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Original Research

To investigate the risk factors associated with nasal colonisation of Methicillin Resistant Staphylococcus Aureus (MRSA) and the pattern of drug sensitivity

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ABSTRACT:
Aim: To investigate the risk factors associated with nasal colonisation of Methicillin Resistant Staphylococcus Aureus (MRSA) and the pattern of drug sensitivity. **Material and methods:** A total of 150 patients admitted in medicine ward were chosen for the study. Study population consisted of patients ≥18 years and both sexes admitted in general medicine ward during the study period. Culture was performed from anterior nares within 48 hours after admission to identify patients colonized with MRSA or MSSA. Only those patients who were negative for MRSA colonisation at the time of admission were further taken up for the study. Patients with pre-existing risk factors for MRSA colonisation were not included in the study. **Results:** Of total 150 subjects, 100 were male and remaining 50 were female. Mean age of study subjects was 37.99 ±6.85 years. Study subjects had a spectrum of pathology/ infections viz. Anemia 25(16.67%), Cardiac disease 18(12%), Chronic liver disease 12(10%), Diabetes 12(10%) and malaria 12(10%) etc. Out of 150 subjects, 20 (13.33%) individuals were infected with MRSA, whereas 10 (6.67%) had MSSA infection. Sterile nasal swab was reported in 100 (66.67%). MRSA carriage was common with use of steroids [OR 6.25 (95%CI 3.58-12.85)], Chronic kidney disease [OR 5.25 (95%CI 21.84-11.52)] and alcoholism [OR 3.15 (95%CI 1.05-4.63)]. **Conclusion:** The incidence of MRSA infection among hospitalised patients was found to be 13.33%. The risk variables that demonstrated statistical significance for MRSA were the use of steroids, the presence of Chronic renal disease, and drinking. Given the significance of each patient, it is crucial to maintain a high level of suspicion for MRSA.
Keywords: MRSA, Nasal colonisation, Culture, Risk factors, Antibiotic

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INTRODUCTION

Staphylococcus aureus (*S. aureus*) is a normal flora of moist squamous epithelium of the anterior nares. Majority of the populations (60 %) are intermittent carriers while 20 % of the population is always colonized with *S. aureus* and 20 % of populations never carry this organism [1]. The evidence suggests that the populations harboring *S. aureus* and its methicillin resistant (MRSA) strains are at higher risk for developing invasive infection [2]. A range of minor as well as life threatening conditions like skin infections (pimples, impetigo, boils, cellulitis, folliculitis, carbuncles, scalded skin syndrome, abscesses), pneumonia, meningitis, osteomyelitis, endocarditis, toxic shock syndrome (TSS), and septicemia can be caused by *S. aureus* [3]. Coagulase negative *Staphylococcus* species (CoNS) act as the most common causative agents of nosocomial bacteremia [4]. Methicillin resistant Staphylococcus aureus (MRSA) is an important pathogen worldwide in health care settings. Infections caused by MRSA are difficult to treat and impose great financial burden on health care [5]. Approximately 40% of nosocomial infections in India are caused by MRSA. Almost any site can be infected by MRSA, commonest are blood stream infections, skin and soft tissue infections and pneumonia [6,7]. Hospitalised patients are at increased risk to acquire MRSA colonisation and

subsequent infections. In hospital environment patients usually get colonised with MRSA either via unclean hands of health care workers or by contaminated medical equipment and fomites [8]. Certain risk factors in hospitalised patients increase the risk for MRSA colonisation like indwelling catheters, hemodialysis, immunocompromised state etc [9]. Infections with resistant organisms are notorious to impart significant health and economic consequences [10]. In this landscape of changing epidemiology of MRSA infections, a study addressing this knowledge gap was obligatory. Thus this study was planned to study the prevalence and associated risk factors for MRSA colonisation in hospitalised patients.

