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Research Article

# Detection of Fungal Contamination of Ward Furnishing and Medical Equipment Used in intensive Care Unit and Neonatal Intensive Care Unit

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## Abstract

**Background:** Nosocomial infections acquired during hospitalization depend on the characteristics of the microorganisms, with a high risk of being acquired when the contaminated environment. Cross-transmission of microorganisms by contaminated surfaces and the hands of health care workers are considered to be the main route of the spread of nosocomial infections.

**Aim of study:** This study aim to detect the fungal contamination of ward furnishings and medical equipment used in the intensive care unit and Neonatal intensive care unit.

**Materials and Methods:** Fifty environmental swabs were collected from ward furnishings and medical equipment including predefined surfaces (armrest beds, wash sinks, medical tables), between August and September 2021.Swab specimens were immediately inoculated onto plates that contained Sabouraud Dextrose Agar. After that samples were incubated for a 1 to 7 days period at 28°C and checked every day for growth.

**Results:** Out of fifty swabs samples, 21(42%) yielded Fungal growth. From these isolated organisms *Penicillum species* was the predominant isolate 10 (47.6%) followed by*Aspergillus flavus.Penicillum species* was the commonest fungal isolates among ICU, while *Aspergillus flavus* were the predominant isolates among Neonatal ICU. The most contaminant Equipment was found in Neonatal ICU samples 5(55.6%), and the most contaminant Place in ICU was the floors 3(25%).

**Conclusion:** This study showed that ICU of the hospital may contain fungi indicating that may form potential source of cross-infection through health care workers to their patients.

**Keywords:** Fungi, Neonatal, ICU, and Infection.

## INTRODUCTION:

Fungi are a large and diverse group of eukaryotic microorganisms. There are approximately 100,000 species of fungi, about 200 of which are pathogens.[1]The two groups of fungi that have practical importance in the Hospitals are molds and yeasts. Generally, fungi can be differentiated easily into these two types based on the macroscopic appearance of their colonies. [1]

Fungi are common in the air and on surfaces, particularly where moisture is present. Although fungi are not normally found in Hospitals in high numbers, the walls surrounding Hospitals can contain fungi and fungi will present challenges to air handling systems. Breaches to these areas can lead to the ingress of fungi. This is important since in any built environment there are very few natural indoor fungi; most fungi found indoors originate from the outside environment and their presence inside is due to some mechanism of transfer. [2] Hence as the outdoor species pool varies, so will the indoor airborne fungal communities.

Room condition of the clean room has a bearing on the possibility of a vector (like air or water) breaching the clean room and with the ability of a facility to respond to an incident with an effective cleaning and disinfection program (since damaged surfaces are more difficult to clean and disinfectant). The probability of this comes down to how well a particular facility if maintained, although the success of maintaining a facility become more difficult with ageing facilities (an indefinable time, although, in the pharmaceutical context a facility over twenty-five years old might reasonably be defined as ageing).[6,7]

Further with the room, as well as water there is an associated with fungi and temperature, high indoor humidity together with limited ventilation. [8] Here higher ventilation rates reduce the prevalence of fungi, together with consideration given to the hygrothermal performance of building assemblies.

Poorly maintained machinery can also be a source of fungi and repairing damage should form part of a facility's mycoremediation strategy. An example is with worn or damaged filters, which can blow air around a facility. A second area is following maintenance activity, such as the opening of panels on machines. The inner areas of equipment, especially those not typically intended to be exposed to the cleanroom environment, can be a source of contamination.

Personnel are often well trained but issues can arise in relation to personal hygiene (in relation to entry into a facility, such as removal of outdoor clothing at the first change area and hand washing). A level of fungi is naturally associated with the human microbiome of the skin.[9] Personnel can introduce contamination in the form of soil, especially in footwear. It is very important there is a shoe change using captive shoes on entry into a cleanroom area (plus the wearing of anti-moisture cleanroom socks), together with wearing the correct cleanroom gowns, gloves and masks.[10]Other personnel variables relate to the effectiveness of cleaning and disinfection, especially if contract staff is used for these activities. These personnel activities should be addressed through training.

