passive settle plate method for air culture and with the help of sterile cotton swab for surface. The total fungal concentration was determined by 2-5 days after sampling. The fungal isolates were identified by macroscopic and microscopic observation.
RESULTS: Analysis of the fungal concentration in the different types of environments revealed different levels of contamination. The fungal genus most commonly encountered was *Aspergillus*, followed by *Penicillum* and *Curvularia* species.
CONCLUSIONS: The study detected a wide range of potentially pathogenic fungal isolates from the environment and from different areas of hospitals at a tertiary care centre. Among the preventive measures that should be considered are more frequent mechanical removal of dust, better cleaning and maintenance of air conditioners and other equipment that produce bio-aerosols, correction of room humidity, use of protective clothing by hospital personnel, and better staff training regarding the threats of infection by airborne microorganisms.

KEYWORDS

Fungi,*Aspergillus, Penicillium*, Hospital Environment

INTRODUCTION

The ubiquitous nature of fungi makes them one of the common isolates in healthcare facilities. Various studies have highlighted the fact that hospital infections are caused by different species of fungi, like *Candida albicans* and other species such as *Aspergillus, Cladosporium, and Penicillium*(1-3). Although fungi are ubiquitous in the environment, but they rarely cause symptoms in humans, due to immunity and other effective defence mechanisms, like the cell-mediated (T-dependent) immunity. But, when the immunity of host is compromised due to various condition like HIV infection, tuberculosis, malignancy, hemolymphoproliferative disorders, (4-7), as well as in condition like medical therapy; or particular conditions, such as organ transplantation—may lead to the uncontrolled multiplication of fungi and the consequent onset of infection. Among organ transplant recipients like kidney transplant, approximately 11% of infections are due to fungal etiological agent. Out of total cases, around 47% of these cases of infection occurs during the initial 2 months after organ transplantation (8). In patients of solid organ transplantation, *Aspergillus* and *Candida* species were found to be the causative fungal agents in 80% of cases (9). The incidence of invasive aspergillosis in immunocompromised individuals has steadily increased during the past 2 decades and remains as serious complication and may be lethal (10). The risk factor related to exposure to fungi involve not only immunosuppressed patients but also perfectly healthy persons among whom hyperreactivity to the fungal allergen may develop; such hyperreactivity may cause respiratory disorders, such as asthma and allergic alveolitis (11). A saprophytic fungus like *Aspergillus fumigatus* found in a wide range of environments, frequently causes allergies, most notably bronchopulmonary allergic aspergillosis (12-13) Several studies have reported the possible onset of respiratory disorders after hypersensitization to various genera of fungi, such as *Penicillium*, *Cladosporium* as well as *Rhizopus*. Various strains of Aspergillus and Penicillium seem to be chiefly involved in the genesis of asthma and allergic alveolitis. A very few studies have attempted to correlate the level of fungal pollution in hospital environmental set up with the occurrence of specific diseases among patients or hospital staff. The aim of the current study is to isolate the fungi from environmental sources and hospital equipments in a tertiary care teaching hospital and ascertain which of the environments examined presented the highest health risk.

MATERIALS AND METHODS:

Time and place of study: This study was done from October 2016 to September 2017 in Department of Microbiology at All India Institute of Medical Sciences, Patna. Samples were collected from Operation theatres (OT), Outpatient departments (OPD) and wards. The samples were collected from tap handle, door knob and equipment trays of (a) OTs, (b) OPD rooms, (c) General Medicine, General Surgery and Pediatrics wards and (d) laboratories of the institute. Surface samples were collected using 2 sterile swab sticks for each site, moistened with sterile normal saline, and sent to microbiology lab as soon as possible. Swabs were directly inoculated on 2 sets Sabouraud's dextrose agar (SDA) slants, one kept at 37^0C and another at 22^0C. After inoculation, media was incubated at 37^0C for 3 weeks and observed daily for any growth. Fungi were identified by lacto-phenol cotton blue mount and conventional tests like germ tube test, Dalmau technique and sugar fermentation.

