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MRSA CARRIAGE IN HEALTHCARE WORKERS AT A TERTIARY CARE HOSPITAL IN CENTRAL INDIA: A POINT PREVALENCE STUDY

Clinical Microbiology

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ABSTRACT

Introduction:- *Staphylococcus aureus* is a bacteria famous for its nosocomial infections and severe syndromes it can cause when infected. Its most dangerous property is the ability to mutate into a multi drug resistant strain which is very tough to eliminate. In order to prevent the infections and treat it efficiently we must identify the source of nosocomial infections which are mostly from HealthCare Workers (HCWs). So, it is of prime importance to screen the carrier HCWs and treat them effectively. For this purpose, current study was conducted to identify the prevalence of MRSA carriage in healthcare workers in a tertiary care hospital in central India. **Materials And Methods: -** A total of **85 Consenting healthcare workers** were sampled by taking their nasal swabs. These swabs were then inoculated on 5% sheep blood agar and incubated for 24 hours at 37°C. After incubation colony growth seen was identified by various tests like Gram staining, Catalase, Tube and Slide Coagulase test. **Results: -** Moreover **19** (22.3%) isolates were identified to be *Staphylococcus aureus* out of 85 and among them **4** (4.7%) were identified to be MRSA by the modified Kirby bauer Disk diffusion method in which antibiotic susceptibility testing was done. Maximum load of MRSA was found in nurses (7.9%) followed by doctors (2.8%). **Conclusion: -** This data is analyzed and will help the institutional Hospital Infection Control Committee (HICC) to decrease the carriage of this organism and stop its prevalence in the hospital.

KEYWORDS

MRSA, Healthcare workers, Nosocomial infections

INTRODUCTION:

Healthcare workers in India are susceptible to a plethora of microbes within the hospital setup. One of these many microbes is *Staphylococcus aureus*. It is a gram-positive, catalase and coagulase-positive, non-motile, spherical cocci-shaped bacterium [1]. It can cause skin and soft tissue infections (folliculitis, abscess), osteomyelitis, toxic shock syndrome, food poisoning, scalded skin syndrome etc. [2] Staphylococcal infections occur in large numbers in hospitalized patients. These nosocomial infections cause prolonged duration of hospital stay, significantly high treatment cost, and higher mortality rates [3]. In the past, staphylococcal infections were treated by the administration of Penicillin, but by 1945 most of the isolates of *Staphylococcus aureus* were penicillin-resistant[4]. This was due to the production of an enzyme called penicillinase which splits the beta-lactam ring and renders penicillin ineffective. After that in the late 1950s (1959), Methicillin was introduced but that too shortly in 1961 was found ineffective because of the detection of Methicillin-resistant strains (MRSA)[5]. In these strains there was a mutation in the cell wall. A protein named Penicillin-binding protein (PBP) mutated to PBP2a which is encoded by the mecA gene. PBP has a great affinity for the beta-lactam antibiotics but PBP2a has less affinity which makes this family of antibiotics ineffective [4]. MRSA acquiring resistance from many antibiotics poses a great challenge in its treatment due to shortage in the arsenal of antibiotics still effective against the bacteria.

HCWs are the greatest source for nosocomial transmissions of MRSA to hospitalized patients and other people in the community as they act as a mediator between the hospital and the community [1]. Therefore, there's an urgent need to screen the HCWs for the MRSA carriage and provide necessary treatment to them in order to reduce the risk of hospital acquired infections in patients. This bacteria is abundantly found in the anterior nares of the carriers[6].

The rate of nasal carriage of *Staphylococcus aureus* in healthcare workers from several studies in India is found to be 17.5-41.66 %[1-4]. As of now, these MRSA are treated with Vancomycin (drug of choice for MRSA), but recently vancomycin-resistant strains have also emerged (VRSA)[7]. This makes the treatment even more challenging by narrowing the available therapeutic options.

This study will determine the prevalence of nasal carriage of MRSA in HCWs and will help in formulating an MRSA control policy based on the results. This will also help in exposing the lacunae in the present sanitary protocols, which will aid in reducing future infections.

AIMS AND OBJECTIVES:

1. To detect the carriage of *Staphylococcus aureus* in the anterior nares of healthcare
providers working in a tertiary care hospital in Central India.
2. To identify the prevalence of Methicillin-Resistant *Staphylococcus aureus* (MRSA) strain in those carriers.
3. To formulate an MRSA control policy based on the outcome of the research.

