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A retrospective analysis of microbiological surveillance of operation theatres

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ABSTRACT

Introduction: There are various infection diseases that have a significant impact on the health of the people. The healthcare associated infections are important cause of the patient morbidity and mortality. Research shows that the microbiological contamination of air and environment in the Operation Theaters (OTs) are one of the major risk factors of Surgical Site Infection (SSI). More than 10% patients admitted to acute care hospitals in the developed nations and 25% patients in developing nations got the infection, which was not presented at the time of admission. Annually, more than 1.3% patients were reported with SSI, and it caused 15000 deaths.
Aim: The study aims to conduct a retrospective analysis of microbiological surveillance of operation theatres
Materials and Methods: This retrospective study analyzes the microbiological surveillance data from OTs over a period of 5 years from April 2017 up to March 2022 and was conducted at a tertiary care hospital, Odisha, India. Prior approval for the study was taken from the institute, and Ethical committee has provided the guidelines for maintaining the standard approach. For collecting the sample, two groups were defined that involve the swabbing surface and settle plate method. Moreover, a total of 4200 surface swab samples were taken from the 5 OTs of the hospital during the study. Out of these, 900 samples per OT were collected from General Surgery, Urology, Orthopedics and Ear, Nose, Throat (ENT) OTs whereas 600 samples were from Ophthalmology OT.
Results: Staphylococcus aureus count was 7 (3.2%) and Enterococcus spp. was 6 (2.7%). Moreover, the bacterial CFU/m^3 was analyzed for identifying the level of infection through air. As per the outcome of the analysis, the count of air was ranged from 28-134 as the general is having highest count 137 and Ophthalmology was having least in OT.
Conclusion: The study has shown that surgical site infection is a serious problem for the postoperative patients and staff members as it causes chronic illness that could lead to uncertain death. The microbiological quality of the air and surface of the OTs plays a critical role in such illness and issues to patients and staff members. However, the hospitals tries to maintain the good level of hygiene and low bacterial contamination rates on surface swabbing and CFU count per m^3 of air within permissible limits.

1. Introduction

There are various infection diseases that have a significant impact on the health of the people. The infection related to the health care activities have a significant impact

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on the patient's mortality.[1] Research shows that the microbiological contamination of air and environment in the Operation Theaters (OTs) are one of the major risk factors of Surgical Site Infection (SSI). More than 10% patients admitted to acute care hospitals in the developed nations and 25% patients in developing nations got the infection which were not presented at the time of admission.[2] Annually, more than 1.3% patients were reported with the SSI, and it caused 15000 deaths.[3] There are various factors that have a significant impact on the level of infection that involve the surfaces, air quality and equipments used in OTs.[4] There are various factors that have direct or indirect impact on the postoperative infection as the design of the OT, disinfection procedure, sanitization, surgical techniques and air quality management. In addition to this, the effective utilization of the prophylactic antibodies is helpful for minimizing the issues related to SSI.[5]

According to report, 20% of nosocomial infection in developed countries have a significant impact on the health of the people, whereas the rate of this infection is 40% in developing nations.[6] Moreover, the hospital infections are considered to be major source of morbidity and mortality with postoperative, surgical site infection is being second most common cause after the unitary tract infections.[7] As per the reports, the poor quality of the air and unhygienic environment in the OTs have a significant impact on the patient's health and increases the level of infection among the postoperative patients.[8] Moreover, the OT surface is one of the most infected areas in the OTs and increases the risk of the most cross-contamination bacterial infection in patients and staff members of care organization.[9,10] The most infected sources of the postoperative infection are bed, the bedside table, the power supply carriage etc., which are frequently touched and are easily contaminated.[11,12] The current study analyzes the bacterial colonization of surface and use of the equipment in the OTs and to identify the microbial contamination of air in the OTs of a tertiary hospital.

2. Materials and Methods

This retrospective study analyzes the microbiological surveillance data from OTs over a period of 5 years from April 2017 up to March 2022. It was conducted at a tertiary care hospital, Odisha, India. The approval from the Ethical committee was taken and standard guidelines were followed for completing the study. The sample was collected through swab and settle plates. For the study, the researcher has taken the surface sample considering the process of antibodies and disinfection cleaning process in OTs. For the collection of the sample, the sterile swabs were considered for gathering the data from the various sites and equipments. Moreover, the bacterial species were removed using the clinical methods and the air sampling was conducted using the settle plate.

