

High prevalence of MRSA in Indian Hospital Setting: A large 3-year observational study

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Abstract-

Objectives

We determined the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) nasal carriage upon hospital discharge, among children who were screened at admission for nasal *S. aureus* carriage between January 2020 and January 2023. We also aimed to evaluate the prevalence of MRSA carriers without the standard risk factors.

Methods

We conducted an observational study to determine the prevalence of MRSA nasal carriage among patients who were screened at the time of admission for nasal *S. aureus* carriage January 2020 and January 2023. All samples were cultured using chromogenic agar plates.

Results

In total, 702 nasal swabs were obtained from 2826 patients. Overall, *S. aureus* was detected in 105/702 patients of whom 61 were MRSA. Results of the questionnaire revealed that 18 of the 97 patients (18.5 %) had no known risk factors for MRSA carriage.

Conclusion

Our study revealed a very high prevalence of MRSA carriage upon hospital admission over a 3 years period. This calls for a restrictive antibiotic prescription policy.

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the leading pathogens causing infections in patients admitted to hospitals all over the world. In order to prevent transmission of MRSA in hospital settings, a 'Search and Destroy (S&D) policy' has been applied in the north European Countries. (1) Scandinavian countries that have implemented S&D policy with astute use of antibiotics have reportedly maintained a low endemic levels of MRSA. (2) (3) (4)

S&D policy focuses on isolation of patients at increased risk for MRSA carriage, wearing of personal protective equipment (PPE) by Health Care Workers (HCW), disinfection of the room after discharge of these patients, measures for outpatients in case of extensive physical contact between HCW and patient during the visit. (1)

However, no S&D policy is generally in place in healthcare institutes across India. An observational study was carried out. There are multiple contributing factors, which include cost burden, requirement of resource intense setting such as testing facility, availability of additional trained human resource to screen, enforce and monitor S&D policy, high vigilance in outdoor settings, overload of duties in already overburdened HCWs and finally lack of awareness regarding the menace of MRSA.

This study was designed to evaluate prevalence of MRSA in hospitalized children over a three year period. By extension, the objective of this study was to estimate potential risk of MRSA in the Indian setting. We entertained the possibility that awareness regarding the prevalence of MRSA and associated heightened risk of increased morbidity and mortality, will propel the Indian policy makers and healthcare leaders to consider S&D policy.

Methods

This observational study was performed in the DACJ Hospital, DACH, a tertiary care pediatric specialty hospital in the north part of India. The study population consisted of all patients who were hospitalized between January 2020 and January 2023. Screening was performed on the day of admission in all patients in the emergency department itself. All *S. aureus* carriers received treatment with mupirocin nasal ointment and chlorhexidine soap before shifting to the ward or critical care floor. (5)

Nasal swabs were collected during preoperative assessments using the ICMR approved nasal swab kit (Recombigen Laboratories Private Limited). Presumptive *S. aureus* colonies were confirmed with a latex agglutination test (Oscar Slide Test Latex Kit for Hospital), and DNase (DNase agar; Finecare Kit). Antibiotic susceptibility testing was performed using an automated system (Vitek 2, bioMérieux, France) and MRSA confirmation was completed by detecting staphylococcal protein A (spa), the gene for methicillin resistance (mecA), and staphylococcal cassette chromosome (SCCmec) by PCR. (RotorGeneQ, Qiagen).

When nasal carriage of MRSA was detected, a questionnaire was conducted by the hospital infection control specialist to assess the presence of potential risk factors for MRSA carriage. The determination of risk factors was derived from original article "Risk Factors Associated with Methicillin-resistant *Staphylococcus aureus* Infection in Children" endorsed by the Indian Academy of Pediatrics. (6)

Ethics statement

The data used in this study were part of routine practices in the DACH hospital and did not require approval from an ethics committee. The data was anonymized and analysed.

Results

In total, MRSA carriage was assessed in 702 admissions (of 2826 patients). In 46 tests (6.6%) no result could be obtained because no growth was observed on the blood agar. Therefore 656 admissions (93.4%) were included in the analysis (Table 1).

Overall, upon hospital admission *S. aureus* was detected in 421/656 patients (64.2%; 95% CI 49.3–69.5%) of whom 105 were MRSA (24.9% 95% CI 21.4–26.4%). Of the 105 MRSA carriers who were identified, 61 (58.1%) had known risk factor for MRSA carriage, and 44 (41.9%) had no known risk factors as described in the Indian Academy of Pediatrics original study. (5)

Table 1. Sample distribution and characteristics of the preadmission nasal screening for *Staphylococcus aureus* nasal carriage, 2020-2023

	2020-21	2021-22	2022-23
No. of screening samples (% of overall samples)	212 (30.2)	286 (40.7)	204 (29.1)
Samples excluded (% of total excluded)	21 (45.6)	12 (26.1)	13 (28.3)
Samples included (% of total included)	191 (29.1)	274 (41.7)	191 (29.2)
Included Samples, Age in years, median (range)	3.2 (2.9-3.6)	2.8 (2.6-3.5)	3.1 (2.7-3.20)
No. of males (%)	103 (53.9)	164 (59.9)	104 (54.4)
Presenting complaints			
No. of CNS presentations with Seizures/Headache (%)	42 (29.3)	53 (37.1)	48 (33.6)
No. of GI presentations with Nausea/Vomiting/Diarrhea/Pain Abdomen (%)	21 (24.7)	26 (30.6)	38 (44.7)
No. of RS presentations with Cough/Cold/Coryza (%)	31 (27.7)	54 (48.2)	27 (24.1)
No. of CVS presentations with CHF/abnormalities in 2D-Echo (%)	23 (23)	54 (54)	23 (23)
No. of Other presentations with Trauma/Shock/Fever (%)	74 (34.3)	87 (40.3)	55 (25.4)
MRSA carriers (%)	38 (36.2)	26 (24.7)	41 (39.1)
With risk factors (%)	21 (34.5)	14 (22.9)	26 (42.6)
Without known risk factors (%)	17 (38.6)	12 (27.3)	15 (34.1)