MATERIALS AND METHODS:

Study Area:

This study is conducted in the Department of Microbiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra (India), a tertiary care hospital in central India.

Study Type:

It is a point prevalence study, a type of cross-sectional study which is used to identify the number of people suffering from a disease or a condition at a specific point in time.

The formula for prevalence is:-

$$\text{Prevalence} = \frac{\text{No. of people in sample with characteristic of interest}}{\text{Total no. of people in sample}} \times 100$$

Study Duration:

The study was conducted in a span of 2 months from 5th July 2022 to 4th September 2022.

Determination Of Sample Size:

The rate of nasal carriage of *Staphylococcus aureus* among healthcare providers from several studies ranges from 17.5-41.66 % [1-4]. So, p-value = 29.58%,

Using the sample size formula,

$$n = \frac{3.84p(1-p)}{l^2}$$

where p= prevalence, l= allowable error, and confidence interval= 95%. Considering l=10%, after calculation, n=79.98 which is rounded off to 80.

So, a minimum of 80 consenting healthcare providers are to be

screened for nasal carriage of *Staphylococcus aureus* and MRSA to produce significant results.

In this study **85** participants were screened and sampled after obtaining their consent.

Inclusion Criteria:
1. Healthcare providers posted in Critical Care Units, MICU, SICU, Medicine Wards,
ENT Wards, Operation Theaters.
2. Healthcare providers included in the study are doctors, nurses and class IV workers by occupation.
3. Class IV workers category includes sanitation workers, patient handlers, housekeeping staff.

Exclusion Criteria:
1. Healthcare providers who recently had fever, cough or any sign of upper respiratory tract infection.
2. Healthcare providers with history of recent nasal surgery, use of nasal antibiotics or any other nasal spray in the past 1 month.
3. Medical students were excluded because of not having prolonged exposure to hospital settings.

Ethical Considerations:
Written informed consent was taken from all the participants in the study and then their sample was collected. Approval from the Institutional Ethics Committee was also granted for this study. **(Ref No. - IGGMC/Pharmacology/IEC/105-06/2022 dated 18/02/2022)**

Sample Collection:
A sterile moistened cotton swab was inserted into each nostril and rotated gently 5 times on the anterior nares of the study participants and transported to the laboratory in a sterile sealed test tube[2].

Culture And Identification:
The sample was then inoculated on 5% sheep blood agar and incubated at 37°C for 24 hours. The isolates were then identified as *S. aureus* based on colony morphology, gram tain, catalase test, slide and tube coagulase test[8].

MRSA Detection By Antimicrobial Susceptibility Testing:
All isolates of *Staphylococcus aureus* strains were tested against different antimicrobial agents by the modified Kirby Bauer disk diffusion method [9]. The antimicrobial disks used were – Penicillin, Doxycycline, Clindamycin, Chloramphenicol, Cotrimoxazole, Cefoxitin, Ciprofloxacin, Azithromycin and Linezolid. Antimicrobial susceptibility testing has been performed as per the Clinical and Laboratory Standards Institute guidelines [8]. Colonies with an inhibition zone of less than or equal to 21 mm for Cefoxitin disk (Image-1) have been considered methicillin-resistant (MRSA)[1].

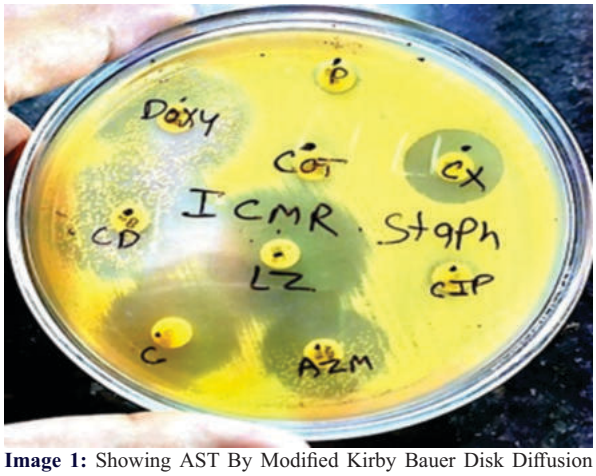

Image 1: Showing AST By Modified Kirby Bauer Disk Diffusion Method

Statistical Analysis:
The data collected from the study was compiled in MS Excel and then it was analyzed with suitable statistical tests.

