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Screening of MRSA in Health Care Professionals in a Tertiary Care Hospital

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Abstract: ***Background: Staphylococcus aureus, particularly Methicillin-resistant Staphylococcus aureus (MRSA), commonly colonizes the anterior nares in humans. A growing concern is the development of resistance, which increases the risk of hospital outbreaks through hand-to-nose or hand-to-hand transmission. This study aimed to assess MRSA colonization in the nasal and interdigital web spaces of healthcare staff and determine its sensitivity to Mupirocin, a common decolonization agent. Materials and Methods: A total of 540 healthcare personnel from various clinical departments were screened over six months for MRSA colonization in the anterior nares and hand web spaces. Colonization was assessed using Cefoxitin 30mcg discs and Mupirocin 5mcg discs via the Kirby-Bauer disc diffusion method. Results were interpreted using CLSI guidelines, and data analysis was performed using Microsoft Office Excel. Results: The prevalence of MRSA nasal colonization was 9.25%, while hand colonization was 0.37%. Conclusion: The high rate of nasal MRSA colonization among healthcare workers is concerning and highlights the need for routine screening and decolonization therapy. Although hand colonization remains low, the potential for transmission cannot be dismissed. Most MRSA isolates were susceptible to Mupirocin, indicating its effectiveness for decolonization.***

Keywords: Staphylococcus aureus, nasal and hand colonization, healthcare professionals, MRSA, Mupirocin

1. Introduction

Staphylococcus aureus is a common commensal of the nasal vestibule and also of the skin of groin, perineum and axilla. In hospitals the proportion of members of staff whose anterior nares are colonised with *Staph aureus* is 50-60%, patients in hospitals tend to be colonised depending on the length of their stay.[1]

2. Literature Survey

Staphylococcus aureus is one of the common pathogens inhabiting the hospital environment. It is resistant to semi synthetic penicillinase resistant penicillins such as Oxacillin and Methicillin due to presence of an altered penicillin binding protein called PBP2a or PBPs from chromosomal gene called *mecA*. The *S. aureus* strains with *mecA* gene are termed as Methicillin resistant *Staphylococcus aureus* (MRSA). The organism acquires this gene from exposure to hospitals and other health care facilities. It is transmitted to the patients via hands of health care professionals (HCPs). Colonized HCPs and students may invariably become the source for infection among at risk patients.[2, 3] The fact that multidrug resistant organisms are spreading in the community and the hospital is a matter of grave concern. It is imperative to detect and decolonize the MRSA carriers in order to drop down the escalating rate of MRSA infection in hospitalized patients, especially in intensive care units.[4]

Identification of the carriers followed by decolonization with 2% Mupirocin, chlorhexidine glucoanate, bacitracin along with oral therapies with tetracycline, folate inhibitors etc. have known to be effective in reducing the transmission and controlling the spread of MRSA.[5]

Problem definition:
This research aimed to evaluate the prevalence of MRSA colonization among healthcare professionals and assess the efficacy of Mupirocin, a widely used antibacterial agent for decolonization.

3. Materials and methods

A prospective study was conducted for over 6 months from October 2023 to April 2024 after obtaining clearance from Institutional Ethics committee.

Statistical analysis was done using proportion method. Sample size was calculated using the formula

$n = 4PQ/d^2$

where, n= sample size, P= prevalence, Q=100-P, d= allowable error
for the current study p= 5.7% = 0.057, Q=94.3%, d= 2% = 0.02, therefore n = 540

Data entry and analysis was done using Microsoft Office Excel.

A total of 540 adult healthcare professionals with no respiratory illness[6] in the past 1 month were included in the study including 114 postgraduate students, 62 MBBS interns, 8 senior doctors, 273 staff nurses, 83 housekeeping staff posted in various clinical departments.

Staff working in non-clinical departments and those having respiratory illness in the past 1 month were excluded from the study.

Nasal swabs and hand web space swabs were collected from these subjects.

