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***Research Article***

# MICROBIAL EVALUATION OF HOSPITAL ENVIRONMENT AND SURFACE: A STUDY IN TERTIARY CARE CENTRE

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## ABSTRACT
Hospital acquired infection often have serious consequences for the individual in the hospital and for the community at large. Airborne and direct contacts are the most important routes of transmission. Aim: The present observational study was aimed to identify and determine the prevalence of pathogens in air and surface, which could lead to hospital acquired infections. Materials & Methods: The present study was conducted between October 2013 and Nov. 2014 in the department of Microbiology of a teaching tertiary care hospital located in central India. Total 1544 samples (air & surface) were collected from the operation theatres of hi-tech multi super-speciality and In vitro fertility centre of our hospital. Out of 1544 samples, 562 were air samplings & swabs for aerobic culture while 982 swabs were collected from different sites for anaerobic isolation. All samples were processed by standard procedures. Result: Out of the 1544 samples tested, 562 were collected for aerobic bacterial isolation & 982 were sampled for anaerobic bacterial (*Clostridium tetani*) testing. Out of 562 samples, 10 (3.5%) were contaminated by *Staphylococcus aureus*, 22 (7.8%) had Coagulase negative Staphylococci (CoNS) and 3(1.6%) *Pseudomans aeruginosa* were isolated from the air sampling with the lowest prevalence in Cardic OT, Neurosurgery OT, and General OT & IVF centre. Conclusion: The Study shows that the most common organism identified in the air sample and surface swabs were CoNS followed by Bacillus, *Staphylococcus aureus* and *Pseudomonas aeruginosa*.

***Keywords:*** *Hospital Acquired Infection, Air Sampling, Robertson Cooked Meat Media*

## INTRODUCTION
The hospital environment is receiving increasing attention as a source for acquisition and spread of pathogens among hospitalized patients (Dancer). In particular, four key organisms appear to survive in the environment long enough to place patients at risk. Vegetative bacteria such as *Staphylococcus aureus*, (Cohen *et al.*, 2008; Neely *et al.*, 2000) *Enterococcus*, (Weber *et al.*, 1997) and *Acinetobacter* (Catalano *et al.*, 1999; Jawad *et al.*, 1998; Musa *et al.*, 1990) which may persist in environmental air and surface for days or weeks and *Clostridium* spores that can persist for several months (Kim *et al.*, 1981). Fear of hospital acquired infection encourages the decontamination for the elimination of hospital pathogens. There is general consensus that environmental cleanliness is important for controlling infection (Dettenkofer *et al.*, 2004; Dancer, 2004; Getchell-White *et al.*, 1989; Bhalla *et al.*, 2004; Wu *et al.*, 2005; Dancer, 1999). Environmental monitoring means the microbiological testing of air, surface and equipment in order to detect changing trends of micro-flora and viable counts (Sandle, 2006) Hospital-associated infections are an important cause of patient morbidity and mortality (Zerr *et al.*,). Hence Infection control by environmental monitoring and basic hygiene should be at the heart of good hospital management (Griffith *et al.*, 2005). Hence, a study was carried out to look for the organisms and the frequency of isolation in air samples and surface swabs after fumigation.

## MATERIALS AND METHODS
The present study was conducted between Oct. 2013- Nov. 2014 in the department of Microbiology of a teaching tertiary care hospital located in central India. Total 1544 samples (air & surface) were collected from the hi-tech multi super-speciality and In Vitro Fertility (IVF) centres of out hospital. Out of 1544

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samples collected, 562 were air samplings & swabs for aerobic culture while 982 swabs were collected from different sites for anaerobic isolation. Collection of swabs & air sampling was done according to the study protocol. Sampling was always done following fumigation. Staff took great care in hand & forearm washing and in accurate use of personal protective equipment such as mask, gowns, caps, boots and gloves. Air sampling was performed to determine the index of microbial air Contamination (MAC). This index corresponds to the number of colony forming units (CFU) counted on a petri-dish, with a diameter of 90 mm placed according to the 1/1/1 scheme (for 1 hr/ 1meter above the floor/about 1 meter away from wall or any major obstacles). Total viable count (TVC) was evaluated by using settle plate & swab method. Petri dishes containing blood agar media were transported to the operation theatres and IVF cabins in sealed plastic bags. The plates were labelled with sample number, site within the theatre along with the time and date of sample collection. The plates were placed at chosen places in the operation theatre and IVF cabins. After this exposure, the plates were covered with their lids and taken to laboratory in sealed plastic bags and incubated at 37°C for 24 hours. After incubation the colonies were counted and identification of isolates was performed. Concentration of airborne bacteria was expressed as colony forming units per cubic meter cube (cfu/m3). Air sampling was considered unsatisfactory if the colony count was more than 30 cfu from routine OT & more than five from neurosurgery OT while single colony of a pathogen like *staphylococcus aureus* was considered as significant. The swabs taken from different articles were streaked on blood agar and MacConkey agar media plates. These culture plates along with those exposed in air were incubated at 37°C under aerobic conditions for 24 hrs. Identification of the pathogens were done through conventional biochemical methods (Cheesbrouh).