OBSERVATIONS AND RESULTS:
Study was conducted on 85 Healthcare workers affiliated with a tertiary care hospital in central India. **Table 1** shows the distribution of HCWs according to their Occupation and Gender. Out of those 85, 29(34.1%) were males and 56(65.9%) were females. **Table 2** shows the distribution of Methicillin resistant (MRSA) and Methicillin sensitive (MSSA) strains. Prevalence of *Staphylococcus aureus* in this study was found to be **22.3%** (19 out of 85), and prevalence of MRSA was found to be **4.7%** (4 out of 85). Percentage of S. aureus resistant to methicillin in this study was found to be **21%** (4 out of 19). 7.9% of samples were found to be MRSA positive in nurses whereas 2.8% samples were found to be MRSA positive in doctors. **Figure 1** is a pie chart showing various percentages of MRSA and MSSA in all the participants.

Table 1: Categorical Distribution Of Healthcare Workers Screened For Methicillin Resistant *Staphylococcus Aureus*

HCWs	Male	Female	Total
Doctors	13	22	35
Nurses	09	29	38
Class IV workers	07	05	12
Total	29(34.1%)	56(65.9%)	85

Table 2: Distribution Of MRSA And MSSA Among Healthcare Workers

HCWs	Total	S. aureus present	MSSA	MRSA
Doctors	35	5(14.3%)	4(11.4%)	1(2.8%)
Nurses	38	11(29%)	8(21%)	3(7.9%)
Class IV workers	12	3(25%)	3(25%)	0(0%)
Total	85	19(22.3%)	15(79%)	4(4.7%)

Figure 1

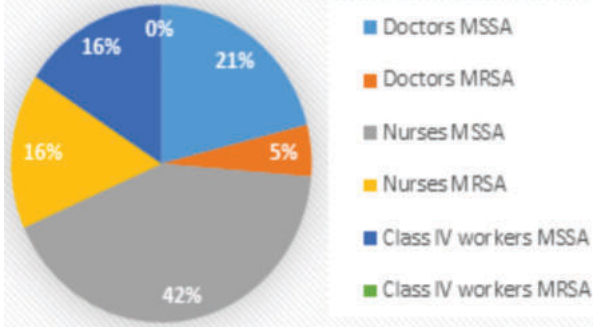

Table 3 shows the susceptibility of the *Staphylococcus aureus* isolated towards the drugs recommended by the Clinical and Laboratory Standards Institute guidelines. Maximum resistance is shown against Ciprofloxacin, Cotrimoxazole, Penicillin and Chloramphenicol. Resistance against Cefoxitin was found to be in 4 isolates. Maximum sensitivity was found for Linezolid, Doxycycline and Clindamycin. Image-1 Shows AST for one of the MRSA positive isolates.

Table 3: Results Of Antimicrobial Susceptibility Test On The S. Aureus Isolates

Antibiotics	Sensitive	Resistant
Penicillin	9(47.36%)	10(52.63%)
Cefoxitin	15(78.94%)	4(21.05%)
Ciprofloxacin	6(31.57%)	13(68.42%)
Azithromycin	14(73.68%)	5(26.31%)
Linezolid	18(94.73%)	1(5.26%)
Doxycycline	17(89.47%)	2(10.52%)
Chloramphenicol	9(47.36%)	10(52.63%)
Clindamycin	17(89.47%)	2(10.52%)
Cotrimoxazole	7(36.84%)	12(63.15%)

Figure 2

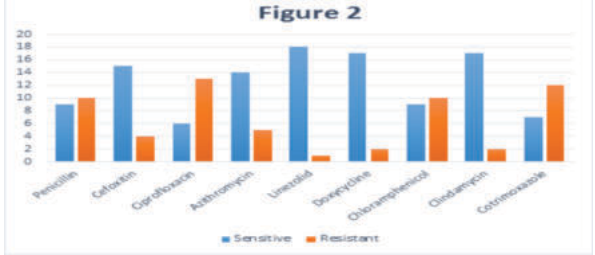

Figure 2 shows different sensitivity and resistance of various

antibiotics in all the 19 isolates of *Staphylococcus aureus*.

