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Isolation of Fungal Contaminants from Various Working Surface Areas of a Tertiary care Teaching Hospital, Amalapuram

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Abstract

INTRODUCTION: Hospital environments, particularly those in tertiary care teaching hospitals, play a critical role in patient care and medical education. However, these environments can also serve as reservoirs for various microbial contaminants, including fungi, which pose significant risks to immunocompromised patients, healthcare workers, and visitors. This study aims to assess the incidence of fungal contaminants on various working surface areas in a tertiary care teaching hospital in Amalapuram. By identifying the types and prevalence of fungi present, it is possible to understand the environmental factors contributing to fungal contamination and implement necessary infection control measures.

OBJECTIVES: The principal goal of this study is to identify the presence of fungi on various working surface areas of a Tertiary care Teaching Hospital, Amalapuram.

MATERIALS AND METHODS: Moistened swabs were collected from various surface areas including bed rails, door handles, medical equipment, light switches, and nursing stations, ceilings, AC airvents, walls, IV stands etc… and were inoculated on SDA and the fungi were identified based on morphology.

RESULTS: A total of 100 swabs were collected from different areas of the hospital- different wards, OTs, all ICUs. Out of 100 swabs, 64 swabs showed growth on SDA slants. Out of 64 isolates, 23 isolates were Aspergillus niger (40%), 10 were A.fumigatus (15%), 20 were Fusarium (31%), 4 were Curvularia (6%), 2 were Cladosporium (3%), Allescheria boydii - 1(1%), Exophiala jaenselmei-1(1%), Gliocladium -1(1%), Phoma -1(1%), Chaetomium -1 (%).

CONCLUSION: Most of the patients in the hospitals are immune compromised. These fungal isolates in the hospital environment may become an additional economic burden to their present situation as most of them are multi drug resistant. So, measures to control hospital infection in the hospital environment mainly ICUs is very much needed

INTRODUCTION:

Hospital environments, particularly those in tertiary teaching hospitals, play a critical role in patient care and medical education. However, these environments can also serve as reservoirs for various microbial contaminants, including fungi, which pose significant risks to immunocompromised patients, healthcare workers, and visitors.

Fungal contaminants, such as Aspergillus, Candida and Penicillium species can enter the human body through inhalation and dermal contact, causing various reactions and symptoms in humans contributing to increased morbidity and mortality rates in healthcare settings[1].

The presence of fungal contaminants on working surfaces in hospitals can be attributed to multiple factors, including poor ventilation, inadequate cleaning practices, and high foot traffic[2,3]. These fungi can be disseminated through air, water and direct contact leading to outbreaks that are challenging to control. This challenge may relate to the environment niches that they occupy; the relative ease of dispersal; the ability of fungi to grow on almost any substrate[4], with the identification of fungi remaining a relatively specialist area when compared to the characterisation of bacteria

Fungi are ubiquitous in distribution and are a serious threat to public health[5]. Fungi are able to grow on almost all natural and synthetic materials, especially if they are hygroscopic or wet. Inorganic materials get frequently colonized as they absorb dust and serve as good growth substrates for Aspergillus[6]. Common contributors to biological pollutants are leaks in plumbing, roofs or air conditioners, humidifiers, and bathrooms; and ice damming on building roofs allows water to seep through the roof sheathing[7]. Fiber glass insulation and ceiling tiles support the growth of a number of fungi, among them frequently isolated were A. versicolor, Alternaria, Cladosporium, and Penicillium species[8]

This study aims to assess the incidence of fungal contaminants on various working surface areas in a tertiary teaching hospital in Amalapuram. By identifying the types and prevalence of fungi present, it is possible to understand the environmental factors contributing to fungal contamination and implement necessary infection control measures. The findings of this study will be instrumental in developing targeted strategies to reduce the risk of fungal infections and improve overall hospital hygiene and patient safety.

Objectives :

The principal goal of this study is to identify the presence of fungi on various working surface areas of a Tertiary care Teaching Hospital, Amalapuram.

Materials and Methods :

The present study was conducted in the Department of Microbiology, Konaseema Institute of Medical Sciences & Research Foundation, Amalapuram, from June 2023 to June 2024.

