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Original Research Article

CLINICO-MICROBIOLOGICAL CORRELATION OF MRSA ISOLATES AND ITS SIGNIFICANCE

Anjali Krishna L[1], Greeshma Hareendranath[2], Chinnu Sajeev[3], Neethu John [4,] Anupama C J[5]

[1]MBBS Intern, Government T D Medical College Alappuzha, Kerala, India.
[2]Associate Professor (CAP), Department of Microbiology, Government Medical College Kottayam, Kerala, India.
[3]Assistant Professor, Department of Microbiology, Government T D Medical College Alappuzha, Kerala, India.
[4]Associate Professor (CAP), Department of Microbiology, Government Medical College Ernakulam, Kerala, India.
[5]Senior Resident, Department of Community Medicine, Government T D Medical College Alappuzha, Kerala, India.

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Corresponding Author:
Dr. Anjali Krishna L,
Email: akkrishnanjali@gmail.com

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ABSTRACT

Background: Staphylococcus aureus is a Gram positive cocci producing a wide spectrum of infections ranging from localized pyogenic infections to life threatening infections in man. MRSA poses problems in clinical practice due to its resistance to the commonly used antimicrobials. In the era of emerging antibiotic resistance, clinico-microbiological correlation and the judicious use of antimicrobials becomes important in the present scenario. The Aim is to describe the clinico-microbiological correlation of MRSA isolates and its significance/outcomes. **Materials and Methods:** This descriptive study was conducted in a tertiary care centre in Kerala with a study population of 30 patients who were reported with MRSA infections from various clinical samples, including pus, blood, urine and respiratory samples. Clinical history and treatment history were recorded by semi-structured questionnaire and case records and were followed up till discharge. Antimicrobial susceptibility test reports were clinically correlated with the clinical conditions and treatment given. **Results:** Our study population included 30 cases in which the pus swab was the most common sample obtained followed by blood sample. Skin and soft tissue infections followed by bloodstream infections accounted for more than 60% of the total cases under study. Department of Nephrology reported the maximum number of MRSA cases (6 cases). Of the total study population, only 37% patients were treated with the suggested anti-MRSA drug protocols, while 19 patients were found to be responding to the routine standard antimicrobials and were observed to be mere colonizers. **Conclusion:** Though being a challenging pathogen and the infections being tedious to control, the majority of the infections were found to be colonisations and hence cautious use of antimicrobials are to be observed.

INTRODUCTION

Staphylococcus aureus is a gram positive cocci producing a wide spectrum of infections ranging from localized pyogenic infections to life threatening infections in man. Methicillin resistance is encoded by Chr mecA gene which alters the PBP present on its cell wall to PBP2a leading to resistance to B lactam antibiotics.[1]

MRSA has serious implications as it has been associated with high morbidity and mortality, excessive health care costs and prolonged hospitalization.[2]

The higher prevalence of MRSA in hospital environments is due to vulnerable patient population, infected or colonized patients acting as reservoirs, increased antimicrobial use as well as any breaches in infection prevention and control measures. Prevalence is usually higher in the ICU settings.

Transmission in health care settings occurs by direct or indirect contact during patient care. Direct transmission occurs from one person to another, mainly through contaminated hands or direct contact with blood or body fluids from an infectious person. Indirect transmission occurs through the transfer of infectious agents through contaminated personal objects or persons.

According to ICMR, prevalence of MRSA was reported to be 42% in 2019. Methicillin resistance

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was found to be 41% in a study done by Joshi S et al,[3] while in another study done by Pushpa et al 30.8% of the total Staphylococcus aureus isolates were found to be MRSA .[4]

In the era of emerging antimicrobial resistance, a study on MRSA is essential. MRSA can be prevented to a great extent by maintaining contact precautions and proper hand hygiene, proper wound care, isolating and cohorting patients, adequate environmental cleaning and decolonisation measures.[5] We therefore decided to conduct this study to explore the correlation between clinical and microbiological profile of MRSA isolates and to assess the outcome of the patients infected with MRSA among patients admitted in a tertiary care centre.

