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Role of Infection Prevention and Control practices [IPC] in the era of mupirocin resistance: A study from a tertiary care center

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ABSTRACT

Introduction: Carriage of Staphylococcus aureus in the web spaces and anterior nares among the health care workers is a substantial source of human infections. Screening, detection and treatment of such carriers is an important modality in prevention of infections. Colonized health workers especially in teaching hospitals may subsequently develop clinical infections and act as reservoirs for infection among vulnerable individuals.

Objectives: Screening of the nursing staff from various departments including critical and non critical areas, identification and speciation of staphylococcus and determining its resistance to cefoxitin and Mupirocin.

Materials and Methods: The study was done in the department of Microbiology, Rajarajeswari medical college and hospital, Bangalore, Karnataka. Two swabs were collected from each health care personnel, one swab from anterior nares and other from the web spaces. Swabs were streaked on to blood agar and MacConkey agar plate and incubated at 37°C for 48hours. Identification done by standard protocols. Susceptibility to cefoxitin and mupirocin was done by Kirby- baeur disc diffusion method. MIC of mupirocin was done E-test method.

Results: A total of 200 nursing staff was screened during the study period. Majority of the cultures yielded Coagulase negative staphylococcus followed by no growth from the anterior nares. From the web spaces majority yielded no growth. Out of 78 CONS that were isolated 72 were sensitive to cefoxitin and 8 were resistant. Out of 24 isolated Staphylococcus aureus isolates 20 isolates were sensitive and 4 were resistant to cefoxitin. The MIC values of the four methicillin resistant Staphylococc us aureus were 0.38, 0.25, 0.25, 0.19 which were reported as sensitive strains.

1. Introduction

Healthcare professionals, especially nursing professionals, due to occupational exposure are considered as the most susceptible population to be colonized by multi drug resistant microorganisms. The nature of the work by nursing professionals involve close physical contact with patients. This is considered as a rationale in the colonization and dissemination of microorganisms, eventually resulting in outbreaks. Asymptomatic carriers of Staphylococcus in the health care professionals act as disseminators to the population those are susceptible to the infections.[1] The major disappointment in the prevention of MRSA to the hospital infection control teams is the colonization of the resistant strain in the anterior nares and the web spaces of the health care personnel. This is considered as one of the major cause of nosocomial infections.[2] Nasal colonization with S. aureus is an important step in the pathogenesis and spread of S. aureus in fections. These strains act as reservoir for infection and lead to surgical site and bloodstream infections. Eradication of Staphylococcal colonization is still considered as an important strategy to prevent infection and transmission of these strains.

Methicillin-resistant Staphylococcus aureus (MRSA) was first reported in the year 1961. Subsequently MRSA

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is endemic in many hospitals including tertiary care centers.[3] Mupirocin is a topical antibiotic that interferes with bacterial protein synthesis, which can be used for eradication of staphylococcal nasal colonization and thus helps in the control of MRSA transmissi on in Health Care facilities.[4] As an antibiotic, mupirocin (pseudomonic acid A) is an analogue of isoleucine that inhibits protein synthesis by competitively binding to the enzyme isoleucyl-tRNA synthetase. It is active against gram-positive as well as some gram-negative bacteria. Mupirocin usage for the eradication of S. aureus in the nasal carriers was a success.[5,6] There was major reduction in the nosocomial infections. Unfortunately today, mupirocin resistant Staphyloccus aureus strains has been reported from many parts of the world. The prevalence of these strains in India was reported as 14.6%.[7,8] Thus the present study was taken to study the prevalence of mupirocin resistant staphylococcus colonization among health care workers. The knowledge of professionals on their carrier state is imperative for the adoption of isolation measures, that helps in the prevention of dissemination in the healthcare services.