DISCUSSION:

MRSA carriage among healthcare workers in Central India was never determined till date. This study shows that the prevalence of *Staphylococcus aureus* is **22.3%** (19 out of 85) and out of these 21% (4 out of 19) were found to be MRSA. As *S. aureus* is a commensal, 22.3% is not a shocking number but it becomes a threat when the amount of bacteria resistant to several antibiotics increase in number. The prevalence of MRSA was found to be **4.7%** (4 out of 85) in this study with most of the MRSA found in nursing staff. More amount of resistant strains found in nurses (7.9%) indicates more exposure with poor hand hygiene and infection control habits. Only 1 out of 35 samples of doctors was found to be MRSA positive (2.8%). This indicates that regardless of higher exposure if better hand hygiene and infection control habits are followed then infections can be minimized. No samples were found to be positive for MRSA in class IV workers. This might be an indication of low direct patient exposure with the housekeeping workers.

MRSA prevalence found in this study was 4.7% which is lower than many other studies like Rongpharpi SR et al [10] (11.43%) and Shibabaw, A et al[11] (12.7), but it was also higher than some studies like Shrestha B et al[12] (2.32%). A literature search conducted by Albrich WC et Al[13]. from January 1980 to March 2006, which involved 127 investigations and screening of 33,318 health-care participants, revealed that (4.6%) of the health care workers were either infected or colonized with MRSA.

In this study it was found that the prevalence of S. aureus was 22.3% which is similar to the prevalence found in several other studies like Rutvi V. et al[2] (22%), Rongpharpi SR et al[10] (22.22%).

Most of the differences in all of the above studies regarding the prevalence of *Staphylococcus aureus* and MRSA is due to the differences in sample sizes and various techniques of data analysis.

Institutional HICC (Hospital Infection Control Committee) was also informed about the data from this study which they will use for better control of the transmission in respective ICUs and wards. Newer policies will be formulated, and workshops will be conducted to educate all the healthcare providers. This will also help in decreasing the number of MRSA cases faster and more efficiently. Those HCWs who were found with MRSA were advised to use Mupirocin nasal spray which is a brilliant topical antibiotic of choice for decolonization of MRSA from the nasal cavity[14].

CONCLUSION:

To conclude, the prevalence of MRSA was found to be 4.7% and carriage for *Staphylococcus aureus* was found to be 22.3%. The number of MRSA found in our hospital is not significant as it is 4.7% ($p < 0.05$), but the amount of *Staphylococcus aureus* is quite huge (22.3%). Prevalence of MRSA is found to be highest in nurses. *Staphylococcus aureus* in this study is found to be most sensitive to Linezolid, Clindamycin and Doxycycline. Also, maximum resistance is shown against Ciprofloxacin, Cotrimoxazole, Penicillin and Chloramphenicol.

In order to control the amount of nosocomial infections in the hospital we must promote good hygiene practices among all the HCWs and even educate the patients and their relatives to follow the norms of hygiene like hand washing regularly. Also, we should warn the people against the overuse and incomplete dosage of antibiotics. MRSA is a multi-drug resistant bacteria which develops mostly because of the self medication and incomplete dosage of antibiotics. In hospital setup it's of prime importance to conduct regular screening for nasal carriage of both HCWs and patients in order to take immediate action and prevent the transmission of resistant species to other people.

Those who came positive in this study for MRSA were referred to clinicians for further treatment. They were advised to wear masks and coat their nasal cavity with Mupirocin nasal spray. Faster and regular screening with better and timely treatment will help us in the prevention of this bacteria and the diseases that it causes.

This study also opens few more aspects of research in future about the effectiveness of various treatments on the MRSA carriers, impact of improved hygiene practices on MRSA, Mupirocin nasal spray and prevalence of MRSA, and many more.

