

## Original Research Article

# Microbiological surveillance of operation theatres, labour room and intensive care units of a tertiary care centre of South-East Assam

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## ABSTRACT

**Background:** With increasing incidence of health care associated infections, microbiological surveillance of air and surfaces of OT, labour room and ICU can become an integral part of hospital infection control practice as it helps in identifying the areas harboring nosocomial pathogens leading to healthcare associated infection. Purpose of the current study was 1) to isolate and identify the microbial contaminants of air and surfaces of various OTs, labour room and ICUs 2) to study the antimicrobial susceptibility pattern of the isolated pathogens.

**Methods:** This surveillance was carried out in operation-theatres, labour room and ICUs of tertiary care referral hospital of South-east Assam in June 2019 and processing of the samples were done in the department of Microbiology. Passive monitoring of air borne microbes was done by settle plate method on Nutrient Agar and Blood Agar plates and surfaces swabs were inoculated on Blood and MacConkey agar and pathogens were identified using biochemical tests. Antibiotic susceptibility testing was done by disc diffusion method on Mueller Hinton agar.

**Results:** Surgery O.T. with 57 CFU/mm<sup>3</sup> and central ICU with no growth showed highest and least contamination respectively. *Proteus mirabilis* was isolated from Surgery O.T. and SNCU level II, *Klebsiella pneumonia* from air and surfaces of surgery and gynaecology O.T. *Staphylococcus aureus* was isolated from air and surfaces all O.T. except ophthalmology O.T. Surface swabs recovered *Pseudomonas spp* from surgery minor O.T and orthopedics O.T and *Acinetobacter spp* from arthroscopy O.T. The pathogenic gram-negative bacilli though isolated, were mostly sensitive to 1<sup>st</sup> and 2<sup>nd</sup> line antimicrobials. But 85% of the *Staphylococcus aureus* isolates were MRSA.

**Conclusions:** The result of this targeted surveillance highlights the need of regular and effective antiseptic cleaning of all surfaces in these crucial areas of the hospital. The unauthorized movement, entry and overcrowding should be avoided as far as possible in these zones. The antimicrobial susceptibility profile of gram negative isolates hints at their community-based origin.

**Keywords:** O.T, ICU, Labour room, Microbiological surveillance, Assam, settle plate

## INTRODUCTION

Microbiological contamination of air and surfaces of various specialized and critical care zones of tertiary care hospitals by potential pathogens has led to rise in incidence of healthcare associated infections<sup>1</sup>. Bacterial contamination of air in the Operation Theatres has been implicated as a major risk factor for surgical site infection.<sup>2</sup> Thus with increasing incidence of health care

associated infections in tertiary care hospitals across India, microbiological surveillance of air and surfaces of operation theatres, labour room and intensive care unit has become an integral part of hospital infection control practice as it helps in identifying the areas harbouring nosocomial pathogens responsible for morbidity and mortality. Aerosols being an important vehicle for transmission of many potential pathogens and contaminated surfaces being able to contribute to

dissemination and transmission of vancomycin resistant Enterococcus (VRE), methicillin resistant *Staphylococcus aureus* (MRSA), extended spectrum beta lactamase (ESBL) producers, molds etc, microbiological surveillance of air and environmental surface sampling though not recommended routinely by CDC but when undertaken as per indications, it gives us a picture of the impact of execution of infection control measures, routine cleaning practices and pattern of antimicrobial resistance of the hospital flora.<sup>3</sup>

### Aim and objectives

Aim and objectives of current study were to isolate and identify the microbial contaminants of air and surfaces of various operation theatres, labour room and intensive care units of the tertiary care hospital of South-East Assam and to study the antimicrobial susceptibility pattern of the isolated nosocomial pathogens for research purpose.

### METHODS

This one-time cross-sectional surveillance study was carried out in operation theatres, labour room and intensive care units of general medicine, cardiology, anaesthesiology and paediatrics of the only tertiary care health care centre of South-east Assam in June 2019 and processing of the samples were done in Bacteriology section of the department of Microbiology.