2. Objective

Screening of the nursing staff from various departments including critical and non critical areas, identification and speciation of staphylococcus and determining its resistance to cefoxitin and Mupirocin

3. Matrials and Methods

The study was done in the department of Microbiology, Rajarajeswari medical college and hospital, Bangalore, Karnataka. The nurses from various departments, both critical and non critical areas were included in the study. Two swabs were collected from each health care personnel, one swab from anterior nares and other from the web spaces. Nares and web spaces were swabbed with sterile rayon-tipped applicator sticks and then inoculated into the BHI broth. Swabs were streaked on to blood agar and MacConkey agar plate and incubated at 37 °C for 48hours. The plates were checked for any growth. The results were documented. The samples that showed growth on culture media were further tested for identification. Identification was done using battery of biochemical tests as per standard protocols. The isolates that were identified as Coagulase negative Staphylococcus and Staphylococcus aureus were subjected to antibiotic susceptibility for cefoxitin on muller hinton agar by Kirby baur disc diffusion testing. The results were documented as CONS, MRCONS, Staphylococcus aureus (SA), MRSA. MRSA were further screened for mupirocin resistance by inoculation onto Mueller-Hinton agar plates followed by MIC testing for the strains that showed mupirocin resistance by disc diffusion.[9,10]

3.1. Detection of Mupirocin resistance by disc diffusion

Mupirocin discs (5 μg and 200 μg) were purchased from Himedia Laboratories Pvt., Ltd., (Mumbai, India). Both the discs were included in the routine sensitivity testing and plates were incubated for 24 h at 35°C + 2°C. The zone diameters were carefully examined with transmitted light . Isolates resistant for both 5 μg and 200 μg discs were considered high-level Mupirocin resistant and are subjected to MIC detection done by E- strip method.

3.2. Mupirocin MIC detection

MIC testing is done by E- strip method using Mueller Hinton Agar.

3.3. Principle

The Epsilometer (E) test is an agar diffusion method which utilizes a predefined continuous and exponential gradient of antibiotic concentrations immobilized along a rectangular strip. For testing mupirocin susceptibility, a strip with concentration gradient of 0.064 to 1024 μg/ml was used. The MICs of mupirocin for isolates that grew on the screening plates were determined by Etest (AB Biodisk).[10]

4. Results

A total of 200 nursing staff was screened during the study period. Two swabs, one from the anterior nares and one from the web spaces were collected from each of the health care worker. The distribution of the Nursing staff among the critical and non-critical areas are as shown in Table 1 . The demographic picture is as shown in Table 2. Majority of the cultures yielded Coagulase negative staphylococcus followed by no growth from the anterior nares. From the web spaces majority yielded no growth. The growth from anterior nares and webspaces are as shown in Table 3. Culture growth of Critical care nursing staff anterior nares and web spaces are as shown in table 4a and 4b respectively. Gram positive cocci that were identified as Staphylococcus aureus and Coagulase negative staphylococcus were subjected to antibiotic susceptibility testing for cefoxitin and mupirocin. Out of 78 CONS that were isolated 72 were sensitive to cefoxitin and 8 were resistant. Out of 24 isolated Staphylococcus aureus isolates 20 isolates were sensitive and 4 were resistant to cefoxitin. The distribution of MRSA among nursing staff is as shown in table 5. The MI C values of the four methicillin resistant Staphylococcus aureus were 0.38, 0.25, 0.25, 0.19 which were reported as sensitive strains.

5. Discussion

Healthcare professionals are considered as a group in peril to the colonization by *Staphylococcus aureus*. Because of the nature of their occupation to work in close physical

Table 1: Distribution of the Nursing staff among various wards

AREA	NO. of health care professionals
Male ortho ward	06
Female ortho ward	06
Male surgery ward	12
Female surgery ward	12
Male medicine ward	12
Female medicine ward	12
Post natal care	08
Antenatal care	10
Labour room	12
SICU	10
NICU	10
PICU	10
MICU	10
Male emergency ward	08
Female emergency ward	08
Male ophthalmology	08
Female ophthalmology	08
Paediatrics	10
Post operative ward	10
Operation theatre	14
Infection control nurse	04
Total	200

