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Environmental screening of multi drug resistant organisms in high touch area of critical and non critical units in tertiary care hospital

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ABSTRACT

Introduction: Patient's environment in Health care settings responsible for causing variety of infections to patients and to the healthcare professions. Many of them are MDRO which may get transmitted as hospitals acquired infections that increases the chances of mortality and morbidity. These study was undertaken to isolate and identify aerobic bacteria with their resistance pattern in high touch areas of critical and non-critical care units of tertiary care hospital in absence of defined outbreaks.

Materials and Methods: The cross sectional analytical study was carried out in the Microbiology Department, after obtaining the Institutional Ethics Committee clearance with waiver of consent during a period of two months. A total 100 samples from nine surface locations of critical and non critical care units of tertiary care hospital were included in this study. All tubes were vortexed and 0.5 μl of the peptone water was inoculated immediately on Blood Agar and MacConkey Agar for semi-quantitative estimation of the organisms.

Result: The environmental screening for MDROs from high touch areas was carried out in the 650 bedded tertiary care hospital.. A total of 34/126 (26.98%) samples from various areas had the growth of microorganisms where Staphylococcus aureus predominated. 24.60% showed S. aureus growth while 2.38% were E.coli. A total of 47.05% strains were isolated from the critical care areas all of which were S. aureus whereas 52.94% strains were from the non-critical areas.

Conclusion: This study established to isolate and identify aerobic bacteria with their resistance pattern in high touch areas of critical and non critical care units of tertiary care hospital in absence of defined outbreak. These creates awareness regarding emerging of MDROs in hospital settings and also leads to improve in imperfect techniques of hand hygiene practices as well as inadequate surface disinfection practices especially in high touch areas.

Key Message: This study established the presence of aerobic bacteria with their resistance pattern in high touch areas of critical and non critical care units of tertiary care hospital in absence of defined outbreak. This will help creates awareness regarding emerging of MDROs in hospital settings and also leads to improve in imperfect techniques of hand hygiene practices as well as inadequate surface disinfection practices especially in high touch areas.

1. Introduction

Patient's environment in Health care settings has proven to be harboring the potential pathogens responsible for causing variety of infections to patients and to the health care professions.[1] These pathogens, many of which are Multi Drug Resistant Organisms (MDRO) may get transmitted from patients to patients and/or to Healthcare workers and has proven to be responsible for increased health care associated infections with increased mortality and morbidity and also adds up to increased healthcare expenses by the patients and the hospitals.[1] This environmental burden of MDRO in healthcare settings and especially in critical care areas poses a great challenge in terms of hospital infection

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control practices. Environmental contamination of MDRO is more challenging when patients are managed in shared facilities as bacterial contamination near patients facilities have been demonstrated near patient's surfaces, medical Equipment's, computers used. The imperfect techniques of hand hygiene practices as well as inadequate surface disinfection practices especially in high touch areas poses a great risk of transmission and dissemination of these MDRO in health care settings. Evidence suggest that Methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE) can be recovered from the environment, even for the extended periods whereas Gram negative organisms have been less frequently isolated. There is little information available for frequently isolated organisms and their resistance pattern from the high touch areas in the vicinity of the patient in environment. These study was undertaken to isolate and identify aerobic bacteria with their resistance pattern in high touch areas of critical and non-critical care units of tertiary care hospital in absence of defined outbreak with the objective to determine antibiogram of the environmental isolates and to detect Antibiotic resistance pattern if any by standard phenotypic.

2. Materials and Methods

The cross sectional analytical study was carried out in the Department of Microbiology, Raipur Institute of Medical Sciences, Raipur, Chhattisgarh, India, after obtaining the Research Advisory Committee (RAC) & Institutional Ethics Committee (IEC) clearance with waiver of consent during a time period of two months. All the environmental samples from different locations of the critical and non- critical care units of tertiary care hospital was included in this study. A total 100 samples were taken from critical care units in tertiary care hospital. Nine surface locations was chosen for testing, they were classified in three categories.

