

## A Clinical Study on Bacteriological Profile in Microbiology Surveillance of Operation Theatres

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### Abstract

**Background:** Microbiological surveillance is an important part of infection control program, providing data regarding types, and counts of microbial flora. **Aims:** This study was carried out with the aim of isolating and identifying the character of microbial contamination in tertiary care hospital by air, surface and equipment OT. **Materials and methods:** Six months of retrospective study was performed of by random data collection of the hospital's six OT's. Air sampling was performed using settle plate method. Surface samples were taken from various OT sites and equipment. This isolated and described bacterial species using traditional methods. **Results:** A total of 95 air samples were collected for 2 year from 5 OT's, 3 ICU's and 1 LR. The bacterial CFU/m<sup>3</sup> counts of air from all OTs ranged from, Labour room showed 75 CFU/m<sup>3</sup>, general surgery 69 CFU/m<sup>3</sup> followed by PICU and NICU 63 CFU/m<sup>3</sup>. least is ophthalmology OT with 6 CFU/m<sup>3</sup>. Out of Total Positive Bacterial isolates most common was Bacillus (54.7%), followed by CoNS (22.1%) and least common Staphylococcus aureus (1.1%). These 95 culture positive isolates. Bacillus spp. with 52 (54.7%) isolates was the most common bacterial isolate followed by coagulase-negative Staphylococcus (CoNS) with 21 (22.1%) isolates. **Conclusions:** The study revealed that our hospital's OT's showed a low on surface swabbing rate of bacterial contamination and that CFU counts per mm<sup>3</sup> of air quality were within permissible limits.

**Keywords:** Microbial contamination; Hospital-associated infections; Coagulase-negative Staphylococcus

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### Introduction

Hospital-associated infections are an significant source of morbidity and mortality with postoperative, surgical site infections (SSI) being the second most common cause after infections of the urinary tract.<sup>1,2</sup> Sources of infection may be either endogenous or exogenous from theatrical

conditions such as air, surfaces, articles throughout the operating theatre. Effective sterilization and disinfection techniques, surgical technique, theatre design, bacterial contamination of theater air, OT discipline and correct use of prophylactic antibiotics are the factors on which the incidence of postoperative infections depends.<sup>3,4</sup>

Microbiological surveillance is an important part of the infection control program, providing data on the types and counts of microbial flora. This study was conducted to identify bacterial surface and equipment colonization in the OTs and to determine microbial air contamination in the OTs of a tertiary care hospital.

Invasive procedures, high antibiotic usage and transmission of bacteria between patients as a result of insufficient infection control measures may explain why OTs and ICUs become "hot zones" for the emergence and spread of microbial resistance. Lack of adherence to defined standards and guidelines may contribute to adverse outcomes of patients in health care facilities. Biological contaminants exist in the air. In this process the larger particle-carrying bacteria settle to exposed surfaces (blood agar plates) by gravity from the air.

The present study was conducted to isolate and identify bacteriological profile and evaluate the level of bacterial contamination found in surface, equipment and air samples surveillance from various OT specialties. It also aims to strengthen the hospital's strategy of infection control toward hospital acquired infection prevention.

## Materials and Methods

This retrospective study was conducted at the Microbiology Department from August 2018 to January 2019 over a period of six months. The study includes Operation Theaters random air and surface sampling. Samples were taken to nursing and cleaning workers without prior knowledge, so that a true picture can be taken out.

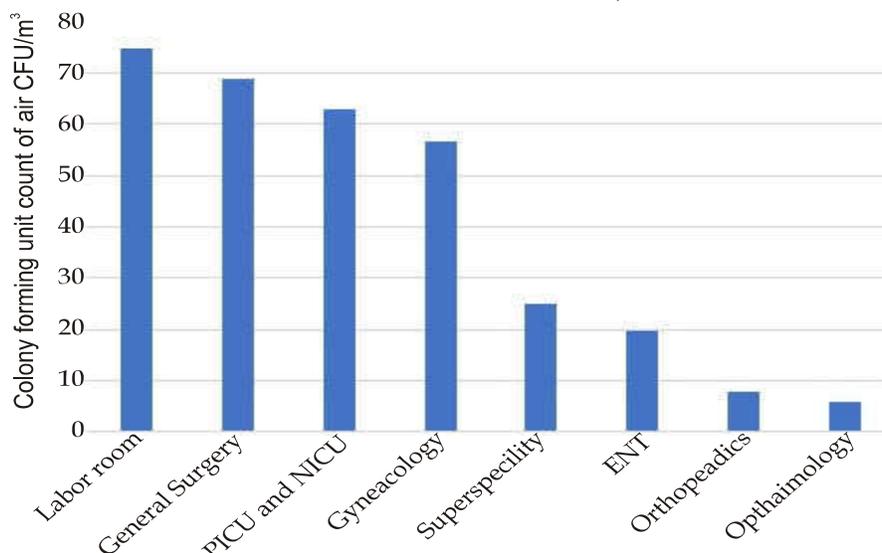


Fig. 1: Bacterial colony count on air sampling of various OT's.