- To collect sample from the nose, the swab was inserted 2–3 cm into the anterior nares and rotated four times and withdrawn.
- For hand swab, the web-space of the hand was swabbed with sterile cotton swab moistened in sterile saline.[6]

Swabs were pre-wetted with saline and streaked onto nutrient agar and mannitol salt agar and incubated for 24-48 hours. Golden yellow colonies on nutrient agar were picked up and gram staining and standard biochemical reactions like catalase and coagulase test were performed (Figure I; a-d). On mannitol salt agar *Staphylococcus aureus* grew as yellow colonies with medium turning yellow (Figure I-e).[7] Then, lawn culture of the growth was performed onto Mueller Hiinton Agar, Cefoxitin (30 mcg) discs and Mupirocin (5 mcg) [8] discs were placed onto the medium and incubated for 24 hours for detection of Methicillin and Mupirocin resistance by Kirby Bauer disc diffusion method. Zone diameters were interpreted according to CLSI M100 ed34 guidelines, for Cefoxitin zone diameter >=22mm was taken as susceptible and any zone < 22mm was taken as Methicillin resistant; for Mupirocin, zone diameter >=14mm was taken as susceptible and any zone <14mm was taken as resistant (Figure II).[9]

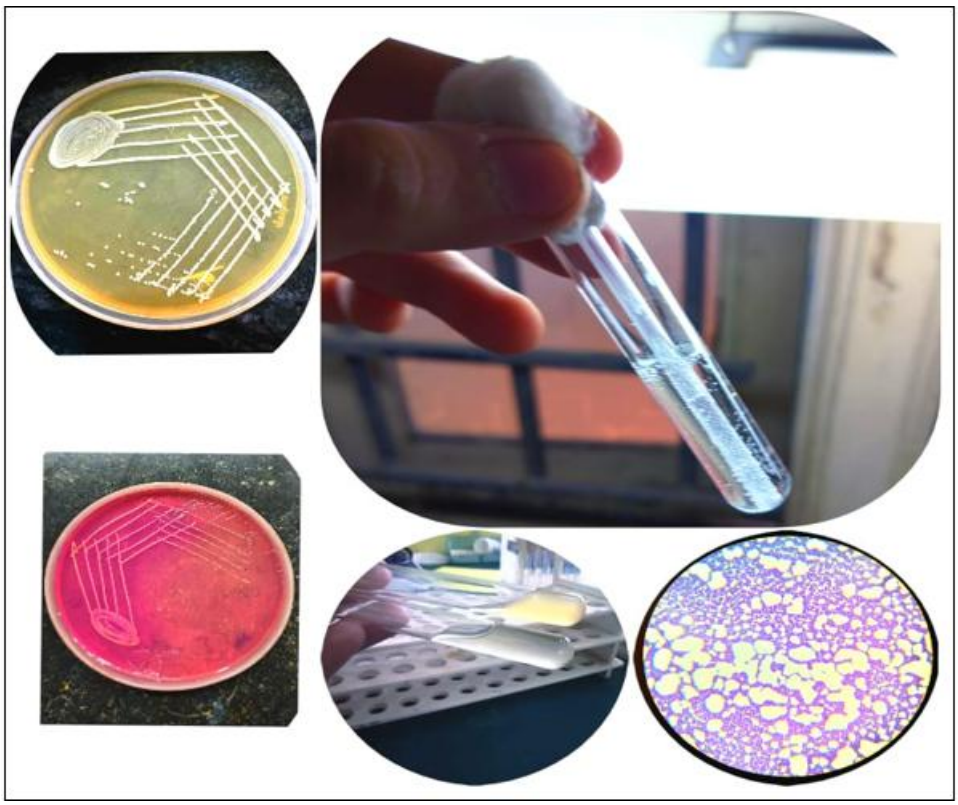


Figure I: a-e Culture of staph aureus onto nutrient and mannitol salt agar and its biochemical reactions