DISCUSSION

In this three years long study among more than 2800 patients screened upon hospital admission between 2020 and 2023, the overall prevalence of nasal carriage of MRSA was 16%. This prevalence is very high and there was no statistically significant changes in this prevalence over the years. This prevalence is much higher than the reported MRSA prevalence at admission in several reports from other countries (range 1.1–7.3%). (7) (8) (9) (10) (11)

This study showed that the majority of the MRSA carriers (61/105 patients; 58.1%) had known risk factor for MRSA carriage, whereby the prevalence of MRSA carriers with and without risk factors remained constant over the years.

It should be noted that the MRSA risk profile from our study population (hospitalization in prior 12 months, exanthematous illness (fever with rash) in prior 12 months, history of minor trauma causing skin discontinuity, antibiotic usage in prior 12 months, immunosuppressant usage, contact with potential *S. aureus* infected patient) may differ from that of the general population in India, and from other hospital settings. Our findings are further supported by the fact that during the study period, there has been no increase in the number of (community acquired) invasive infections caused by MRSA in the DACH Hospital: the proportion of MRSA among all cases of *S. aureus* bacteraemia was very low (26/656; 3.9%, data not shown). Of these, thirteen (50%) were community-onset (6 in 2020-21, 3 in 2021-22 and 4 in 2022-23). In summary, our study showed a sustained high prevalence of MRSA carriage upon hospital admission over a period of 3 years. This indicates that, further evidence must be gathered to confirm the high overall prevalence of MRSA, and if the S&D policy could be effective in Indian setting.

REFERENCES:

1. Dutch Workingparty on Infection Prevention. MRSA hospital. 2012. <http://www.wip.nl>.

2. L.G.M. Bode, H.F.L. Wertheim, J.A.J.W. Kluytmans, D. Bogaers-Hofman, C.M.Vandenbroucke-Grauls, R. Roosendaal, et al. Sustained low prevalence of methicillin-resistant *Staphylococcus aureus* upon admission to hospital in The Netherlands. *J Hosp Infect*, 79 (2011), pp. 198-201.
3. P. Elstrøm, O. Kacelnik, T. Bruun, B. Iversen, S.H. Hauge, P. Aavitsland. Methicillin-resistant *Staphylococcus aureus* in Norway, a low-incidence country, 2006–2010. *J Hosp Infect*, 80 (2012), pp. 36-40.
4. Dutch Institute for Public Health and Environment (RIVM). SWAB. NethMap 2018, Consumption of antimicrobial agents and antimicrobial resistance among medically important bacteria in The Netherlands (2018).
5. L.G.M. Bode, J.A.J.W. Kluytmans, H.F.L. Wertheim, D. Bogaers, C.M.Vandenbroucke-Grauls, R. Roosendaal, et al. Preventing surgical-site infections in nasal carriers of *Staphylococcus aureus*. *New England J Med*, 362 (2010), pp. 9-17.
6. Senthilkumar K, Biswal N, Sistla S. Risk factors associated with methicillin-resistant *Staphylococcus aureus* infection in children. *Indian Pediatr*. 2015 Jan;52(1):31-3. doi: 10.1007/s13312-015-0562-9. PMID: 25638181.
7. A.I. Hidron, E.V. Kourbatova, J.S. Halvosa, B.J. Terrel, L.K. McDougal, F.C.Tenover, et al. Risk Factors for Colonization with Methicillin-Resistant *Staphylococcus aureus* (MRSA) in Patients Admitted to an Urban Hospital: Emergence of Community-Associated MRSA Nasal Carriage. *Clin Infect Dis*, 41 (2005), pp. 159-166.
8. K.A. Davis, J.J. Stewart, H.K. Crouch, C.E. Florez, D.R. Hoshenthal. Methicillin-resistant *Staphylococcus aureus* (MRSA) nares colonization at hospital admission and its effect on subsequent MRSA infection. *Clin Infect Dis*, 39 (2004), pp. 776-782.
9. J.A. Jernigan, A.L. Pullen, L. Flowers, M. Bell, W.R. Jarvis. Prevalence of and risk factors for colonization with methicillin-resistant *Staphylococcus aureus* at the time of hospital admission. *Infect Control Hosp Epidemiol*, 24 (2003), pp. 409-414.
10. J.A. Otter, M.T. Herdman, B. Williams, O. Tosas, J.D. Edgeworth, G.L. French. Low prevalence of methicillin-resistant *Staphylococcus aureus* carriage at hospital admission: implications for risk-factor-based vs universal screening. *J Hosp Infect*, 83 (2013), pp. 114-121.
11. H.B. Santos, D.P. Machado, S.A. Camey, R.S. Kuchenbecker, A.L. Barth, M.B. Wagner. Prevalence and acquisition of MRSA amongst patients admitted to a tertiary-care hospital in Brazil. *BMC Infect Dis*, 10 (2010), p. 328.