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Research Article

Isolation of opportunistic pathogenic fungal contamination from hospital environment

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Abstract: Mycotic diseases of man are an emerging public health problem which receives growing alternation from the health authorities. Most indoor fungal contaminants come from the hazardous non biological agents. Fungi are ubiquitous in distribution and are a serious threat to public health in indoor hospital environment. A report to explain the possible source of infection for human pathogenic fungi of deep mycoses was examined. Soil water and air samples were investigated from in and around the environment of hospitalized patients. This paper reports the results of environmental surveillance of fungi as biological contaminants and their impact on human health in 3 local hospitals of Jabalpur. The air samples in the hospitals yielded *Aspergillus, Rhizopus* and *Candida* species. The dust samples were positive for *Candida, Fusarium, Rhizopus* and *Aspergillus* species. The water of the sterilizing apparatus, yielding *Aspergillus, Fusarium, Rhizopus* and *Candida* species were isolated.

Keywords: ubiquitous; pathogenic fungi; biological contaminants; sterilizing apparatus.

INTRODUCTION

Fungi are ubiquitous in our environment, only a few people realize how intimately our lives are related to these fungi. Mycotic diseases of man are an emerging public health problem which receives growing alternation from the health authorities. Outside such setting may pose threat to various categories of immunocompromised hosts through aerosol transmission, percutaneous inoculation or gastro-intestinal entry (Perfect and Schell 1996). Fungal infections of hospital origin are gaining importance in recent years due to their progressive increase into the high rates of mortality and mobility with which they are associated (Colombo 2000 and pfaller et al. 1996). Many of these infections are endogenous in nature, but others can be acquired by exogenous roots, through the hands of healthcare workers, contaminated infusion products and biomaterials and

abiotic environmental sources (Wenzel et al. 1995).

Fungal species that may be present in hospitals, unusual opportunistic fungi in environment such as *Candida* species remain a major cause of nosocomal infection. *Candida albicans* was the main agent for causing *Fungemia* and *Funguria* (Price et al. 1984). Pfaller et al. (1996) reported that many of fungal infections arise from an endogenous source and their frequency is influenced by the patient population, intravascular catheters and solution, growing diversity of underlying diseases, antifungal used and other supportive care measures employed at specific institutions. Johannes et al. (2001) reported the biodiversity and concentration of airborne fungi over a period of 6 months on a special care unit of a hospital. Various abiotic agents like dust, particulate matter, wall coverings, synthetic paints, glue, polishes and volatile organic compounds (VOCS) may contribute to indoor pollution (Chao et al. 2002, Horner 2003). Fungi are ubiquitous in distribution and are a serious threat to public health in indoor environments (Samet et al. 2003, Khan et al. 2009 and Gaofetoge et al. 2014) also studied to access the microbial composition of the air in the kitchen and selected wards at typical district hospital in South Africa. Airborne fungi are responsible for the majority of fungal infections in human and animals. Outdoor air markedly influences the prevalence of fungal spore levels in indoor air and thus, is the major source of fungal infections in indoor environments especially in hospitalized individuals (Masoomeh et al. 2014) Fungi can contaminate biological solutions. *Rhinocandida atrovirens* has been found to colonize an improperly sterilized endoscope used in examination of immunocompromised patients (Price et al. 1994). Species of the *Fusarium* are regular cause of superficial and deep infections. These species survive on saprobic material in nature and become the source of infection by inhaled or enter via break in the skin or through gastro-intestinal tract (Anaissee et al. 1988). In suitable conditions, filamentous fungi grow and sporulate in various substrates and constitute significant sources of airborne fungal conidia and hyphal fragments in indoor environments. Most outbreaks of nosocomial fungal conidia and hyphal fragments in indoor environments (Qudiesat et al. 2009). In the hospital environment, the airborne microbiota is formed mainly by filamentous fungi, especially those belonging to the Genera *Asperigillus, Cladosporium, Paecilomyces, Scopu lariopsis*. (Rainer et al. 2011 and Sanca et al. 2002). Yeasts have been found of the genera *Candida, Rhodotorula, Cryptococcus* and *Trichosporon* (Calderone et al. 2001; Krajewska et al. 2004; Pini et. al., 2005 and Moretti et. al. 2007).