Sampling procedures used in the study were surfaces wabbing and settle platemethod.<sup>5</sup> All standard operating procedures were followed while taking samples, Sterile

swabs soaked in nutrient broth were used for collectingsamples from different sites and equipments (table top, Instrumenttrolley, OT light, Suction apparatus, Monitor, infusion pump, doorhandle) from six OTs of the hospital.

Samples were immediately transported to the microbiology laboratory for further processing after proper labeling. Blood agar and Mac Conkey agar culture plates were aerobically inoculated and incubated for 24 hours at 37 degree centigrade. Isolated bacterial species were described using traditional method. Air sampling wasdone by method of settling plate. Blood agar plates with sample number, site, time and date were taken in OT. Plates were held in the middle of OT at around 1 mt above ground and 1 mt from the wall and four corners.<sup>8</sup> Plates were exposed for an hour, at the time when OT's were working. In plastic bags were packed on exposed plates and sent to laboratory for microbiology.

For 24 hours the plates were incubated at 37 degrees centigrade. Colonies were counted, and conventional methods used to identify bacterial isolates. Therefore, by Omeliansky formula the colony forming unit (cfu) per plate was expressed as cfu / m<sup>3</sup>.

## Results

A total of 95 air samples were collected for 2 year from 5 OT's, 3 ICU's and 1 LR.

**Table-1:** Number of Bacterial isolates obtained from OTs in Surface Sampling

Bacterial isolates	Number	Percentages
Bacillus species	52	54.7
Coagulase negative staphylococcus(CoNS)	21	22.1
Klebisella	9	9.5
Escherichia coli	6	6.3
Micrococci	4	4.2
Pseudomonas species	2	2.1
Staphylococcus aureus	1	1.1

Out of Total Positive Bacterial isolates most common was Bacillus (54.7%), followed by CoNS(22.1%) and least common Staphylococcus aureus (1.1%).

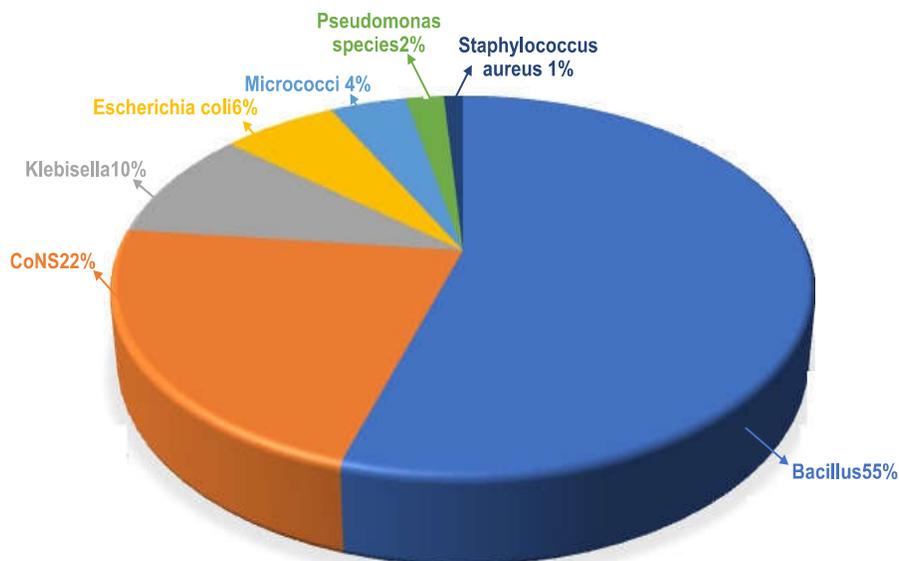


Fig. 1: Bacterial colony count on air sampling of various OT's.

**Table 2:** Species-wise distribution of isolates obtained from surface samples .

Name of OT	Bacillus species	CoNS	Klebisella	Escherichia coli
Labour room	20	7	2	2
General surgery	14	4	0	0
PICU and NICU	6	2	0	0
Gynaecology	5	2	1	1
Superspeciality	3	2	3	2
ENT	2	2	0	1
Orthopaedics	1	1	2	0
Ophthalmology	1	1	1	0
Total isolates	52	21	9	6

Labour room and general surgery OT s have bacillus species of isolates followed by PICU and NICU.