RESULTS:

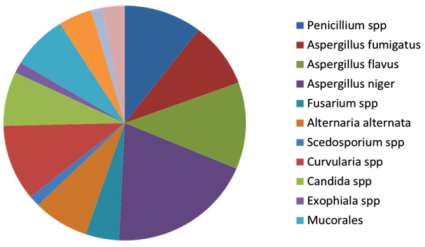
A total of 76 swabs were collected from different areas of the hospitals viz. OPDs, wards, laboratories and operation theatres (OT). 56 out of 76 (71.8%) swabs yielded fungal growth on SDA slants. More than one species of fungus was isolated on 12 out of 56 (21.4%) sources. Table 1 Showing total number and percentage of isolated fungi from all studied units. Among total 68 fungal isolates *Aspergillus niger* was commonest (19.1%) followed by *Aspergillus flavus* (11.7%), *Curvularia*spp, *Penicillium*spp (both 10.2%), respectively. Only 7.3% of the isolated fungi (5 out of 68) were yeast forms consisting of *Candida glabrata* (3 isolates), *Candida parapsillosis* (1 isolate) and *Candida albicans*(1 isolate). Figure 1 depicts the proportion of different fungal isolates. Among different areas from where sampling was done, maximum number of isolates came from Out- patient departments (OPDs). Among all the various sites sampled, fungi are most frequently isolated from door handles followed by tap knobs.

TABLE 1

Isolated Fungi	Total Number	Total Percentage
Aspergillous species	26	46.40
Penicillium species	07	12.50
Curvularia species	07	12.50
Candida species	05	09

Alternaria species	05	09
Rhizopus species	04	07
Fusarium species	04	07
Scopulariopsis species	03	5.40
Acremonium species	02	3.60
Apophysomyces, Exophiala, Scedosporium, Phoma sp.	01 (for each)	1.8 (For each)

FIGURE 1



DISCUSSION

The results of the study reveal various degrees of contamination from all the environments examined, even though all areas are well cleaned with suitable sterilizing agent. The degree of contamination by fungi in the hospital environment may increase dramatically in combination with various factors, such as the presence of construction activity and a favourable microclimate. Because exposure to fungi can cause serious health problems, it is clearly essential, in the above-mentioned risk situations, to evaluate the degree of contamination in the various environments and to use those evaluations to determine the risk of infection for patients and staff alike, in that the use of air conditioning systems does not provide complete protection against fungi. If airborne fungal spores are adsorbed to larger particles, they can settle on surfaces. This means that work surfaces, kitchen utensils, and foodstuffs may also become contaminated. Moreover, in kitchens, the fungal contamination of substrates that may be handled by patients, such as cutlery or certain foods (e.g. fruit), is a risk factor for skin infections. Among immunocompromised patients, such infections may not necessarily remain restricted to the skin but may spread to other organs and tissues. The most common isolated fungal species was Aspergillus, followed by *Penicillium* from the hospital. Among the total 56 fungal isolates, *Aspergillus* (46.4%, n = 26) species were the most dominant, followed by *Penicillium* and *Curvularia* (12.5%, n = 7). From the perspective of nosocomial fungal infections, further study to determine the origin of fungi and clinical significance may be needed. *Aspergillus* spps. especially *A. niger*, *A. flavus* and *A. fumigatus* are frequently isolated and grow in the Hospitals environment. This Aspergillus species were considered the major source of fungal infections in Hospital and can cause nosocomial infections (14,15). Similar to our results *A. niger* was the highest isolated mould in the environment of Sebha Medical Centre, Libya (16). Similar to our results Perdelli et al (2006) recorded that Aspergillus species were isolated in low percentage from operation theatres and predominant in working and open area of hospital such as wards, kitchen, outpatient departments and laboratories (17).

Conclusion: The study detected a wide range of potentially pathogenic fungal isolates from the environment and from different areas of hospitals at a tertiary care centre. The hospital environment were analysed and presented a similar contamination level, with the *Aspergillous* genus being the most common, especially *A. niger*. Therefore, considering the presence of these microorganisms with pathogenic potential, air monitoring and surfaces swab were essential for prevention of hospital infections. Among the preventive measures that should be considered are more frequent mechanical removal of dust, better cleaning and maintenance of air conditioners and other equipment that produce bio-aerosols, correction of room humidity, use of protective clothing by hospital personnel, and better staff training regarding the threats of infection by airborne microorganisms. Thus, active environmental surveillance and application of strict cleaning procedures should be implemented in order to prevent cross-infection and hospital outbreaks.

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