MATERIALS AND METHODS

It was a descriptive study conducted in a tertiary care centre in Kerala with a study population of 30 patients who were reported with MRSA infections from various clinical samples excluding the MRSA positive patients admitted in Neonatal ICU due to restricted permission as part of hospital infection control protocol. Consecutive sampling was done for a period of 2 months from December 2023 to January 2024 after getting approval of from Institutional Ethics Committee.

Sample size was calculated using the formula, 4pq/d2

Substituting prevalence from a previous study [6], p = 36.6%

q=63.4%

d= 20% of p= 7.3

Substituting the values n=174

For finite population N= 30 (30 cases MRSA in two months)

n = n0/ 1+n0/N = 25.8 ~ 30 samples

Data was collected using a semi-structured questionnaire which included the socioeconomic details, history of presenting complaints, history of previous hospitalisation in the recent past, antibiotic usage pattern, no. of days of hospitalization, chronic diseases or co-morbid conditions. Data was collected from patients, bystanders and treating doctors. Additional information was also obtained from the case sheets and laboratory records.

Data collected was entered in excel sheet and analysis was done using SPSS version 26. Quantitative variables were expressed as mean and standard deviation and categorical variables were expressed as frequencies and percentages.

No measures were taken to address the missing data. Descriptive analysis was done.

RESULTS

- The gender distribution of the study population was found to be equal.
- More isolates were detected among the lower socioeconomic strata.
- 87% of the subjects in the study population were aware of hand hygiene practices.
- 23% had history of previous hospitalization.
- Diabetes mellitus was found to be the commonest comorbid condition associated with MRSA infections.
- Majority of the patients with MRSA isolation was from the department of Nephrology.

Table 1: MRSA distribution in different age groups

Age Group	Number isolated	Percentage (%)
Children (upto 12 years)	4	13
Adults	26	87
Total	30	100

Table 2A: MRSA isolations- sample wise distribution

Sample	MRSA Isolated	%
Pus Swab	18	60
Exudates	2	7
Blood	6	20
Urine	2	7
Respiratory specimens	2	7

Table 2B: MRSA isolations- sample-wise distribution in different age groups

Sample	Children (upto 12 years)	Adults	Total
Pus Swab	3	15	18
Exudates	0	2	2
Blood	1	5	6
Urine	0	2	2
Respiratory specimens	0	2	2
Total	4	26	30

Table 3: MRSA distribution from Skin infections

Type of infection	Number	Percentage of infections
SSI	4	29
Pustules	3	21
Abscess	3	21

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Skin erosions	2	15
Ulcer	1	7
Catheter exit site infection	1	7
TOTAL	14	100

Table 4: Repeat samples received on request and the microbiological outcome

Specimen	Total number reported	Repeat sample received	MRSA isolated from the repeat sample
Swab (Skin, Ear, Wound and Pus) and Exudates	20	12	3
Blood	6	2	0

Table 5A: Clinico-microbiological correlation- MRSA positive cases

Age group	No. of MRSA isolated	Not treated with anti-MRSA drugs	Treated with anti-MRSA drugs	Clinical outcome		
				D/d better	D/d, not improved	Expired
Children (upto 12 years)	4	4	0	4	0	0
Adults	26	15	11	25	0	1
Total	30	19	11	29	0	1

Table 5B: Clinico-microbiological correlation and outcomes-MRSA isolation in adults sample wise

Samples	No. of MRSA isolates	Not treated with anti-MRSA drugs	Treated with anti-MRSA drugs		Clinical outcome	
			Systemic	Topical	D/d better	Expired
Pus Swab	15	9	6	0	15	0
Exudate	2	2	0	0	2	0
Blood	5	1	4	0	5	0
Urine	2	2	0	0	2	0
Respiratory specimens	2	1	1	0	1	1
Total	26	15	11	0	25	1

In paediatric cases, 3 swab samples and 1 blood sample were collected. However, all the cases were observed to improve clinically without the inclusion of anti-MRSA drugs.