Asperigillus are the common cause of hospital acquired fungal infection. Many species are found, on a wide variety of substrates including forage products, food products, cotton, leather and other organic debris. *A. flavus* was isolated from wood-pulp based fire proofing material in a cancer hospital (Aisner et al. 1976). Airborne spores probably also infect tissues exposed during surgery (Gray et al. 1986 and Patheram et al. 1979). Conidia of *Aspergillus* may gain entry into susceptible patients by contaminated hospital supplies (Grossman 1985 and McCarty 1986). Staib et al. (1978) isolated *Aspergillus fumigatus* and *A. niger* from the soil of various potted indoor plants kept in the room of a patient suffering from aspergillosis. The reported cases of Aspergillosis from hospital source

have been reviewed by Walsh and Dixon (1989).

MATERIAL AND METHODS

To explain the possible source of deep mycoses, soil, water and air samples were screened from the environment of hospitalized patients from the various hospitals of Jabalpur.

(A)Soil sample collection:

Soil sample were collected from the floor of the hospitals general wards aseptically in polythene bags. 1 gm of air dried sieved soil was mixed with 10 ml distilled water by vigorously shaking and then allowed to sediment for 5-20 minutes. 5 ml of the suspension was then kept at 37^0 C for 1 hr and then dilution (1:10, 1:100, 1:1000) of sample was prepared, and 1 ml each of all the three dilution was plated on petriplates containing SDA media.

(B)Isolation of water mycoflora:

Water samples from the sterilization vessel were collected aseptically in different hospitals in sterilized plastic bottles. Three different dilution (1:10, 1:100, 1:1000) were prepared and 1 ml of each of all the dilution was plated on petriplates containing SDA media.

(C)Isolation of air mycoflora:

Previously prepared SDA containing petriplates was exposed at different corners of the general wards of the hospitals for 5-10 minutes. These petriplates were then transported to the laboratory and kept in incubator upto 7 days at 37^0C for the growth and isolation of fungi.

(D)Isolation of fungi from surgical instruments of the hospitals:

Surgical instruments were rinsed with sterilized distilled water and then the water was inoculated on SDA media and incubated at 37 ^{0}C for growth and observed up to 7 days.

Table- Epidemiological data of isolation of fungi from extra human sources.

S.No	Site (Nature of sample)	Yeast isolated	Moulds isolated
	Air		
1.	Hospital -1	*Candida sp.*	*Aspergillus falvus, Rhizopus sp.*
2.	Hospital -2	*Candida sp.*	*Aspergillus fumigates, Rhizopus sp.*
3.	Hospital -3	Nil	Nil
	Dust		
1.	Hospital -1	*Candida sp.*	*Aspergillus niger, Fusarium sp.*
2.	Hospital -2	*Candida sp.*	*Aspergillus niger, A. fumigates, Rhizopus, A. flavus*
3.	Hospital -3	*Candida sp.*	*Aspergillus sp.*
	Water (Sterlizing apparatus)		

1.	Hospital -1	Nil	*Asparegillus niger, A. terreus, Rhizopus, Fusarium sp.*
2.	Hospital -2	-	*Asparegillus niger, Rhizopus, Fusarium sp.*
3.	Hospital -3	*Candida sp.*	*Asparegillus niger, A.flavus.*
	Instruments wash		
1.	Hospital -1 (OPD instruments)	Nil	Nil
2.	Hospital -2	-	*Aspergillus sp.*
3.	Hospital -3	-	Nil

RESULTS AND DISCUSSIONS

Isolation of fungal species from samples taken from in and around the hospital environment. The air sampled in the hospital yielded Aspergillus flavus, *A. fumagitus, Rhizopus sp.* and *Candida sp*. from two hospitals and no fungi was isolated from one hospital. The dust sample of all hospitals were positive for fungi and *Candida sp.,Fusarium sp., Rhizopus sp.* and *Aspergillus niger, A. fumigates, A. flavus*. The water of the sterilizing apparatus in which the instruments are sterilized, yielded *A.niger, A. terreus, A.flavus, Fusarium* and *Rhizopus* species but only from one hospital sample, yeast *Candida sp*. was isolated. Only *Aspergillus* could be isolated from the wash of surgical instruments of various hospitals.