MATERIAL AND METHODS

This was a cross sectional conducted at a rural tertiary care teaching hospital. A total of 150 patients admitted in medicine ward were chosen for the study. Study population consisted of patients ≥18 years and both sexes admitted in general medicine ward during the study period. Culture was performed from anterior nares within 48 hours after admission to identify patients colonized with MRSA or MSSA. Only those patients who were negative for MRSA colonisation at the time of admission were further taken up for the study. Patients with pre-existing risk factors for MRSA colonisation were not included in the study. All samples were collected under aseptic conditions following recommended procedures. Individuals with cultures growing any other organism simultaneously along with MRSA/MSSA were excluded. The clinical details of each patient were noted on a pre-structured proforma. Patients were enquired about the presence of any associated risk factors like previous hospitalisation (30 days), duration of hospital stay, previous surgery, previous antibiotic use etc. Nasal swabs were collected from both anterior nares with the help of moistened cotton swabs. Swabs were collected at the time of admission and after 48 hrs of admission and transported immediately to Microbiology laboratory for culture and sensitivity. Swabs were processed for gram staining and culture. Culture was put on blood agar plates and were incubated at 37^0C for overnight. Growth was identified by standard biochemical tests. Antimicrobial susceptibility testing was done by Kirby-Bauer disc diffusion method. Cefoxitin resistant strains were taken as MRSA. Isolation of MRSA from nasal swabs in absence of any systemic signs of infection was considered as colonisation. Before commencement of study ethical clearance was taken from Institutional ethical committee. Informed consent was taken from each patient. Patients' data were anonymized to maintain confidentiality. Categorical variables were summarized by frequency and percentage. Continuous variables were summarized using mean and SD (for normally distributed variables). Chi-squared test was used as test of association between two categorical variables whereas OR with 95% CI was used to report the strength of association between them. All the data were analysed using SPSS 25.0. A P-value <0.05 was considered statistically significant.

RESULTS

Of total 150 subjects, 100 were male and remaining 50 were female. Mean age of study subjects was 37.99 ±6.85 years. Study subjects had a spectrum of pathology/ infections viz. Anemia 25(16.67%), Cardiac disease 18(12%), Chronic liver disease 12(10%), Diabetes 12(10%) and malaria 12(10%) etc. (Table 1)

Table1: Basic profile of the patients

Basic Profile	Number	Percentage
Gender		
Male	100	66.67
Female	50	33.33
Age		
Mean	37.99 ±6.85	
Chronic liver disease	15	10
Poisoning	5	3.33
Anemia	25	16.67
Tuberculosis	10	6.67
Diabetes mellitus	15	10
CVA	15	10
COPD	13	8.67
Chronic kidney disease	7	4.67
Malaria	15	10
Cardiac disease	18	12
Others	12	8
Total	**150**	**100**

Out of 150 subjects, 20 (13.33%) individuals were infected with MRSA, whereas 10 (6.67%) had MSSA infection. Sterile nasal swab was reported in 100 (66.67%). (Table 2).

Table 2: Outcome of nasal swab culture

	Number	Percentage
Sterile	100	66.67
Culture Positive	50	33.33
MRSA	20	13.33
MSSA	10	6.67
Micrococcus	8	5.33
Coagulase negative staphylococcus	6	4
Gram negative bacteria	4	2.67
Diphtheroids	2	1.33

MRSA carriage was common with use of steroids [OR 6.25 (95%CI 3.58-12.85)], Chronic kidney disease [OR 5.25 (95%CI 21.84-11.52)] and alcoholism [OR 3.15 (95%CI 1.05-4.63)]. (Table 3).

Table 3: Risk factors associated with MRSA and MSSA infections

Variables	MRSA(N=20)n(%)	MSSA(N=10)n(%)	Odds Ratio(95%CI)
Use of steroids	5(20%)	1(10%)	6.25(3.58-12.85)
Alcoholism	2(10%)	1(10%)	3.15(1.05-4.63)
Diabetes mellitus	3(15%)	1(10%)	1.81(0.71-3.06)
Cardiac disease	2(10%)	2(20%)	0.86(0.28-1.85)
Chronic kidney disease	3(15%)	1(10%)	5.25(1.84-11.52)
CVA	2(10%)	1(10%)	0.91(0.31-3.26)
COPD	1(5%)	1(10%)	1.37(0.31-6.63)
Skin infection in past 12 months	1(5%)	1(10%)	1.81(1.11-3.33)
Anemia	1(5%)	1(10%)	0.83(0.14-2.06)

Table4: Antibiotic susceptibility pattern of MRSA

Antibiotic	Sensitivity
Vancomycin	100
Linezolid	100
Erythromycin	65
Clindamycin	52
Cotrimoxazole	52
Amikacin	77

Vancomycin & linezolid were found to be sensitive in all twenty four patients of MRSA. Clindamycin & Cotrimoxazole were found to be sensitive in half of the MRSA patients. (Table 4)