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Conflict Of Interest-Nil

REFERENCES:

1. M R, D'Souza M, Kotigadde S, Saralaya K V, Kotian M S. Prevalence of Methicillin Resistant Staphylococcus aureus Carriage amongst Health Care Workers of Critical Care Units in Kasturba Medical College Hospital, Mangalore, India. J Clin Diagn Res. 2013 Dec;7(12):2697-700. doi: 10.7860/JCDR/2013/5160.3735. Epub 2013 Dec 15. PMID: 24551616; PMCID: PMC3919305.
2. Rutvi V, Sangeeta PD, Sima BK, Piyush PA. Nasal Carriage Rate of Methicillin Resistant Staphylococcus aureus (MRSA) among Civil Hospital Health care workers. Int J Med. Public Health. 2016;6(4):180-3.
3. Kausar Rawani and Siddharth Pimpalkar. 2020. Screening of Nasal MRSA Carriage among Health Care Workers at a Tertiary Care Centre in Chhattisgarh at Rajnandgaon District. Int.J.Curr.Microbiol.App.Sci. 9(12): 1467-1474. doi: https://doi.org/10.20546/ijcmas.2020.912.174
4. Stapleton PD, Taylor PW. Methicillin resistance in Staphylococcus aureus: mechanisms and modulation. Sci Prog. 2002;85(Pt 1):57-72. doi: 10.3184/003685002783238870. PMID: 11969119; PMCID: PMC2065735.
5. Askarian M, Zeinalzadeh A, Japoni A, Alborzi A, Memish ZA. Prevalence of nasal carriage of methicillin-resistant Staphylococcus aureus and its antibiotic susceptibility pattern in healthcare workers at Namazi Hospital, Shiraz, Iran. Int J Infect Dis. 2009 Sep;13(5):e241-7. doi: 10.1016/j.ijid.2008.11.026. Epub 2009 Mar 9. PMID: 19269873.
6. Peacock SJ, Justice A, Griffiths D, de Silva GD, Kantzanou MN, Crook D, Sleeman K, Day NP. Determinants of acquisition and carriage of Staphylococcus aureus in infancy. J Clin Microbiol. 2003 Dec;41(12):5718-25. doi: 10.1128/JCM.41.12.5718-5725.2003. PMID: 14662966; PMCID: PMC308978.
7. Chakraborty, Subhankari & Mahapatra, Santanu & Roy, Manjusri. (2011). Isolation and Identification of Vancomycin Resistant Staphylococcus aureus from Post Operative Pus Sample. Al Ameen Journal of Medical Sciences. 4. https://www.researchgate.net/publication/50853369_Isolation_and_Identification_of_Vancomycin_Resistant_Staphylococcus_aureus_from_Post_Operative_Pus_Sample
8. Clinical and Laboratory Standard Institute. Performance Standard for Antimicrobial Susceptibility Testing: Eighteenth Informational Supplement; M100S. Wayne, PA, USA: CLSI; 2017
9. Gupta, Lovely & Agarwal, Mohini & Bala, Kumud. (2015). NASAL CARRIAGE OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) IN HEALTH CARE WORKERS AND HEALTHY INDIVIDUALS IN A TERTIARY CARE HOSPITAL. International Journal of Pharmacy and Biological Sciences. 5. 2321-3272.
10. Rongpharpi SR, Hazarika NK, Kalita H. The prevalence of nasal carriage of Staphylococcus aureus among healthcare workers at a tertiary care hospital in assam with special reference to MRSA. J Clin Diagn Res. 2013 Feb;7(2):257-60. doi: 10.7860/JCDR/2013/4320.2741. Epub 2013 Feb 1. PMID: 23543837; PMCID: PMC3592287.
11. Shibabaw, A., Abebe, T. & Mihret, A. Nasal carriage rate of methicillin resistant Staphylococcus aureus among Dessie Referral Hospital Health Care Workers; Dessie, Northeast Ethiopia. Antimicrob Resist Infect Control 2, 25 (2013). https://doi.org/10.1186/2047-2994-2-25
12. Shrestha B, Pokhrel BM, Mohapatra TM. Staphylococcus aureus nasal carriage among health care workers in a Nepal Hospital. Braz J Infect Dis. 2009 Oct;13(5):322. doi: 10.1590/S1413-86702009000500001. PMID: 20428628
13. Albrich WC, Harbarth S. Healthcare workers: Source, vector or victim of MRSA. Lancet Infect. Dis. 2008; 8: 289-301.
14. Edward A, Bell Pharm D, BCPS. Mupirocin: an effective choice for the reduction of nasal carriage and transmission during outbreaks. Infectious disease in children. Pediatric Annals. 2007