2.1. Immediate patient environment

1. Bed frames
2. Side table
3. Tray

2.2. Commonly accessed surfaces not in close physical proximity to patients

1. Door handles
2. Switches
3. Partition stands

2.3. Commonly used equipment

1. IV stands
2. BP appratus
3. Stetho-scopes

2.4. Sample collection and processing

A sterile flocked nylon swab moistened with sterile saline solution was rotated and swabbed in a standardized pattern within the defined area for each sampling point. Samples collected was transported immediately to bacteriology laboratory of Microbiology Department. Swab samples collected for each surface was dipped in a sterile test tube with 1 ml of sterile peptone water. The tubes was vortexed and 0.5 μl of the peptone water was inoculated on immediately on Blood Agar (BA) and MacConkey Agar (MA) for semi-quantitative estimation of the organisms. Smears was also prepared for direct examination.

Inoculated BA & MA plates was incubated for 18-24 Hrs. at 37OC. Colonies were identified using standard microbiological techniques.[2] The Antibiotic Sensitivity pattern was assessed using Kirby Bauer Disk Diffusion method for the drugs as per CLSI guidelines 2018.

2.5. Resistance pattern determination

The identified strains of Staphylococcus aureus was further tested for presence of MRSA using Cefoxitin Disk Diffusion Test and inducible clindamycin resistance by D-test according to CLSI guidelines.[3]

All gram negative bacilli showing resistance to at least two or more of the third-generation cephalosporins on routine antimicrobial susceptibility testing by disc diffusion method was tested by phenotypic method of Novel disc placement by Camela Roudrigues.[4]

All data was maintained in Microsoft office Excel. All statistical analysis was carried out using Excel and Appropriate Statistical tools was applied wherever required like tests of proportion and tests of significance.

3. Result

The environmental screening for multidrug resistant organisms from high touch areas in critical and non-critical areas of the tertiary care hospital was carried out in the 650 bedded tertiary care hospital attached to a teaching hospital. Samples were collected as described in methodology from 3 areas each in immediate patient vicinity, commonly accessed areas by patients as well as healthcare professionals and equipment used. The growth of organisms in various areas is detailed in Table 1.

A total of 34/126 (26.98%) samples from various areas had the growth of microorganisms where Staphylococcus aureus predominated. 31/126 (24.60%) has shown the growth of S. aureus while 3/126 (2.38%) have shown the grown of E.coli. 3 samples from psychiatry have shown the growth of both E.coli and S. aureus Table 2.

A total of 16/34 (47.05) strains were isolated from the critical care areas all of which were S. aureus whereas a total of 18/34 (52.94%) strains were from the non-critical areas. Of the strains isolated from the non-critical areas 12

Table 1: Organisms isolated from high touch areas from different critical and non-critical areas of tertiary care hospital

		Critical Care Areas							Non- Critical Area						
	Area of Sample Collection	**Casualty**	**SICU**	**ICU**	**CCU**	**NICU**	**OT**	**Post OT Recovery**	**Medicine**	**Pediatrics**	**Psychiatry**	**Orthopedics**	**ENT**	**ObGy**	**Ophthalmology**
Immediate Patient Vicinity	Bed Frames	SA	NG	SA	NG	NG	NG	NG	NG	NG	EC	SA	NG	NG	NG
	Side Tables	SA	NG	SA	SA	NG	NG	NG	SA	NG	EC	SA	NG	NG	NG
	Tray/Trolly	SA	NG	SA	NG	NG	NG	NG	NG	NG	EC	NG	NG	NG	NG
Commonly Accessed areas	Door Handles	SA	NG	NG	SA	NG	NG	NG	SA	NG	SA +EC	SA	NG	NG	NG
	Switches	SA	NG	NG	NG	NG	NG	NG	NG	NG	SA +EC	NG	NG	NG	NG
	Partition stands	NG	NG	NG	SA	NG	NG	NG	SA	NG	SA +EC	NG	NG	NG	NG
	IV stands	SA	NG	SA	NG	NG	NG	NG	NG	NG	SA	NG	NG	NG	NG
Commonly Used Equipment	BP apparatus	SA	NG	SA	NG	NG	NG	NG	NG	NG	SA	NG	NG	NG	NG
	Stethoscopes	SA	NG	SA	NG	NG	NG	NG	NG	NG	SA	NG	NG	NG	NG