DISCUSSION

This study was conducted among 150 patients to study the prevalence and associated risk factors for MRSA colonisation among hospitalised patients. In this study we observed that Out of 150 subjects, 20 (13.33%) individuals were infected with MRSA, whereas 10 (6.67%) had MSSA infection. Sterile nasal swab was reported in 100 (66.67%). The result of this study is in agreement with previous community- based study conducted by Chatterjee et al. He found a slightly higher rate of 52.3% [11]. However, a lower rate of colonization (compared to Chatterjee et al.) was found in the study done by Shetty et al.(25%) and Ramana et al. (16%) [12,13]. However, this is in contrast to a study from South India that had reported a prevalence of 74% of CA-MRSA [14]. This lower prevalence of nasal colonization may be attributed to the difference in geographical distribution (underserved poor) and characteristics of population (muslim predominant) in this study as well as other factors such as sampling technique, its transportation, different culture media, and methods of isolation and identification of S. aureus and MRSA. In this study, it was observed that MRSA carriage was common with use of steroids, Chronic kidney disease and alcoholism. Infections predominated in both the groups, proportions being 50% for MRSA, in concurrence with other study [15]. However, MRSA was associated with significantly higher odds of Skin infection in past 12 months, COPD and Diabetes mellitus, which reiterate the findings of previous studies [16]. Prior receipt of antibiotics is an established risk factor that selects for drug-resistant MRSA and facilitates colonization and infection. However, we could not assign a particular class of antibiotics; the data could not be ascertained with certainty in all patients as available prescription prior to the hospitalization was uniformly poor in the study setting. A similar finding was recorded by Hanberger H et al. in his study among forteen thousand adult ICU patients, MRSA was associated with cancer and chronic renal failure [17]. In this

study, it was observed that Vancomycin & linezolid were found to be sensitive in all twenty four patients of MRSA. Clindamycin & Cotrimoxazole were found to be sensitive in half of the MRSA patients. This is in contrast to the study by Ramana et al [13].and Reta et al [18]. Reta et al. found that 100% resistance to penicillin but only 11.8% resistance to co-trimoxazole. Whereas, Ramana et al. found that 100% isolates were resistance to penicillin but only 14.3% resistance to co-trimoxazole. Ramana et al. also found that gentamicin being the highest susceptibility rate followed by co-trimoxazole, erythromycin, and tetracycline. The lower level of resistance to few antibiotics among the rural population may be attributed to the non-availability of medical practitioners and less use of over-the- counter sale of the drugs attributed to underserved population.

CONCLUSION

The incidence of MRSA infection among hospitalised patients was found to be 13.33%. The risk variables that demonstrated statistical significance for MRSA were the use of steroids, the presence of Chronic renal disease, and drinking. Given the significance of each patient, it is crucial to maintain a high level of suspicion for MRSA. Early identification of MRSA, particularly in individuals with risk factors, is essential. Prompt management including the use of suitable antibiotics and source control measures is necessary to ensure the survival of these patients.