In the hospital environment, the airbone microbiota is formed mainly by filamentous fungi, especially those belonging to the genera *Aspergillus, Cladosporium, Paecilomyces, Penicillum, Scopulariopsis* (Rainer et al. 2001and Sanca et al. 2002). Yeasts have been found of the genera *Candida, Rhodotorula, Cryptococcus* and *Trichosporon* (Calderone et al. 2005and Moretti et al. 2007).The reservoir from which fungus infects humans or animals is a site (ecological niche) in nature where the pathogen grows as a saprophyte. The occurrence of fungal infection in man are mainly due to inhaling conidia released in the environment by the saprophyte source of the pathogen. Workers showing compost would be at risk of inhaling conidia of various *Aspergillus* sp. (Kwon. C. and Bennett 1992). In the present study, the isolation of fungi from air, dust and instrumental wash of 3 hospitals shows that *Aspergillus* sp. were predominant in the hospital environment. However, solid epidemiological support is lacking in the present investigation as it was not possible to pin point the source of infection in the patient due to lack of infrastructure in molecular typing. Although, it is logical to suggest that infection requires inhalation of certain number of spores, the number probably depends upon the degree of immunosuppression. Pugan et al. (1999) reported that risk of invasive aspergillosis mainly depend on the patient's immune status. *Aspergillus* species were the

filamentous fungus most frequently isolated in a multi centre hospital study (Panagopoulou et al. 2002).

The usual reservoir of *Candida* is the patients own body. However, in contemporary medium cross infection due to *Candida sp.* has also been reported (Kwon, C. and Bennett, 1992). Nawange (1999) reported soil as a good source of *C. albicans* the principle agent of systemic candidiosis. McCullough et al. (1998) studied the epidemiological relationship of clinical isolates of *C. albicans* in heroin addict using DNA typing methods. It was found that a new sub-group of *C. albicans* was responsible for infection in such patients. In the present study the isolation of fusarium sp. from the dust of the ward of one of the hospitals. *Fusarium* is a well known plant pathogen causing a lot of management problems of such patients in contemporary medicine. Many of the *Fusarium* sp are being increasingly complicated as human pathogen (Barde and Singh 1983) causing a lot of management problems of such patients in contemporary medicine. Nawange (1999) reported garbage soil as a good source of *Fusarium sp*. They may cause invasive infection in immunocompromised host (Gamis et al. 1991). A significant finding of the study is the isolation of *Rhizopus sp*. from the environment of hospitals. Zygomycosis is worldwide in distribution. As a disease is an opportunistic infection, the distribution of the various clinical forms is based on predispose factors rather than in age, sex, race and geography (Singh and Naidu 2000). Environment contaminated with the spores of order mucorales may act as a source of infection in immunosuppressed patients (Sharma et al. 1997).

Conclusion: Human pathogenic fungal biodiversity of regional epidemiology is a significant factor in the causation of such diseases in the patients. Patients environment be continuously monitored so that the reservoir of such fungi the environment be identified and destroyed. The adherence to good infection control procedures, particularly hand washing, proper sterilization of surgical instruments, use of air filter in the room of the hospitalized patients would definitely decrease the admittance of the number of such cases in the hospitals. We conclude that patients environment be continuously monitored so the reservoirs of such fungi in the environment be identified and destroyed. The findings of the present study confirm the need for further documented studies to evaluate the safety of the hospital system and to define new preventive measures. We conducted a prospective study to investigate the presence of micro fungal contamination in the hospital environment during the one year period. In the present study, about 9 different genera were isolated from a hospital environment.