The detection of the type of fungi can sometimes provide clues as to the origin, in terms of atmospheric air; the built environment and water. This makes identification important, either through visual means or by using a microbial identification system. With identification, while only a small proportion of world's species of fungi have been characterized those likely to be found in Hospitals fall within a narrow grouping. Identification methods include visual identification from colonies grown on media, by comparing recoveries with text books.[11] phenotypic systems; or genotypic methods which look either at the D1/D2 region of the large ribosome subunit or the internal transcribed spacer regions. [12, 13]

Some common types of fungi are:

Common environmental fungi *Pencillium* and *Aspergillus* species, Buildings and damp environments – *Cladosporium*, People – *Aspergillus*, *Penicillium*, *Trychophyton*

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(26).immunosuppressed patients in ICU may have a serious complications and may be lethal when infected with fungi also healthy persons or non immunosupressed patients may develop hyper reactivity to the fungal allergen may lead to respiratory disorders. Newborn babies staying on hospital wards are likely to be colonized by microorganisms, including potentially pathogenic fungi.

This research aim to study the fungal contamination of ward furnishings and medical equipment used in the intensive care unit and Neonatal intensive care unit.

Beside recognize the commonest fungi contaminated

## MATERIALS AND METHODS:

This study was cross-sectional study**,** collected from Al-Raqi hospital, Khartoum state, Sudan. The study included ward furnishings and medical equipment used in the intensive care unit and Neonatal intensive care unit at Al-Raqi hospital. 50 swabs were collected from ward furnishings and medical equipment used in the intensive care unit.

**Laboratory Processing:**

A total of fifty environmental Swabs from different ward furnishings and medical equipment used in the intensive care unit were collected randomly. The isolated was already identified by many procedure involve macroscopic, microscopic examination and cultural characteristic.

**Collection of swabs samples:**

Surface swab specimens were collected from predefined surfaces (armrest beds, wash sinks, medical tables) with cotton tipped applicators, pre-moistened with sterile saline from; ward furnishings and medical equipment in intensive care unit (ICU) and neonatal ICU.

**Laboratory methods:**

The swabs were immediately inoculated onto plates that contained Sabouraud Dextrose Agar. Then incubated for a 1 to 7 day period at 28°C. Samples checked daily for fungal growth. Fungi and yeast considered to have a distinct morphologically were isolated.

**Identification of isolated organisms:**

Genus and species of the filamentous fungi were identified based on their macroscopic and microscopic morphological characteristics of the vegetative mycelium and the reproductive structures by standard mycological methods. The macroscopic examination was based on visual observation of morphological characteristics and color of aerial mycelium, while the microscopic analysis was performed by preparation of lactophenol cotton blue stained slides. The slides were prepared with tape that adhered to aerial mycelium and placed on the lactophenol cotton blue-stained slides.

## RESULTS:

A total of fifty environmental swabs collected from Al-Raqi hospital, Khartoum state, Sudan. Fungal growth had been isolated from different ward furnishings and medical equipment used in the intensive care unit such as (floors, walls, doors and doors handle). Out of fifty swaps samples 21(42%) yielded Fungal growth and 29(58%) yielded no fungal growth. (Table 1)From the isolated organisms *Penicillum species* was the predominant fungal isolated 10 (47.6%), while *Aspergillus flavus* represent 6(31.6%),*Aspergillus niger*2 (10.5%), *Aspergillus fumigates* 2(10.5%), *Rhizopus* 1 (5.3%).(Table 2)

On the other hand (Table 3) indicate that *Penicillumspecies*was the commonest fungal isolates among ICU samples. While *Aspergillusflavus*were the predominant fungal isolates among Neonatal ICU samples. (Table 4)

Results from (Table 3 and 4) showed that the most contaminantEquipment was found in Neonatal ICU samples 5(55.6%), and the most contaminant Place in ICU was the floors 3(25%) followed by wall 2(16.7%), and most contaminant Place neonatal ICU was floor and wall 2(22.2%).

**Table 1:** Distribution of study sample according to culture growth:

| Sample | Frequency | Percentage % |
|---|---|---|
| Growth | 21 | %42 |
| No Growth | 29 | %58 |
| Total | 50 | 100% |

**Table2:** Distribution number of isolated organisms:

| Organisms | Frequency | Percentage % |
|---|---|---|
| *Aspergillus flavus* | 6 | 31.6 % |
| *Aspergillus niger* | 2 | 10.2 % |
| *Aspergillusfu migate* | 2 | 10.5% |
| *Penicillum specie* | 10 | 47.6 % |
| *Rhizopus* | 1 | 5.3 % |