These 95 culture positive isolates. *Bacillus* species. with 52 (54.7%) isolates was the most common bacterial isolate followed by coagulase-negative *Staphylococcus* (CoNS) with 21 (22.1%) isolates.

## Discussion

Harbouring possible pathogens in hospital's OTs and ICUs will present a significant risk to patients. Nosocomial infections prolong hospital stays, establish longterm disability, increase antimicrobial resistance, pose a significant additional financial burden on health care facilities and cause premature death. The study shows that our hospital's microbiological air and surface quality in OTs is satisfactory with very low bacterial contamination rate on surface swabbing and a cfu count per m<sup>3</sup> of air well within permissible limits. Hospital-acquired infections prolong hospital stay for patients, increase morbidity, increase antimicrobial resistance, represent an additional financial burden for the health care system and cause unnecessary deaths.<sup>5</sup> Preventive measures to be taken to avoid such critical situations are not only for the operating personnel but also for the whole infection control team. Microbiological quality of the air illustrates hygienic state of operation theatre. It is assumed that settling plates are more prone to detecting any degradation in the potential air pollution in the theater of operations and conditions that could affect the air quality in OT.<sup>6</sup> In the present study, the count ranged from 5-75 cfu / m<sup>3</sup> of air well within permissible limits and correlated well with studies from Bhatnagar et al, Dipendra et al. and Desai et al.,<sup>5,7,8</sup> where a high count from air sampling was recorded as Anjali et al.<sup>9</sup> Various factors such as methodological monitoring, sampling time (random / operational), ventilation of OT, disinfectants and sterilization process used in the infection control system may be due to heterogeneity in findings in various studies.

In our study, the highest colony forming unit count per cubic meter of air was observed from Labour room showed 75 CFU/m<sup>3</sup>, general surgery 69 CFU/m<sup>3</sup>, least is ophthalmology OT with 6 CFU/m<sup>3</sup> (Fig. 1) which coincides with Tamrakar Meenakshi et al's study.<sup>10</sup> Anjali K, et al.<sup>9</sup>, Rumana Farooq Mir et al,<sup>11</sup> etc. also reported in their analysis that Ophthalmology OT was the least contaminated.<sup>9</sup> Bacterial air sampling in all OTs showed 5-59 CFU / m<sup>3</sup> between 2342 CFU / m<sup>3</sup>, similar findings, 21- 41 CFU / m<sup>3</sup> were reported by Qudiesat K et al.<sup>12</sup>

In present study highest percentage of occurrence in swab samples while in settle plate samples *Bacillus* species bacterial pathogens were isolated comprising of *Klebsiella*, coagulase negative *Staphylococci* species *Pseudomonas* etc. (table-1 and fig. 2) In study by Anjali et al.<sup>5</sup> The most common isolate was Coagulase negative *Staphylococcus* species (5.8%) followed by *Bacillus* and *Klebsiella* species (4.4%) each.<sup>13</sup> In the study by Desai SN, The most common isolate was *Bacillus* species 34 (91.9%) followed by *S. aureus* 7 (18.9%).<sup>7</sup> Out of 8 OTs 45% were found to be colonized with contaminant *Bacillus* species. This is in concordance with other studies from India and abroad.<sup>13</sup> Six isolates of *Staphylococcus aureus* were obtained during 5 years of surveillance which although is very low at 2.9% is a potential pathogen and an important cause of skin and soft tissue infections. Similarly, CoNS and *Enterococcus* species. are also an important cause of SSI's.

The reason for its presence in the study may be healthcare workers and patients, and its easy cross-transmission. This coincides with other studies by Pasquarella et al., and Desai et al.<sup>6,7</sup> *Staphylococcus aureus* (1.72 percent) was a potential pathogen and a major cause of skin and soft tissue infection in our least common isolate study.

The autoclave sterilized instruments and items showed no growth and strongly touched surface-like door handles, IV stands and OT lights also showed no growth of bacteria

## Conclusions

Our analysis shows that our hospital's microbiological air and surface quality is adequate at OT. This data can be used to establish regional requirements for appropriate microbial population levels and to provide recommendations for reducing microbial population concentrations in indoor air. The high prevalence of infectious sources in the hospital service theater area is troubling and there is a need for increased surveillance and careful monitoring. Implementation of the protocol on infection control, to be adopted at all levels of health care. Extensive studies are therefore required in the field for monitoring, monitoring and comparison of compliance between healthcare facilities, together with infection control measures that will be very useful in controlling Hospital acquired infections.

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