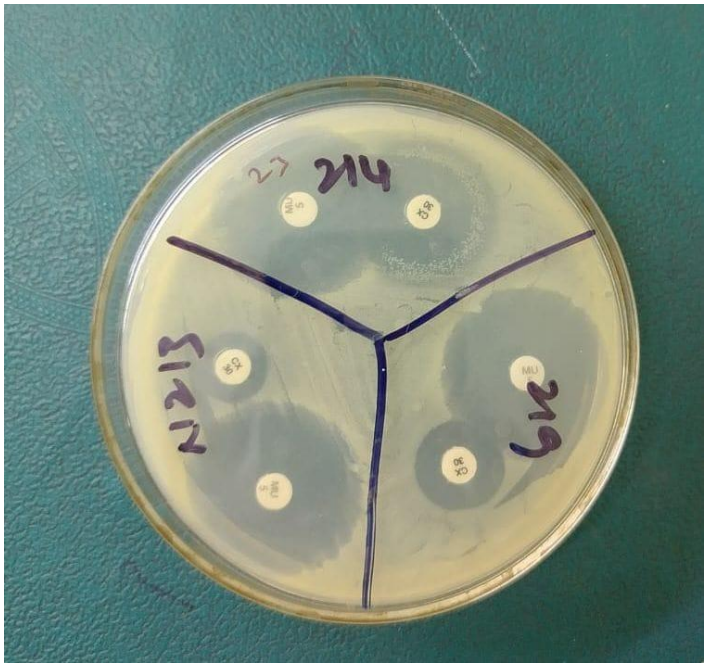


Figure II: Kirby-Bauer disc diffusion method showing sensitivity pattern of Staph aureus to cefoxitin and mupirocin

4. Results

Out of 540 nasal swabs collected, 67 swabs yielded *Staphylococcus aureus*, out of which 50 isolates (74.62%) were MRSA accounting for overall prevalence of **9.25%**.

Out of 540 hand swabs collected, 5 swabs yielded *Staphylococcus aureus*, out of which 2 (40%) isolates were MRSA accounting for overall prevalence of **0.37%.**

Only in one person we found that both the nares and the web spaces were colonized.

Mupirocin resistance was nil in nasal carriers, but 1 of the 2 hand carriers showed mupirocin resistance

The postgraduates and staff nurses accounted for 18 (36%) each, interns 11 (22%) and housekeeping staff 3 (6%) MRSA isolates from nasal swabs

The 2 hand swab MRSA isolates were from the postgraduates (Table I and graph 1).

The Obstetrics and Gyenaecology staff accounted for majority of the isolates followed by the emergency wards and then the ICUs (Table 2 and graph 2)

Table I and graph 1: Group wise distribution of MRSA isolates

STAFF	NASAL SWAB – MRSA	WEB SPACE SWAB – MRSA
Postgraduate	18	2
Interns	11	0
Staff nurse	18	0
Housekeeping staff	3	0

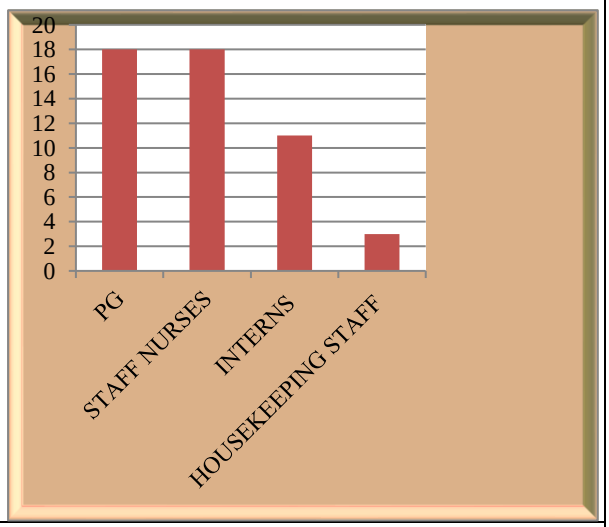
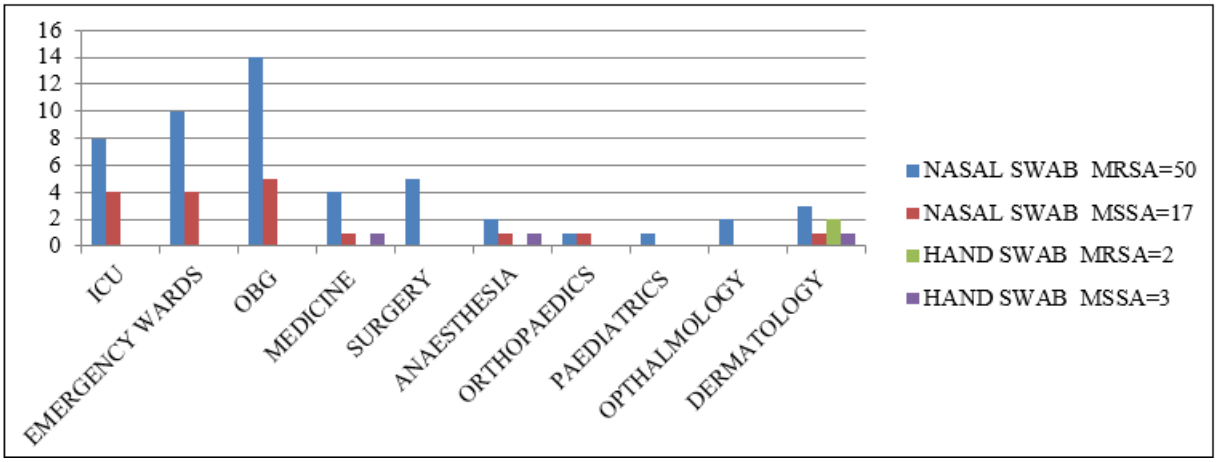