Table 2: Demographic picture

Demography	No of nurses
20-30	165
31-40	32
>40	3
Total	200

Table 3: Growth from anterior nares and webspaces

Culture growth	Nasal swab	Web spaces
CONS	72	98
Staphylococcus aureus	20	13
MRCONS	06	02
MRSA	04	00
GPB	10	00
No growth	88	87
Total	200	200

Table 4: a: Culture growth of Critical care nursing staff anterior nares

Critical care	CONS	Staphylococcus aureus	No Growth
MICU	2	0	8
SICU	1	0	9
PICU	0	0	10
NICU	1	0	9
Labour room	3	2	7
Casualty	0	0	2
Total			

4b: Culture growth of Critical care nursing staff Web spaces

Critical care	CONS	Staphylococcus aureus	No Growth
MICU	1	0	9
SICU	0	0	10
PICU	1	0	9
NICU	0	0	10
Labour room	2	1	9
Casualty	0	0	2
Total	4	1	49

Table 5: Distribution of MRSA in the nursing staff

Area of work	Mrsa colonisers
Critical care areas	00
Non critical areas	
Female Surgery ward	02
Obstrtics and gynaecology	02
Total	04

contact with the patients it is mandatory to know the status of their colonization. Strict adherence of healthcare institutions to hospital infection control policies is the main key to reduce antibiotic resistance. Knowledge on the condition of MRSA carrier is a right of healthcare professionals. The knowledge on their carrier state, help the professionals reflect better on their attitudes and work practices and also to inculcate the hygiene practices in a better way.

S. aureus nasal col onization appears to play a significant role in the epidemiology and pathogene sis of infection.[9] The pre-valence of these strains in Korea, India, South Africa and Nigeria has been reported 5%, 14.6%, 7% and 0.5 % resp ectively.[11]

Currently pre valence of mupirocin resistance in MRSA is increasing in areas where antibiotics are widely used.[12] Mupirocin is a topical antibiotic that has been used extensively for treating methicillin resistan *Staphylococcus aureu*s (MRSA) associated infections. However mupirocin-resistant MRSA is on rise because of extensive and widespread use of this agent. Studies had shown that previous exposure has been identified as a risk factor for the development Mupirocin resistance in MRSA.[13] Moreover, reducing Mupirocin use was associated with lower Mupirocin resistance levels over time. In our study coagulase negative staphylococcus was the predominant isolate, followed by Staphylococcus aureus. None of the isolates were resistant to mupirocin. Similar study conducted in the same centre in the year 2013 showed MRSA isolation 1.33%, mupirocin resistance as 1%.[14] In our study, one isolate showed MRSA and none of the isolates were mupirocin resistace. This can be attributed to the strict infection control practices that were followed in our hospital. Continuous education and training of

the health care personnel about standard precautions, hand hygiene in particular plays a crucial role to reduce hospital acquired infections and hospital spread of drug resistant strains. Ensuring high compliance with hand hygiene is mandatory for the success of the infection prevention and control. The reasons for screening include to prevent contamination of Staphylococcus aureus into immediate environment [e.g. bed frame, case notes, curtains, etc], to identify and treat the carriers. Screening plays an important role as 10-30% of carriers with staphylococcus eventually develop MRSA. However intranasal mupirocin and chlorhexidine washing are extensively used to decolonize MRSA carriers, there are some recent studies showing the emergence of resistance to these agents also. Hence the screening for mupirocin resistance should be made mandatory for all the health care workers.

6. Conclusion

The results of this study indicate that good infection control practice are the essential elements in preventing the emergence and also the spread of mupirocin resistance. Continued surveillance for mupirocin resistance is important in order to retain the usefulness of this agent for the treatment and prevention of staphylococcal infections. Infection control team as well as the administrative services should work hand in hand to screen isolate and destroy the source of infection for the holistic health care.

7. Source of Funding

None.

8. Conflict of Interest

None.

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