Swab soaked in nutrient broth were used to collect samples from the instrument trolley, Boyle's machine, operation table and top lights and immediately introduced into Robertson's cooked meat broth. All the samples were labelled properly and immediately transported to the microbiology laboratory. For *Clostridium tetani* observation, swabs soaked in RCMB were incubated at 37°C for one week. All the swabs were microscopically examined for *clostridium tetani* like organisms after performing the Gram staining on the eighth day following incubation.

## RESULTS AND DISCUSSION

Out of the 1544 samples, 562 were used for aerobic bacterial isolation & 982 for anaerobic bacterial (*Clostridium tetanni*) detection. Out of 562 samples, 20 (3.5%) *Staphylococcus aureus,* 44 (7.8%) Coagulase negative *Staphylococci* (CoNS), Bacillus (4.6%) and 6 (1.06%) *Pseudomans aeruginosa* were isolated from the air sampling. Neurosurgery and Cardiac OT showed low contamination of *Staphylococcus aureus* as compared to general OT & IVF centre. *Pseudomonas* was not found in neurosurgery OT but the cardiac OT, general OT and IVF centre were equally contaminated with the *Pseudomonas*.

**Table 1: Show the organisms isolated from air samples / surfaces/ articles' of hi-tech super-speciality & IVF centre**

| OT/IVF | Total no. of samples collected | CoNS | *Bacillus* | *Staphylococcus aureus* | *Pseudomonas aeruginosa* | *Clostridium tetani* |
|---|---|---|---|---|---|---|
| Cardiac OT | 200 | 08 (4%) | 06 (3%) | 02 (1%) | 02 (1%) | 00 (00%) |
| Neurosurgery OT | 200 | 06 (3%) | 04 (2%) | 02 (1%) | 00 (00%) | 02 (1%) |
| General OT | 240 | 10 (4.1%) | 06 (2.5%) | 04 (1.6%) | 02 (0.83%) | 02 (0.83%) |
| IVF centre | 342 | 20 (5.8%) | 10 (2.9%) | 12 (3.5%) | 2 (0.58%) | 02 (0.58%) |

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Out of 982 samples, 6 (0.6%) were found to be positive for *Clostridium tetani* like organisms with no contamination in cardiac OT while neurosurgery OT, general OT & IVF centre were again equally contaminated with spore bearing organism.

Microbial contamination of air in the operating room is generally considered to be a risk factor for surgical site infections in clean surgery (Weber and Rutala 1997). According to Pasquarella *et al.,* (2004) microbiological quality of air may be considered as the mirror of hygienic conditions of the operation theatres. The quality of indoor air depends on external and internal sources such as cleaning procedures, ventilation, the surgical team and their activities (Fleischer *et al.,* 2005). A number of studies have been carried out in operation theatres to determine relationship between total bacterial count in OT air and risk of infection. Studies reveal that the colony counts more than 30 in routine OTs & more than five from Neurosurgery OT were considered significant to cause infection. The risk was lower when they were below from cut offs (Fleischer *et al.,* 2005; Parker, 1978). The present study revealed that very low bacterial contamination (2.07%) was found in different operation theatres and IVF cabins of our hospital. Aerobic bacterial count was comparatively more in cardiac OT, as compared to neurosurgery & general OT located in our hi-tech super speciality hospital. However, no anaerobic organism was detected from cardiac OT. From operation theatre surfaces *Clostridium tetani* (0.6%) *Pseudomonas aeruginosa* (1.06%), *Staphylococcus aureus* (1.2%), *Bacillus* (2.5 %) and CONS (3.7%) were recovered. Settle plate method for air and swabbing technique for surface proved to be valuable in detecting the contamination level in our study. These methods are very useful especially in the settings with limited resources. Routine samplings of floor, walls or furniture which are not in direct contact with patients were not done as they are not the sources of infection. They do not contribute in causing nosocomial infection, unless there is an epidemic.

***Conclusion***

The Study shows that the most common organism identified in the air sample and surface swabs were CoNS followed by Bacillus, *Staphylococcus aureus*, *Pseudomonas aeruginosa and Clostridium tetani.* The study revealed that a very low level of bacterial contamination was present in our settings after fumigation. Hence it adds that fumigation should be considered for asepsis and all efforts should be made to prevent the growth of pathogens. Also, time to time evaluation of the air sampling and anaerobic culture reports of the operation theatres should be done to prevent hospital infection and for betterment of health care facilities in hospitals.

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