Passive monitoring of air borne microbes was done by settle plate method on nutrient agar and blood agar plates following 1,1,1 method and surfaces were sampled at an angle of 30° using swabs moistened with nutrient broth followed by inoculation on Blood and MacConkey agar and subsequent incubation at 37°C for 48 hours. After incubation, the resultant colonies were counted. The level of bacterial contamination of air, usually expressed as the number of bacteria carrying particles per cubic meter (bcp/m<sup>3</sup>) or Bioload (B) was estimated using Koch's sedimentation method according to which;

$$\text{Cfu/m}^3 = (a \times 1000) / (P \times t \times 0.2)$$

Where, a=the number of colonies on the petri plate, p=the surface measurement of the plate used in cm<sup>2</sup>, t=the time of exposure of the petri plate in minutes. No growth was reported after 48 hours of incubation. Bacterial colonies were identified using gram stain, motility and routine standard biochemical tests. Antibiotic susceptibility testing was done by Kirby Bauer disc diffusion method on Mueller Hinton agar following clinical and laboratory standards institute (CLSI) 2019 guidelines. Quality Control strains used were *Staphylococcus aureus* ATCC 25923, *Pseudomonas aeruginosa* -ATCC 27853, *Escherichia coli* ATCC 25922, *Klebsiella pneumoniae* ATCC 27736.

### RESULTS

Surgery O.T. with 57 CFU/mm<sup>3</sup> and central ICU with no growth (Table 1) even after 48 hours of incubation showed highest and least microbial contamination of air respectively. *Proteus mirabilis* was isolated from Surgery O.T. and SNCU level II, *Klebsiella pneumoniae* from air and surfaces of surgery and gynecology O.T. (Table 1).

**Table 1: Organisms recovered from microbial surveillance of air.**

Location of surveillance	Organism isolated by settle plate method	Cfu/m <sup>3</sup>
Surgery major O.T-1	<i>Klebsiella pneumoniae</i>	57
Surgery major O.T-2	<i>Escherichia coli</i>	15
	<i>Enterococcus species</i>	04
Surgery minor O.T-1	<i>Proteus mirabilis</i>	Swarming growth
Surgery minor O.T-2	<i>Klebsiella pneumoniae</i>	12
	<i>Staphylococcus aureus</i>	16
Labour room	<i>Staphylococcus aureus</i>	23
C.S O.T.	<i>Klebsiella pneumoniae</i>	51
NICU	<i>Staphylococcus aureus</i>	20
SCNU level 2	<i>Proteus mirabilis</i>	Swarming growth
SCNU level 3	<i>Coagulase negative Staphylococcus</i>	30
	<i>Bacillus species</i>	5
ENT major O.T.	<i>Coagulase negative Staphylococcus</i>	12
ENT minor O.T.	<i>Micrococcus species</i>	10
Gynaecology major O.T.	<i>Staphylococcus aureus</i>	36
Gynaecology minor O.T.	<i>Staphylococcus aureus</i>	14
Medicine ICU 1	<i>Staphylococcus aureus</i>	31
Medicine ICU 2	No growth	---
Central ICU	No growth	---
Orthopedics major O.T.	<i>Staphylococcus aureus</i>	16
Arthroscopy O.T.	<i>Coagulase negative Staphylococcus</i>	08
Ophthalmology O.T.	<i>Bacillus species</i>	03
	<i>Micrococcus species</i>	20