More than 4200 samples were collected for the surface swab from 5 different OTs of the health care organization. For the study, 900 samples were collected from the surgery wards, Urology, Orthopedics and ENT OTs whereas 600 samples were collected from the Ophthalmology OT.

3. Results

According to analysis of Table 1 single isolate was obtained from 180 swabs and 15 swabs gave two isolates. Bacillus spp. with 184 (84.7%) isolates was the most common bacterial isolate followed by Coagulase-Negative Staphylococcus (CoNS) with 20 (9.2%) isolates. Here, the highest positive swab number was 92 and isolated were 98 that were collected from the surgical OTs. In addition to this, Staphylococcus aureus count was 7 (3.2%) and Enterococcus spp. was 6 (2.7%).

According to analysis of Table 2 the bacterial CFU/m^3 was analyzed for identifying the level of infection through air. As per the outcome of the analysis, the count of air were range of 28-134 as the general is having the highest count 137 and Ophthalmology was having least in OT.

4. Discussion

The microbial contamination in OT is one of the leading postoperative infections in all nations and it has a serious impact on the health and recovery of the patients as well as their families. There are various cases identified that have a significant impact on the patients and lead to many chronic disease. The current study has analyzed the hospital-acquired infection including the cultures from other body sites of the patients.[13] According to analysis, the infection-prolong hospital stay can create the long-term disability and increase the resistance to antimicrobials. Moreover, it has a direct impact on the financial burden for the health system and causes uncertain deaths. Therefore, proper training and cleaning procedure are required for managing the issues and protecting the staff and patients.[3] As per the analysis outcome of the current study, Bacillus spp. with 184 (84.7%) isolates was the most common bacterial isolate followed by coagulase-negative Staphylococcus (CoNS) with 20 (9.2%) isolates. Here, the highest positive swab number was 92 and isolated were 98 that were collected from the surgical OTs. According to analysis of study of Najotra et al., (2017),[1] the contamination rate of bacteria in OT was 4.4% (n=198). The study has shown low outcome as other studies has shown the positivity rate. However, the reason behind the issues was the duration of the study which was short as 5 years but long term studies like 15 years can be helpful for analyzing the actual issues and positivity rate.

The quality of air was also considered for identifying the issues related to the hospital stay infection and hygiene conditions of the OTs. The issue related to the quality of air is more sensitive in detecting the increase of microbial

Table 1: Bacterial isolate from surface swabs (Operation theater wise distribution)

OTs	Bacillus spp.	CoNS	Staphylococcus aureus	Enterococcus spp.
General surgery	82	10	1	3
Urology	43	3	0	2
Orthopaedics	39	4	0	0
ENT	14	3	4	0
Ophthalmology	6	0	2	1
Total isolates	184 (84.7%)	20 (9.2%)	7 (3.2%)	6 (2.7%)

Table 2: Colony forming unit count of air from various operation theater's on air sampling

Name of OT	CFU/m ^{3}
General surgery	131
ENT	105
Urology	94
Orthopaedics	54
Ophthalmology	28

air contamination on the operation theater.[14] According to current analysis, the bacterial CFU/m^3 was analyzed for identifying the level of infection through air. As per the outcome of the analysis, the count of air were range of 28-134 as the general is having highest count 137 and Ophthalmology was having least in OT. Apart from this, the outcome of the study of Marchese et al., (2021)[15] and Patel et al., (2019),[7] has suggested that the 20% of nosocomial infection in developed countries is having a significant impact on the health of the people, whereas the rate of this infection is 40% in developing nations. More than 10% patients admitted to acute care hospital in the developed nations and 25% patients in developing nations got the infection which were not presented at the time of admission.

5. Conclusion

The study has shown that surgical site infection is a serious problem for the postoperative patients and staff members as it causes chronic illness that could lead to uncertain death. The microbiological quality of the air and surface of the OTs plays a critical role in such illness and issues to patients and staff members. Hospitals try to maintain a good level of hygiene and low bacterial contamination rates on surface swabbing and CFU count per m^3 of air within permissible limits. The consideration of the settle plate for air and swabbing techniques for surface cleaning are very effective and improve the level of hygiene in OTs even in limited resources settings.

6. Source of Funding

None.

7. Conflict of Interest

None.

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