

Investigation Of Bacterial Counts In Air At Different Wards Of A Tertiary Care Hospital, Western Rajasthan

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ABSTRACT

INTRODUCTION: - Nosocomial infections represent an important cause of morbidity and mortality in population. It has been suggested that many pathogens can survive as bio-aerosols, spread considerable distances and result in infection..Thus, in this study, the basic aim was to investigate bacterial air load of the hospital environment in tertiary care hospital western Rajasthan.

METERIAL &METHOD: - Settle plate method is adopted using standard sized MacConkey agar and Blood agar plates.Plates are distributed atvarious distance in the wards like Intensive Care Unit, Critical Care Unit, Post-Surgical ward, Orthopaedic ward and surgical ward and left opened to the air for one hour.Then Colonies of Air Petri Plates are counted for colony forming unit per cubic meter (cfu/m³).

RESULT:- Microbial Indoor Air Contamination of is observed in this study. Maximum microbial Indoor Air contamination is found in Post Surgical ward (Female) wards i.e. 1062.72 CFU/m³. Minimum microbial Indoor Air contamination is found in ICU A i.e. 311.35 CFU/m³. *Coagulase negative Staphylococci*, *Staphylococcus aureus*, *Micrococcus*, *Bacillus spp.*, *E. coli*, *Klebsiella* were diagnosed.

CONCLUSION: -In conclusion almost all indoor air samples showed higher aerobic bacterial load. So Prevention of contamination risk of nosocomial pathogens and infections stands out as problem that must be weighed in mind.

Key words :- Nosocomial infection, Air, Bacterial Counts, Contamination

INTRODUCTION

Nosocomial infections represent an important cause of morbidity and mortality in population [1]. It is associated with a considerable increase in morbidity and mortality of patients at a hospital as well as to significant increases in costs.

Hospital Wards and intensive care units (ICU) are the workplaces that need the highest hygiene standards, also the same requirements for the personnel working there and the equipment used by them [2]. Intensive care units are places where the most severely ill patients are treated and where the highest mortality rates occur.

It has been suggested that many pathogens can survive as bio-aerosols, spread considerable distances and result in infection. so Air-control measures are crucial for reducing dissemination of airborne biological particles in hospitals. Monitoring is strongly recommended for epidemiological investigation in epidemic situations, as nosocomial outbreaks have been linked to airborne transmission of pathogens. Since air-control measures (i.e., use of high efficiency particulate air filtration, laminar air-flow systems, high rates of room-air exchange, positive pressure rooms, and well-sealed rooms) are strongly recommended in hospital units housing high-risk patients, we consider that regular monitoring is essential to assess air control efficiency and also to detect any irregular introduction of airborne particles.

The aim of this study is to determine the particle number in critical area in addition the training of healthcare personnel about strict infection control procedure, environmental disinfection, and optimum disinfection methods.

MATERIAL & METHOD

This study was carried out in the Department of Microbiology, Dr. S.N. Medical College, Jodhpur to investigation of bacterial counts in air at different wards, from Mahatma Gandhi Hospital. Samples were collected from different wards such as Intensive care unit (ICU), Critical care unit (CCU), surgical ward, Post Surgical ward & orthopaedic ward.

SAMPLE COLLECTION:-

Settle plate method [3],[4] is adopted using standard sized MacConkey agar and Blood agar plates. Plates used are pre incubated overnight under the conditions that matched incubation of air samples to be taken. Then plates are distributed at various distance in the wards and left opened to the air for one hour.

After exposure of one hour that allows sufficient time for settling of particles in natural and efficient manner, samples are transported to the microbiology laboratory.

PROCESSING OF SAMPLE:-

The air plates are incubated at 37°C for 24-48Hours. Colonies of Air Petri Plates are counted for colony forming unit per cubic meter (cfu/m³) and there presentative colonies from each plate are picked up and confirmed by colony morphology, Gram's staining and biochemical reactions [3], [4]

RESULT

On average counts of particle were 1062.72 cfu/m³ bacteria in post surgical ward (female), 1037.86 cfu/m³ bacteria in orthopaedic (female), 1025.41 cfu/m³ bacteria in orthopaedic (male), 857.04 cfu/m³ bacteria in critical care unit II, 811.08 cfu/m³ bacteria in surgical ward, 791.61 cfu/m³ bacteria in post surgical ward (male), 635.43 cfu/m³ bacteria in critical care unit I, 500.05 cfu/m³ bacteria in ICU B, 325.34 cfu/m³ bacteria in IICU, 311.35 cfu/m³ bacteria in ICU A.

These data shows that while the air of post surgical ward (female) ward unit have higher colony counts, the air of intensive care unit (A) have the least colony counts. Bacterial counts in different parts of hospital are demonstrated at **Table 1 & Chart 1**

As to contamination , the most frequent gram positive bacteria (*Coagulase negative Staphylococci*, *Staph aureus*, *Micrococcus* and *Bacillus spp*) were diagnosed. Whereas gram negative bacteria (*E.coli* , *Klebsiella*) & fungal spp. (*Aspergillus* , *Rizopus*) found in air of some wards.