SA- Staphylococcus aureus, SICU- Surgical Intensive Care Unit, NICU- Neonatal Intensive Care Unit, EC- E.coli, ICU- Intensive care Unit, OT – Operation Theatre, NG- No growth, CCU- Cardiac Care Unit

Table 2: Number and Species of organism grown in the samples collected from various Critical and Non-Critical areas

	Critical Areas	**Non-Critical Areas**
Immediate Patient Vicinity	6/21 S.aureus - 06	6/21 S.aureus - 06
Commonly Accessed areas	04/21 S.aureus – 04	9/21 S.aureus – 03 , E.coli –03 S.aureus + E.coli - 03
Commonly Used Equipment	06/21 S.aureus - 06	03/21 S.aureus - 03
Total 34/126	16/63	18/63

strains were S. aureus and 6 strains were of E.coli.

A total of 5/31 (16.12%) Staphylococcus aureus strains were found to be MRSA strains as tested by the Cefoxitin disk diffusion test, 1 each from Casualty, Psychiatry and Medicine and 2 from Orthopedics. 2/3 strains from orthopedics were MRSA strain. 24/26 remaining strains of S. aureus were sensitive to commonly used antimicrobials whereas 2 strains have shown resistance to Clindamycin. Erythromycin and Cloxacillin.

Only 2/6 isolates of E.coli were resistant to Amikacin, Amoxicillin and Aztreonam and no specific resistance mechanism was identified in any of the strains.

4. Discussion

In health care settings the patients environment carrying pathogens responsible for causing variety of infections to patients and to the healthcare professions. Many of them are MDRO which may get transmitted as hospitals acquired infections that increases the chances of mortality and morbidity. Thus these study was carried to isolate and identify aerobic bacteria with their resistance pattern in high touch areas of critical and non critical care units of tertiary care hospital in absence of defined outbreak. In our study the environmental screening for multidrug resistant organisms was carried out in the 650 bedded tertiary care hospital attached to a teaching hospital where samples were taken from a nine surface location in which a total of 34/126 (26.98%) samples from various areas had the growth of microorganisms where Staphylococcus aureus predominated. 31/126 (24.60%) has shown the growth of S. aureus while 3/126 (2.38%) have shown the grown of E.coli. 3 samples from psychiatry have shown the growth of both E.coli and S. aureus, where as in Thean Yan Tan et al[5] study was carried out in an 800 bed acute hospital where swabs taken from 82 sites of which 65 samples (79%) samples yielded a total of 97 isolates, in which 60 (73%) were positive for 3 MDROs. In our study A total of 5/31 (16.12%) Staphylococcus aureus strains were found to be MRSA strains as tested by the Cefoxitin disk diffusion test, 1 each from Casualty, Psychiatry and Medicine and 2 from Orthopedics. 2/3 strains from orthopedics were MRSA strain. 24/26 remaining strains of S. aureus were sensitive to commonly used antimicrobials whereas 2 strains have shown resistance to Clindamycin. Erythromycin and Cloxacillin. Only 2/6 isolates of E.coli were resistant to Amikacin, Amoxicillin and Aztreonam and no specific resistance mechanism was identified in any of the strains. A total of 16/34 (47.05) strains were isolated from the critical care areas all of which were S. aureus whereas a total of 18/34 (52.94%) strains were from the non-critical areas showed that contamination were more in non-critical areas as compare to that study. The proportion of environmental sites positive for MRSA was higher in his study as compared to our study where as a in French et al.[6] 2004 showed that MRSA was cultured from 43% of beds of individual not known to be MRSA positive. These study was having limitation in terms of sample size due to short duration of period of time.

5. Conclusion

This study established the presence of aerobic bacteria with their resistance pattern in high touch areas of critical and non-critical care units of tertiary care hospital in absence of defined outbreak. This will help create awareness regarding emerging of MDROs in hospital settings and also leads to improvement in hand hygiene practices as well as inadequate surface disinfection practices especially in high touch areas.

6. Source of Funding

None.

7. Conflict of Interest

None.

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