Antimicrobial susceptibility of MRSA isolates:

Susceptibility to Vancomycin and Linezolid was found to be 100% followed by Gentamicin, Cotrimoxazole and Clindamycin This pattern was observed in pus swabs, exudates as well as blood samples. Respiratory samples from which MRSA was reported, showed resistance to erythromycin but were sensitive to Linezolid and Cotrimoxazole. Urine samples from which MRSA was reported, all were susceptible to Nitrofurantoin, Linezolid, Gentamicin and Cotrimoxazole.

DISCUSSION

Colonisation and infection by MRSA is a widespread and known cause of prolonged hospitalisation, morbidity and mortality in patients with a wide range of conditions, from simple skin and soft tissue infections to life-threatening bloodstream infections.

This study investigated a group of 30 patients who were admitted to different departments and tested positive for MRSA. In this study, MRSA accounted for 0.6% of the total bacterial isolates from various clinical samples tested during the two-month study period. The isolation rate of MRSA in a similar study conducted by Pushpa et al was found to be 2.9%,[4] while a study by Kalpana et al observed it to be 4%.[7]

Based on the demographic data obtained in our study, we found no significant correlation between gender and the occurrence of MRSA infections. Our study population consisted of 80% individuals belonging to lower socioeconomic status. Although most of the patients claimed to practise good hand hygiene upon questioning, we did not audit this behaviour in our study, and all these patients were reported with MRSA. Only 23% of the study population had a history of recent hospitalisation. A study by Jorg J Ruhe et al observed previous hospitalisation as one of the risk factors of MRSA infections.[8]

Our study found that diabetes was the most common comorbidity associated with MRSA patients, which was consistent with a previous study done by Vijayamohan N, Nair S P.[9] The highest percentage of MRSA infections were found from the department of Nephrology in the present study.

In our study, 14 cases of MRSA were found from skin and soft tissue infections which included from pustules (3), abscesses (3), ulcer (1), surgical site infections (4) , secondary bacterial infections of skin erosions (2) and catheter exit site infection (1). There were 5 cases of bloodstream infections in the present study in which 3 were Catheter Related Blood Stream Infections (CRBSI). Two cases of sepsis were also noted. Out of the three respiratory infections noted in our study, two patients had consolidation of the lungs. A study conducted by Rekha and Sulekha on lower respiratory tract infections found that 15.4% of the total Staphylococcus aureus isolates were Methicillin resistant.[10] A similar study conducted in Punjab by

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Neerja Jindal et al observed maximum isolates from skin and soft tissue infections followed by blood stream infections which was in accordance with the present study.[11] There were two cases of musculoskeletal infections: one was a case of osteomyelitis and the other was an infected hemiarthroplasty. In another study from central Kerala by Chinnu et al, MRSA accounted for 5.8% of all the chronic osteomyelitis cases.[12] Four MRSA isolates were cases of Chronic Suppurative Otitis Media.

In the present study, 87% of the study population were of adult age group and only 14% were from paediatric age group. [Table 1]

Most of the MRSA isolations were from swabs 18(60%) followed by isolation from blood 6(20%). [Table 2A, 2B]. Another study conducted at a tertiary care centre in Kerala also found most of the isolates from swab, which was similar to our findings.[4]

We received 14 repeat samples of which 12 were pus swabs and exudates, and 2 samples from blood. Only 3 MRSA were yielded in the repeat cultures of swabs while none were isolated from repeat blood samples.

We found a 100% sensitivity to Vancomycin and Linezolid among the MRSA isolates. At our diagnostic facility, Cefoxitin disc diffusion method was used for screening MRSA. Other alternative drugs for MRSA were also simultaneously tested, which showed variable sensitivity pattern.