Table No. 1:- Microbial Indoor Air Load in Relation to Wards

Name of Ward	Bacteria /Fungi (CFU/ m ³)	Microbial contamination*
ICU A	311.35	Middle
ICU B	500.05	Middle
IICU	325.34	Middle
CCU (I)	635.43	High
CCU (II)	857.04	High
POST SURGICAL (Male)	791.61	High
POST SURGICAL (Female)	1062.72	High
ORTHOPAEDIC (Male)	1025.41	High
ORTHOPAEDIC (Female)	1037.86	High
SURGICAL	811.08	High

*Categories of microbial indoor air contamination by AHEM [5]

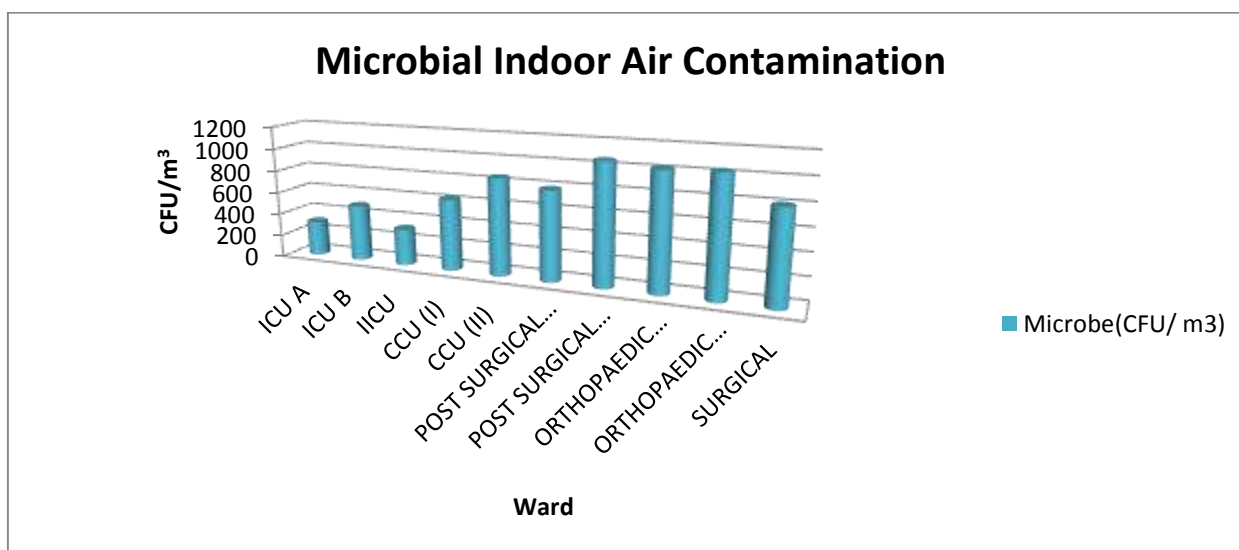


Table 2:- Spectrum Of Microbial Finding In The Air Samples.

<i>Coagulase negative Staphylococcus</i> <i>Staphylococcus aureus</i> <i>Micrococcus spp.</i> <i>Bacillus spp</i> <i>Escherichia coli</i> <i>Klebsiella</i> <i>Aspergillus spp.</i> <i>Rhizopus</i>
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DISCUSSION& CONCLUSION

During epidemics monitoring is generally based on counts of particles and counts of colonyformingunits on solid media after capture by air samplers in hospital units [6]. According to our study, Intensive care unit-A (ICU-A) has the lowest air contamination while the Post surgical ward has the highest air contamination. On average counts of particle are 311 cfu/m³ to 1062 cfu/m³ respectively. Which is found higher then study conducted by **Marie Vackova et al.** [7]

Mehmetet al [8]who investigatedbacterial counts in air at intensive care units and operating rooms.On an average counts of particle were 8160 cfu/m³ bacteria in neonatal intensive care units, 610 cfu/m³ bacteria in reanimation intensive care units, 2308 cfu/m³ bacteria in general surgery intensive care units, 2491 cfu/m³ bacteria in operating rooms. This is much higher than our study.

Concentrations of bacteria were higher than fungi. **Sudharsanam S et al** [9] found Microbial loads vary with the sampling method. Moreover, previous studies have not given consistent results due to the different samplers used, the different places sampled (operating rooms, dental clinics, pharmaceutical clean-rooms. ICU, Surgical wards etc.) and/or the different parameters applied (volume of air sampled, sampling time protocol, point of sampling, etc.).

This study indicates that the Gram positive bacteria, *Coagulase negative Staphylococci*, *Staph aureus*, *Micrococcus* and *Bacillus spp.* are isolated from all the air samples. Whereas gram negative bacteria (*E.coli* ,*Klebsiella*) & fungal spp. (*Aspergillus* , *Rizopus*) found in air of some wards. Gram positive bacteria could be detected significantly and frequently as compared to Gram negative bacteria which are less often isolated from the environment. It is in accordance to the study conducted by **Qudiesatet al.**[10]who assessed the Airborne Pathogens in Healthcare Settings.

In conclusion almost all indoor air samples showed higher aerobic bacterial load. The range of microbial air load at a ward depended on disinfectivetreatment activities in the wards.

The microbiological quality of the air in the wards is a significant parameter to control healthcare associatedrespiratory infections, and regular microbial monitoring can representanuseful tool to assess environmental quality and to identify critical situations which require corrective intervention. Prevention of

contamination risk of nosocomial pathogens and infections stands out as a problem that must be weighed in mind. In the meantime, it is possible to conclude that settle plate method can be used for general monitoring of air contamination, such as routine surveillance programs. It is obvious that, the training of healthcare personnel about strict infection control procedure, hand hygiene, environmental disinfection and eventually, optimum disinfection methods are of great importance.

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