REFERENCES

1. Hamdan-Partida A, González-García S, de la Rosa García E, Bustos-Martínez J. Community-acquired methicillin-resistant Staphylococcus aureus can persist in the throat. Int J Med Microbiol. 2018;308(4):469-75. doi: 10.1016/j.ijmm.2018.04.002, PMID 29661650.
2. Ansari S, Gautam R, Shrestha S, Ansari SR, Subedi SN, Chhetri MR. Risk factors assessment for nasal colonization of Staphylococcus aureus and its methicillin resistant strains among pre-clinical medical students of Nepal. BMC Res Notes. 2016 April 12;9:214. doi: 10.1186/s13104-016-2021-7, PMID 27068121, PMCID PMC4828777.
3. Adhikari RP, Shrestha S, Barakoti A, Amatya R. Inducible clindamycin and methicillin resistant Staphylococcus aureus in a tertiary care hospital, Kathmandu, Nepal. BMC Infect Dis. 2017;17(1):483. doi: 10.1186/s12879-017-2584-5, PMID 28693489.
4. von Eiff C, Becker K, Machka K, Stammer H, Peters G. Nasal carriage as a source of *Staphylococcus aureus* bacteremia. N Engl J Med. 2001;344(1):11-6. doi: 10.1056/NEJM200101043440102, PMID 11136954.
5. John B. Experimental staph vaccine broadly protective in animal studies. NIH. Archived from the original on 5 May 2007. [retrieved Jul 28 2007].
6. Wertheim HF, Melles DC, Vos MC, van Leeuwen W, van Belkum A, Verbrugh HA, et al. The role of nasal carriage in *Staphylococcus aureus* infections. Lancet Infect Dis. 2005;5(12):751-62. doi: 10.1016/S1473-3099(05)70295-4, PMID 16310147.
7. Ansari S, Nepal HP, Gautam R, Rayamajhi N, Shrestha S, Upadhyay G et al. Threat of drug resistant *Staphylococcus aureus* to health in Nepal. BMC Infect Dis. 2014;14:157. doi: 10.1186/1471-2334-14-157, PMID 24655316.
8. Legese H, Kahsay AG, Kahsay A, Araya T, Adhanom G, Muthupandian S, et al. Nasal carriage, risk factors and antimicrobial susceptibility pattern of methicillin resistant Staphylococcus aureus among healthcare workers in Adigrat and Wukro hospitals, Tigray, Northern Ethiopia. BMC Res Notes. 2018;11(1):250. doi: 10.1186/s13104-018-3353-2, PMID 29685170.
9. Al-Humaidan OS, El-Kersh TA, Al-Akeel RA. Risk factors of nasal carriage of Staphylococcus aureus and methicillin-resistant Staphylococcus aureus among health care staff in a teaching hospital in central Saudi Arabia. Saudi Med J. 2015;36(9):1084-90. doi: 10.15537/smj.2015.9.12460, PMID 26318466.
10. Castro A, Komora N, Ferreira V, Lira A, Mota M, Silva J, et al. Prevalence of Staphylococcus aureus from nares and hands on health care professionals in a Portuguese Hospital. J Appl Microbiol. 2016;121(3):831-9. doi: 10.1111/jam.13186, PMID 27206682.
11. Chatterjee SS, Ray P, Aggarwal A, Das A, Sharma M. A community- based study on nasal carriage of Staphylococcus aureus. Indian J Med Res. 2009;130(6):742-8. PMID 20090137.
12. Shetty V, Trumbull K, Hegde A, Shenoy V, Prabhu R, K S, et al. Prevalence of community- acquired methicillin- resistant Staphylococcus aureus Nasal colonization among children. J Clin Diagn Res. 2014;8(12):DC12-5. doi: 10.7860/JCDR/2014/9986.5276, PMID 25653946.
13. Ramana KV, Mohanty SK, Wilson CG. Staphylococcus aureus colonization of anterior nares of school going children. Indian J Pediatr. 2009;76(8):813-6. doi: 10.1007/s12098-009-0159-1, PMID 19562273.
14. Eshwara VK, Munim F, Tellapragada C, Kamath A, Varma M, Lewis LE, et al. Staphylococcus aureus bacteremia in an Indian tertiary care hospital: observational study on clinical epidemiology, resistance characteristics, and carriage of the Panton-Valentine leukocidin gene. Int J Infect Dis. 2013;17(11):e1051-5–e1055. doi: 10.1016/j.ijid.2013.06.002, PMID 23891294.
15. Joshi S, Ray P, Manchanda V, Bajaj J, Chitnis D, Gautam V. Methicillin resistant Staphylococcus aureus (MRSA) in India: prevalence & susceptibility pattern. Indian J Med Res. 2013;137(2):363-9. PMID 23563381.
16. Singh S, Malhotra R, Grover P, Bansal R, Galhotra S, Kaur R, et al. Antimicrobial resistance profile of methicillin-resistant Staphylococcus aureus colonizing the anterior nares of health-care workers and outpatients attending the remotely located tertiary care hospital of North India. J Lab Phys. 2017;9(4):317-21. doi: 10.4103/JLP.JLP_8_17, PMID 28966498.
17. Hanberger H, Walther S, Leone M, Barie PS, Rello J, Lipman J, et al. Increased mortality associated with methicillin-resistant Staphylococcus aureus (MRSA) infection in the intensive care unit: results from the EPIC II study. Int J Antimicrob Agents. 2011;38(4):331-5. doi: 10.1016/j.ijantimicag.2011.05.013, PMID 21798720.

18. Reta A, Gedefaw L, Sewunet T, Beyene G. Nasal carriage, risk factors and antimicrobial susceptibility pattern of methicillin resistant Staphylococcus aureus among school children in Ethiopia. J Med Microbiol Diagn. 2015;4:177.