Table II and graph 2: Department-wise distribution

DEPARTMENT	NASAL SWAB		HAND SWAB	
	MRSA=50	MSSA=17	MRSA=2	MSSA=3
ICU	8	4		
EMERGENCY WARDS	10	4		
OBG	14	5		
MEDICINE	4	1		1
SURGERY	5			
ANAESTHESIA	2	1		1
ORTHOPAEDICS	1	1		
PAEDIATRICS	1			
OPTHALMOLOGY	2			
DERMATOLOGY	3	1	2	1
TOTAL	50	17	2	3



5. Discussion

In our study, the total prevalence of nasal MRSA colonization is 9.25% and the postgraduates are proportionately the most common group to be colonized by MRSA, most probably due to being in close contact with the patients and working bare handed and unhygienic practice of touching the nose frequently.

The hand carriage of MRSA in our study is 0.37%, which is very less in comparison to other studies.

The nursing staff were wearing masks and gloves all the time during patient care and sanitizing their hands each time they touch a patient.

The OBG department was the most colonized as expected again most probably due to poor hand hygiene and personal hygiene measures.

This finding is in contrast to the study conducted by Michael Robert. et. al[10] where the otolaryngologists were the most affected among all the surgeons with overall prevalence being almost similar 9.8%.

Overall, the doctors including the postgraduates and interns were colonised accounting for **58%** of the MRSA isolates, in contrast to the research carried out by Smita S. Mangalgi et. al [11] where nursing staff were the most affected.

The limitation in this study is while collecting hand swabs as the staff would wear gloves during patient care and then sanitize their hands just before the sample collection. The risk of hand-to-hand transmission could not clearly be assessed.

Another major limitation was consent from the senior doctors for the study. As a result, the planned proportion of healthcare staff could not be achieved.

Due to large sample size, I could not properly record the demographic details like comorbidities and duration of working in the hospital.

Also, I was not able to track the patients who were in care and treated by these staff. Clinical significance couldn't be assessed.

Mupirocin decolonization and retesting was attempted but there was loss-to-follow up.

6. Conclusion

The number of people carrying MRSA is alarming and warrants urgent need to screen for and implement decolonization therapy as a routine in healthcare staff.

The majority affected are the gynaecologists posing a significant risk to their patients. and may be a major cause of LSCS wound infections in our hospital.

The least affected are the orthopaedicians.

The risk of spreading infections is maximum in the intensive care units followed by emergency departments and then the wards.

Currently, the transmission via hands is found to be negligible but doesn't rule out the risk.

Majority of isolates exhibited sensitivity to Mupirocin, inferring that it can be used as a decolonization therapy effectively.

Strict administration regarding hand hygiene and use of appropriate personal protective equipment and antibiotic policy needs to be implemented.

For cases resistant to mupirocin, chlorhexidine bath, intranasal fusidic acid, intranasal povidone iodine, etc can be tried[12].

Awareness programs regarding maintaining personal hygiene and preventing infections for the staff and the people at risk should be conducted regularly.

Educating the healthcare staff regarding the clinical significance of colonization and encouraging them to actively consent for such studies seems to be the pressing necessity of the moment.

Author contributions:

1) Dr. Haafiza Begum: Conceptualization, study design, sample and data collection, microbiological processing, data analysis, manuscript drafting.
2) Dr. Krishna S Supervision, review of methodology, manuscript editing, and final approval of the version to be published.
3) Dr. Sangeetha C. Patil: Literature review, assistance in laboratory procedures, data interpretation, critical revision of the manuscript.
4) Dr. Pushpalatha H: Statistical analysis, preparation of tables and graphs, contributed to result interpretation and discussion writing.

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Conflicts of Interest:

There are no conflicts of interest

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