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REFERENCES

Perfect J. R. and Schell, W. A. (1966) The new Fungal Opportunists au coming Clin. Infect. Dis. 22 (2), S 112-118.

Clombo A. L. (2000) Epidemiology and treatment of hematogenous candidiasis a brazilian prespective. Braz J Infect Dis. 4, 113-8.

Pfaller M. A. (1996) Nosocomial Candidiasis: emerging species, reservoirs

and modes of transmission. Clin. Infect. Dis. 22 (2), 889-894.

Wenzel R. P. (1995) Nosocomial candidemia: risk factors and attributes mortality. Clin Infect Dis. 20, 1531-4.

Price D. L., Simmons R. B., Ezeonu I. M., Crow S. A. and Abern D. G. (1994) Colonization of fiber glass in solution used in heating, ventilation and air conditioning system. J. Ind. Microbiol. 13, 154-158.

Johannes U P. and Reinhold P. (2001) Biodiversity and Concentration of airborne fungi in hospital environment. Mycopathologia. 149(2), 87-97.

Chao H. J., Schwarts J., Milton D. K. and Burge H. A. (2003) The work environment and workers health in four large office buildings Environmental Health Perspectives. 3, 1242-1248.

Horner W. E. (2003) Assessment of the indoor environment: evaluation of mold growth indoors. Immunology and Allergy Clinics of North America. 23,519-531.

Samet J. M. and Spengler J. D. (2003) Indoor environments and health: Moving into the 21st century. American J. Public Health. 93(9), 1489-1493.

Khan A. A., Karuppayil S. M., Chary M., Kunwar I. K. and Waghray S. (2009). Isolation, identification and testing allergenicity of fungi from air-conditioned indoor environments. Aerobiologica 25, 119-123.

Gaofetoge S., Ntsoaki M., Karabo S. and Ryk L. (2014) Identification of airborne microbiota in selected areas in a health-care setting in South Africa. BMC Microbiology. 14, 100.

Masoomeh S. G., Sanz A. G., Narges A. and Mehdi R. A. (2014) Investigation on distribution of airborne fungi in outdoor environment in Tehran, Iran. Journal of Environmental Health Science and Engineering. 12, 54.

Price D. L., Simmons R. B., Ezeonu I. M., Crow S. A. and Abern D. G. (1994) Colonization of fiber glass in solution used in heating, ventilation and air conditioning system. J. Ind. Microbiol. 13, 154-158.

Anaissic E., Kantarjian, H., Ro J., Hopfer R., Rolston K., Fainstein V. and Bodey G. (1988) The emerging role of *Fusarium* infections in patients with cancer. Medicine. 67, 77-83.

Qudiesat K., Abu E. K., Elkarmi A., Hamad M. and Abussaud M. (2009) Assessment of airborne pathogens in healthcare settings. African Journal of Microbiology Research. 3(2), 66-76.

Rainer J., Peintner U. and Poder R. (2001) Biodiversity and concentration of airborne fungi in hospital environment. Mycopathologia. 149, 87-97.

Sanca S., Asan A., Otkun M.T. and Ture M. (2002) Monitoring Indoor Airborne Fungi and Bacteria in the Different Areas of Trakya University Hospital Edirne Turkey. Indoor Built Enviorn. 11, 285-92.

Calderone R.A. and Fonzi W.A. (2001) Virulence factors of *Candida albicans*. Trends Microbiol. 9, 327-35.

Krajewska K. Krajwska K.E., Lukaszuk C., Rolka H., Lach J. and Karczewski J.

(2004) Occurance of fungal pathogens in the delivery rooms of a hospital obstetrics department. Ginekol Pol. 75, 451-6.

Pini G., Faggi E., Donato R. and Fanci R. (2005) Isolation of *Trichosporon* in a haemotology ward. Mycoses. 48, 45-9.

Moretti M.L. (2007) A importancia crescente das infeccoes fungicas. Rev Panam Infectol. 9, 8-8.