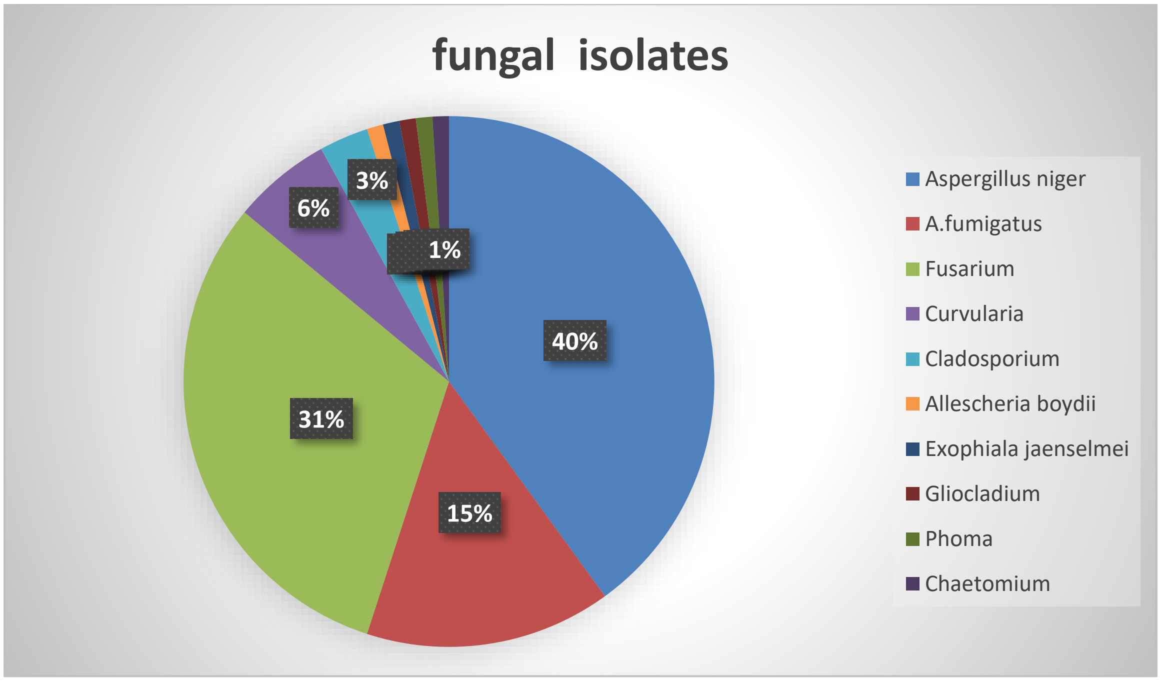
Sample collection method:

- After obtaining Institutional Ethics Committee approval, samples were collected from various surface areas including bed rails, door handles, medical equipment, light switches, and nursing stations, ceilings, AC airvents, walls, IV stands etc…
- Surface samples were collected using sterile swabs moistened with sterile saline and were placed in sterile tubes and sent to microbiology lab as soon as possible.
- The swabs were inoculated onto Sabouraud's dextrose agar (SDA) with chloramphenical to suppress any bacterial growth and incubated at 25^0 C in a BOD incubator temperature and checked daily for fungal growth for 7 days.
- Identification was made according to their macroscopic and microscopic morphological characteristics of the growth by standard mycological methods by Lacto phenol cotton blue (LCB) mount and other conventional tests.[9,10]

RESULTS :

A total of 100 swabs were collected from different areas of the hospital- different wards, OTs, all ICUs. Out of 100 swabs, 64 swabs showed growth on SDA slants. Out of 64 isolates, 23 isolates were Aspergillus niger (40%), 10 were A.fumigatus (15%), 20 were Fusarium (31%), 4 were Curvularia (6%), 2 were Cladosporium (3%), Allescheria boydii -1(1%), Exophiala jaenselmei-1(1%), Gliocladium -1(1%), Phoma -1(1%), Chaetomium -1 (%).

Isolated Fungi	**Total number**	**Percentage (%)**
Aspergillus niger	23	40%
A.fumigatus	10	15%
Fusarium	20	31%
Curvularia	4	6%
Cladosporium	2	3%
Allescheria boydii	1	1%
Exophiala jaenselmei	1	1%
Gliocladium	1	1%
Phoma	1	1%
Chaetomium	1	1%



DISCUSSION :

Moisture, nutrients and temperature are the most important factors that influence the growth of fungi on building materials (Rajasekar and Balasubramanian, 2011).[11]

Nutrients in house dust and water favor fungal growth on building materials. Fiberglass, galvanized steel accumulated with dust or lubricant oil residues, allows the growth of fungi (Kennedy et al., 2004, , Yau and Ng, 2011).[12,13] The temperature in buildings of about 20–25 °C, promotes the growth of mesophilic fungi. However, the temperature below optimum level slows down the growth of fungi. pH range of 5–6.5 in building materials allows the best growth of most of the fungi (Hoang et al., 2010).[14] Sufficient light and oxygen are also critical for the growth of fungi in indoor environments (Zadrazil et al., 1991, Airaksinen et al., 2004, Voisey, 2010).[15,16,17]

External factors (air humidity, seasonality, air and people flow, use of particulate filters, and health professionals' hand hygiene) contribute to indoor air contamination with fungi.