**Table 3:** Distribution of organisms among ICU:

| Organisms | Place | | | | Equipment % |
|---|---|---|---|---|---|
| | Floors | Walls | Doors | Doors handles | |
| *Aspergillus flavus* | 0 | 1 | 1 | 1 | 0 |
| | 0% | 8.3% | 8.3% | 8.3% | 0 % |
| *Aspergillus niger* | 0 | 0 | 0 | 0 | 0 |
| | 0% | 0% | 0% | 0% | 0% |
| *Aspergillus fumigate* | 1 | 0 | 0 | 0 | 1 |
| | 8.3% | 0% | 0% | 0% | 8.3% |
| *Penicillum specie* | 2 | 1 | 1 | 1 | 2 |
| | 16.7% | 8.3% | 8.3% | 8.3% | 16.7% |
| *Rhizopus* | 0 | 0 | 0 | 0 | 0 |
| | 0% | 0% | 0% | 0% | 0% |
| **Total** | 3 | 2 | 2 | 2 | 3 |
| | 25% | 16.7% | 16.7% | 16.7% | 25% |

**Table 3:** Distribution of organisms among Neonatal ICU:

| Organisms | Place | | | | Equipment % |
|---|---|---|---|---|---|
| | Floors | Walls | Doors | Doors handles | |
| *Aspergillus flavus* | 1 | 1 | 0 | 0 | 1 |
| | 11.1% | 11.1% | 0% | 0% | 11.1% |
| *Aspergillus niger* | 1 | 0 | 0 | 0 | 1 |
| | 11.1% | 0% | 0% | 0% | 11.1% |
| *Aspergillus fumigate* | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0% | 0% | 0% | 0 |
| *Penicillum specie* | 0 | 1 | 0 | 0 | 2 |
| | 0% | 11.1% | 0% | 0% | 22.2% |
| *Rhizopus* | 0 | 0 | 0 | 0 | 1 |
| | 0% | 0% | 0% | 0% | 11.1% |
| Total | 2 | 2 | 0 | 0 | 5 |
| | 22.2% | 22.2% | 0% | 0% | 55.6% |

## DISCUSSION

In this study which they found *Aspergillous* species ,*Penicillium* species and *Rhizopus* species was the most predominant fungi among the isolated fungi.These results agree with other previous studies conducted by Kumar, *et al,*Agnieszka Gniadek*et al* ,Jenyffie A.*et al* ,Jean Phellipe Marques do Nascimento *etal.*Among the 50 isolates were the most common isolate *Penicillum spp*(42.1%), followed by *Aspergillus flavus* (31,6%) , *Aspergillus niger* (10,5%), *Aspergillus fumigatus* (10,5%),*Rhizopus spp* (5,3%) ,this study disagree with kumar Among total 68 fungal isolates *Aspergillus niger* was commonest (19.1%) followed by *Aspergillus flavus* (11.7%), *Curvulariaspp*, *Penicillium spp* (both 10.2%), respectively.

In these study isolated fungi from just neonatal ICU and adult ICU the most common isolate *Penicillum spp* disagree with Jean Phellipe Marques do Nascimento were investigating aerial microbiological contamination of a neonatal ICU, an adult ICU and two operating rooms, found that *Aspergillus* and *Penicillum* were the most common fungal genera.

In these study isolated fungi from just neonatal ICU and adult ICU the most common isolate *Penicillum spp* disagree with Agnieszka Gniadek*et al* in percentage of *penicillium* (23.5%) followed by *cladosporium*(19.2%) and *Aspergillus* (14.6%).

In this studythe most common isolate *Penicillum spp* (42.1) disagree with Okolo OM.*et al* and P Kordbacheh.*Aspergillus spp*(29.6%) was the most predominant fungi isolated from special care baby unit ,most of the fungi were isolated from the out born term and out born preterm rooms of the Special care baby unit (SCBU)and noted that *Candida albican* (20.9%),*Penicillum spp*(19.1%),*Aspergillus niger*(16,2%) , and

*Cladosporium spp*(12,9%)were the most common isolated fungi in adult ICU.

## CONCLUSION

This study conclude that within the hospital area, the risk of fungal infection may form a clear problem, with *Aspergillous spp* being one of the most common fungi , considering the presence of these microorganisms. Pathogenic fungi isolated from ICU and Neonatal ICU indicates that the hospital may be a potential source of cross-infection from the hands of health care workers to their patients.

Higher efforts in cleaning (i.e., sterilization and bioburden reduction) do not necessarily decrease the risk for infections, but proper disinfection with suitable detergents maybe vital for eradication of suspected fungal infection.

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## Conflict of interest

The authors declare that there are no conflicts of interest.

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## Author Contribution

All authors similarly contributed to this manuscript, covered wrote, corrected and authorized this manuscript.

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