**Table 2: Organisms isolated from surface sampling of various operation theatres, ICU and labour room.**

Site of Collection of Surface swabs	Organisms isolated in culture of Surface swabs
Arthroscopy O.T.	<i>Acinetobacter lwoffii</i>
Surgery major O.T.	<i>Klebsiella pneumoniae</i> , <i>Staphylococcus aureus</i> .
Surgery minor O.T.	<i>Pseudomonas species</i>
Labour room	No growth
Caesarian section O.T.	No growth
NICU	No growth
SCNU	No growth
Gynaecology O.T.	<i>Staphylococcus aureus</i> , <i>Klebsiella pneumoniae</i> , <i>Escherichia coli</i> .
Orthopaedics O.T.	<i>Staphylococcus aureus</i> , <i>Pseudomonas species</i>
Medicine ICU	<i>Staphylococcus aureus</i>
ENT O.T.	Coagulase negative <i>Staphylococcus</i> , <i>Bacillus spp</i>

*Staphylococcus aureus* was isolated from air and surfaces all O.T. except ophthalmology O.T. human commensal floras isolated during microbial surveillance of air included coagulase negative *Staphylococcus*, *Bacillus spp* and *Micrococcus spp*. Surface swabs recovered *Pseudomonas spp* from Surgery minor O.T. and orthopedics O.T. and *Acinetobacter spp* from arthroscopy O.T. (Table 2). As far as antimicrobial susceptibility is concerned, 85 % of the *Staphylococcus aureus* isolates (including both air and surfaces) were found to be methicillin resistant *Staphylococcus aureus*. Out of all the gram-negative bacilli isolated, 25% were extended spectrum beta lactamase producers and the non-fermenters were found to be sensitive to all the first and second line oral and injectable antimicrobials. ESBL and MRSA detection was done by phenotypic disc-diffusion method.

## DISCUSSION

As per guideline, bioload in an empty operation theatre should not exceed 35 colony forming unit/m<sup>3</sup>. This cut off value has been surpassed by bioload of General surgery major O.T. in this study but orthopedics, ophthalmology and ENT O.T. had bioload within this limit. Similar finding has been reported by Yadav et al in their hospital-based study in North-east India, Anjali et al, Kiranmai et al.<sup>4-6</sup> Desai et al from Western India reported highest bioload in urology O.T.<sup>7</sup> As found in this surveillance, the central ICU of this medical college of Assam showed no growth in both aerial sampling and surface sampling, which has not been reported by other point surveillance studies from India.

In this study the most commonly isolated pathogen was *Staphylococcus aureus* which was detected to be MRSA in 85% cases. Similar prevalence of 72% MRSA in surveillance study had been reported by Deepa et al.<sup>8</sup> On the contrary, Kiranmai et al reported coagulase negative *Staphylococcus* to be the most common isolate, which view has also been seconded by Yadav et al.<sup>4,6</sup> Various gram- negative isolates recovered from surface sampling of operation theatres in this surveillance included *Pseudomonas species*, *Klebsiella pneumoniae*, *Escherichia coli*, *Proteus mirabilis*. Similar organisms had been reported to be isolated by Shah et al from Gujarat and Gomatheswari et al from South India and Getachew et al from Ethiopia.<sup>8-11</sup> This study found that articles and instruments sterilized by autoclave or boiling did not show growth of any organism.

## Limitations

One limitation of this study was non availability of slit air sampler for active surveillance. But studies like this one prove that in resource limited setting despite being considered a crude method, even passive surveillance through settle plate method can give a clue to high-risk zone of hospital harboring nosocomial pathogens.

## CONCLUSION

The result of this targeted surveillance highlights the need of proper execution of preventive measures for maintaining air quality and preventing contamination in the critical areas and asserts the active role of regular and daily antiseptic cleaning of all surfaces in these crucial areas of the hospital. The unauthorized movement, entry and overcrowding should be avoided as far as possible in these zones. The antimicrobial sensitivity profile of the gram-negative bacterial isolates, hints at their community-based origin but at the same time the high prevalence of MRSA isolate is an alarming issue which should raise a concern among all physicians in favor of judicious use of antibiotics. This being a point prevalence study, we were not able to follow up and document the effect of post surveillance fumigation and cleaning procedures on aerial and surface flora.

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