Improving communication among health professionals is a great concern because this can prevent major health complications. High infection rates may be attributed to working conditions, to the physical structure of the ward, to the nurse/bed ratio, to the resident microbiota in the care assistance, and to the presence of multiresistant microbial strains, among others (Jenyffie A et al., 2021).[18]

In the present study the most common isolates are of Aspergillus species (55%) which is co relating with other studies i.e Xunliang Tong et al., 2017 and in his study he worked at different critical care areas of hospital and concluded that 17 -61% of the fungi are of Aspergillus species.[19] In another similar study Dhirendra Kumar et al., 2019 the most isolated fungi from hospital environment and equipment are Aspergillus species (46.4%).[10] Similar study was also done by Parisa Badiee et al., 2023 and they stated that Aspergillus species (19%) are most commonly isolated fungal contaminants in hospital environment.[20] Jenyffie A et al., 2021 in a review of paper fungi in indoor area of critical area of hospital showed most of the fungal isolates in their study was Aspergillus species.[18] Aspergillus species cause aspergillosis infection usually affect the respiratory system and most serious form of aspergillosis is invasive aspergillosis where the infection spreads to blood vessels and beyond.[21]

The next common isolate in our study is Fusarium (31%) while in other studies Dhirendra Kumar et al., 2019 and Parisa Badiee et al., 2023 fusarium isolates are 7%.[10,20] In a review paper by Jenyffie A et al., 2021 it was clear that Fusarium is also one of the most common fungal isolate in hospital environment next to Aspergillus species.[18] Fusarium generally cause keratitis and onychomycosis. It may also cause allergic diseases (sinusitis) and mycotoxicosis in humans.[22,23]

In the present study Curvularia spp (6%) has been isolated next to Fusarium and it has been also isolated in other studies like Frequency of airborne fungus in critical areas at hospital unit by Venceslau et al., (2012) and other study Fungal biodiversity of air in Hospitals Pantoja et al., (2012).[24,25] Curvularia are human pathogens which cause mild skin and nail infections to severe invasive disease.[26]

There are Cladosporium (3%) isolates in our study and these isolates are also seen in 0.5% in Parisa Badiee et al., 2023 study and in Hoseinzadeh et al. (2013) Evaluation of bioaerosols in five educational hospitals wards Cladosporium is a common isolate.[20,27] It is also seen in Calumby et al. (2019) Isolation and identification of anemophilic fungal microbiota in ICU and Souza et al (2019) Airborne fungi in neonatal intensive care unit of a public hospital as a most common fungal isolate.[28,29]

Aboul-Nasr et al. (2014) Indoor surveillance of airborne fungi contaminating Intensive care units and operation rooms and El-Sharkawy et al (2014) Indoor air quality levels in a University Hospital also stated that Cladosporium one of the fungal isolates in their study.[30,31] Cladosporium has been reported to cause several different types of opportunistic infections, including subcutaneous and deep infections, in humans. Cladosporium spores, also potentially lead to the development of respiratory allergy problems such as asthma and rarely cause pulmonary infection.[32]

In the present study other rare isolates are Allescheria boydii (1%), Exophiala jaenselmei (1%), Gliocladium(1%), Phoma(1%) and Chaetomium(1%). In Dhirendra Kumar et al., 2019 study also Exophiala jaenselmei (1.8%) and Phoma(1.8%) were isolated.[10]

Allescheria boydii & Exophiala jaenselmei can cause mycetoma.[33] Gliocladium rarely cause ocular infections.[34] Phoma causes rare opportunistic infections like subcutaneous mycoses and onychomycosis.[35] Chaetomium can cause sinusitis, onychomycosis and empyema.[36]

CONCLUSION:

Most of the patients in the hospitals are immune compromised. These fungal isolates in the hospital environment may become an additional economic burden to their present situation as most of them are multi drug resistant. So, measures to control hospital infection in the hospital environment mainly ICUs is very much needed. So it is necessary to bring awareness that there is a chance of acquiring fungal infections as they commonly form spores and spread infections. Hence promoting good air ventilation and periodical cleaning of air conditioners to control excess moisture in the walls and hospital environment to decrease the fungal saprophytes according to standard protocols is necessary. Also alerting about the situation of hospital environmental fungal infections to the health professionals and hospital management is a crucial step in infection control.

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