Aisner J., Schimpff S.C., Benett J.E., Yaung V.M. and Wiernik P.H. (1976) *Aspergillus* infections in cancer patients: association with fire proofing materials in a new hospital. JAMA. 235, 411-412.

Gray R., Kaplan L., Matloff J., Uman S. and Shachtman J. (1986) Aortic pseudoaneurysm with *Aspergillus aortitis*: an unusual complication of coronary bypass surgery. Chest. 89, 306-309.

Patheram E.S. and Seal R.M. (1979) Aspergillus prosthetic value endocarditis. thorax. 31, 380-390.

Grossman M.E. (1985) Primary cutaneous aspergillosis in six lukemic children. J. Am. Acad. Dermatol. 12, 313-318.

McCarty J.M. (1986) Outbreak of primary cutaneous aspergillosis related to intravenous arm boards. J. Pediatr. 108, 213-218.

Staib F. (1978) Ramuluffunter Suchung auf. *Aspergillus* Artch inder wohnung eines chronisch lung enkranken. Bundesgesundhbl. 21, 471-474.

Walsh T. J. and Dixon D. M. (1989) Nosocomial aspergillosis : environmental microbiology hospital epidemiology diagnosis and treatment. Eur. J. Epidemoil. 5, 131-142.

Rainer J., Peintner U. and Poder R. (2001) Biodiversity and concentration of airborne fungi in hospital environment. Mycopathologia. 149, 87-97

Sanca S., Asan A., Otkun M. T. and Ture M. (2002) Monitoring Indoor Airborne Fungi and Bacteria in the Different Areas of Trakya University Hospital Edirne Turkey. Indoor Built Enviorn. 11, 285-92.

Calderone R.A. and Fonzi W.A. (2001) Virulence factors of *Candida albicans*. Trends Microbiol. 9, 327-35.

Moretti M. L. (2007) A importancia crescente das infeccoes fungicas. Rev Panam Infectol. 9, 8-8.

Kwon-Chung K. J. and Bennett J. E. (1992) Keratomycosis (mycotic keratitis). In: Medical Mycology-philadelphia : Lea and Febiger. 162-168.

Paugam A., Benchetrit M., Fiacre A., Tourte S. and Dupouy C. J. (1999) Comparison of four commercialized biochemical system for clinical yeast identification by colour producing reactions. Medical Mycology. 37, 11-17.

Panagopolou P., Fillofi J., Petrikkos G., Gliakouppi P., Anatoliotaki M. and Farmaki E. (2002) Environamental surveillance of filamentous fungi in three tertiary care hospitals in Greece. J. Hosp. Infect. 52, 185-91.

Nawange S.R. (1999) Search for ecological niche of human pathogenic fungi in the environment of Jabalpur with special

reference to their pathogenic potentials. PhD thesis RDVV. Jabalpur (M.P.).

McCullough Clemans K.V., Del P. A. and Stevens D.A. (1998) Epidemiology of Candida albicans isolates from heroin addicts analyzed by DNA typing. Med. Mycol. 36, 213-217.

Barde A.K. and Singh S.M. (1983) A case study of onychomycosis caused by *Curcularia lunta* (Wakker) Boedijn. Mykosen. 26(6), 311-316.

Gamis A.S., Gudnason T., Giebink G.S. and Ramsay N.K. (1991) Disseminated infection with *Fusarium* in recipiants of bone marrow transplants. Rev. Infect. Dis.13, 1077-1088.

Singh S.M. and Naidu J. (2000) Emerging zygomycosis and infection caused by *Penicillium marnefii* in mycoses in the new mellinium. Venugopal P.V. and Venugopal, T.V. (Eds), published under CME programme, Printed by Udyam Offset, Chennai.

Sharma B., Nawange S.R., Panday A. and Singh S.M. (1997) Examination from soil from residential garbage in Betul India for fungi by the Keratin beling technique. Zbt. Bakt. 286(1), 139-145.