Only 11 out of the 26 adults were treated with anti-MRSA drugs after clinical correlation; none of the children received treatment using anti-MRSA drugs and were managed as colonisation which was justified as all of these patients were cured of the disease with routine management. [Table VA,VB]. Many other studies have similarly shown high rates of colonisation by MRSA.[13]Given the fact that only 11 patients were actually managed with anti-MRSA drugs, this suggests higher chances of colonisation rather than true infection.

MRSA infections require expensive and prolonged treatment, which can lead to financial strain on patients, in addition to their physical health issues. Majority of the patients and bystanders were unaware of the mode of spread of infections and their respective preventive measures. But in this post-Covid era, we could note remarkable awareness of hand hygiene practices in the study population on questioning.

In this study, it was found that only 11 (37%) out of the total 30 patients who tested positive for MRSA required treatment with anti-MRSA drugs due to clinical conditions. The 11 patients who required anti-MRSA drugs included three cases of surgical site infections, two cases of CRBSI patients undergoing dialysis, a case of Steven Johnson syndrome with skin erosions, one case each of case chronic osteomyelitis, chronic otitis media, necrotizing fasciitis, pneumonia and head trauma. These 11 patients with an average of 2 weeks of hospitalization were initially treated with routine antimicrobials but had failed to improve following which they were started on anti-MRSA drugs. Following this treatment, 10 out of the 11 patients (90%) improved. The remaining 19 patients (63%) were managed with standard treatment protocols without the addition of anti-MRSA drugs, indicating that they were only colonised with MRSA and not infected and eventually recovered from their infections.

This suggests a high likelihood of MRSA reported from clinical samples representing mere colonization which is often not clinically correlated. Due to the alarming rates of multidrug-resistant (MDR) organisms in the recent years, it is crucial to use antimicrobials judiciously. Therefore, it is necessary to carefully correlate clinical and microbiological findings and confirm culture reports with repeat samples in the current situation.

Our study had some limitations. MDR pathogens including MRSA are mostly prevalent in ICU settings. However, due to strict infection control protocols in the hospital, data collection was limited to the wards and respective departments.

Most of the infections in our study were found to be colonizations and were managed with routine antimicrobials. Additionally, we received only fewer repeat samples than the observed cases. The lack of available repeat samples to confirm the diagnosis makes it challenging to establish the clinical significance of MRSA isolates and distinguish colonization from true infection.

CONCLUSION

In this study, we explored the clinico-microbiological correlation of MRSA isolates among patients in a tertiary care centre in Kerala. Our findings highlight the challenge that MRSA poses in clinical settings, particularly concerning the tendency leading to overreporting and the misclassification of colonization as infection. Despite the known severity of MRSA infections, a significant portion of our study population demonstrated mere colonization rather than active infection, suggesting that much of the treatment administered may have been unnecessary. This emphasises the importance of careful clinical correlation when diagnosing and treating MRSA cases. This suggests that microbiological isolation of MRSA may not always represent clinically significant infection and the positive culture results should always be interpreted in the appropriate clinical context.

Notably, the majority of MRSA isolates were obtained from patients with skin and soft tissue infections and most patients achieved favourable outcomes with routine antimicrobial treatments, effectively negating the need for more aggressive anti-MRSA therapies. Furthermore, the data illustrates a concerning trend where a significant

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number of cases arose from lower socioeconomic backgrounds, highlighting the complexities surrounding MRSA in these communities. As we continue to navigate the challenges posed by antibiotic resistance, the necessity for vigilant infection control practices and judicious antimicrobial use remains imperative. Education on hygiene practices, coupled with comprehensive clinical assessments, is essential to managing MRSA infections effectively while alleviating the financial and health burdens on patients. In conclusion, our study serves as a vital call to action for a balanced and assertive approach to MRSA management, advocating for evidence-based treatments that are precisely tailored to individual patient needs.

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