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Prevalence And Antibiotic Susceptibility Patterns Of Staphylococcus Aureus Specific To Methicillin-Resistant Staphylococcus Aureus (MRSA) Isolated From Various Clinical Samples In A Tertiary Care Teaching Hospital.

Dr. B. V. Sivamma, Dr. L. Jayalakshmi, Dr. Masood Bin Khaleel
Professor And HOD, Department Of Microbiology, Guntur Medical College, Guntur.
Professor, Department Of Microbiology, Guntur Medical College, Guntur.
Post-Graduate, Department Of Microbiology, Guntur Medical College, Guntur.

Abstract
Objective: *The present study aimed to evaluate MRSA prevalence among Staphylococcus aureus isolates, identify demographic factors associated with infections, and evaluate susceptibility to various antibiotics.*
Material and Methods: *The study involved various clinically infectious samples. S. aureus was identified using a battery of tests and MRSA was identified utilizing the cefoxitin disk diffusion technique. At the same time, adherence to Clinical and Laboratory Standards Institute protocols guided the execution of the antibiotic susceptibility assay.*
Results: *Out of 19,329 culture samples, 514 S. aureus isolates were detected, with 290(56.5%) being MRSA. Most samples originated from individuals aged >60 years (n=67, 36%), and males accounted for (n=193, 67%) of the isolates. Pus samples notably yielded the highest proportion of MRSA (n=232, 80 %), primarily from the surgery ward (n=120, 41.4%). Remarkably, the strains demonstrated substantial sensitivity (>90%) to linezolid, vancomycin, and doxycycline.*
Conclusion: *In summary, MRSA strains were sensitive to drugs such as linezolid, vancomycin, and doxycycline. The emergence of resistant variants emphasizes the necessity for continuous surveillance and careful antibiotic use, informing antibiotic stewardship programs and clinical strategies for managing MRSA infections in health-care settings.*
Keywords: *MRSA, CA-MRSA, HA-MRSA, Staphylococcus aureus, Gram-positive cocci.*

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I. Introduction

Methicillin-resistant Staphylococcus aureus (MRSA) has become a major therapeutic issue worldwide.

The prevalence of MRSA infections has reached epidemic levels worldwide, leading to fewer treatment options [1]. Extended hospital stays, higher rates of mortality and morbidity, and financial hardship are all linked to MRSA infections [2]. There is a broad spectrum of infections caused by MRSA, extending from minor scalded skin infections to potentially fatal diseases such as endocarditis, severe sepsis, pneumonia associated with ventilator use, osteomyelitis, and fatal necrotizing fasciitis; additionally, toxicoses such as toxic shock syndrome, scalded skin syndrome, food poisoning, and fatal necrotizing pneumonia are also caused by MRSA [3]. The reports have pointed out novel MRSA strains that differ genetically, and these include community-associated MRSA (CA-MRSA) as well as livestock-associated MRSA (LA-MRSA) that were initially viewed as healthcare-related problems, hence giving rise to the term hospital-acquired methicillin-resistant S. aureus (HA-MRSA) [4].

Staphylococcus aureus colonizes the nose and the skin of 30% of the population. Hospitals are the main place where MRSA gets transmitted. MRSA causes most nosocomial infections (25–50%).

Transmission of MRSA is facilitated by a prolonged hospital stay, immunosuppression, and overuse of antibiotics, indwelling catheters, invasive medical devices, drug addiction, and insufficient infection control protocols [5]. The pathogen is widespread nowadays and poses a substantial concern to public health because most anti-staphylococcal medications, such as ciprofloxacin, gentamicin, erythromycin, norfloxacin, and tetracycline are not effective against these isolates [6].

II. Methods

Study design

A prospective study was initiated following approval from the Institutional Ethics Committee (GMC/IEC/034/2025) at the Department of Microbiology, Guntur Medical College, Guntur, from January 2025 to December 2025.

Source of data

All clinically suspected infectious samples were submitted to the diagnostic microbiology laboratory.
Patient demographics, such as age, sex, and clinical sample site, were documented in a pro forma.

Study subjects

Inclusion criteria

Various specimens were included in the study, which include pus/wound swabs, tissue specimens, blood, urine, cerebrospinal fluid, central venous pressure tips, throat swabs, and sputum.

Exclusion criteria

The following criteria were excluded from the study:
Patients on antibiotics
Grossly contaminated samples
Incomplete patient details

Identification of bacterial isolate

All samples were inoculated on blood, chocolate, and MacConkey agar. Identification of S. aureus was done by colony morphology, Gram staining, and the catalase test. Strains positive for coagulase were identified as S. aureus, and methicillin susceptibility was determined using a cefoxitin disk.
A modified Kirby–Bauer disk diffusion method was employed to perform antibiotic susceptibility testing.

A total of 3–5 colonies isolated from the blood agar plates were inoculated in normal saline using a sterile wire to make the bacterial suspension. The turbidness of suspension was then standardized to 0.5

McFarland turbidity standard, after which Muller–Hinton plates were inoculated using sterile cotton swabs, and then antibiotics were placed and incubated at 35°C for 24 h.

The zones of inhibition around the antibiotic disk were measured and reported according to the Clinical and Laboratory Standards Institute guidelines. The cefoxitin-resistant strain was labeled as MRSA, and the
A cefoxitin-sensitive strain was labeled as methicillin-sensitive S. aureus MSSA.

The tested antibiotics reported for MRSA strains were: Vancomycin, linezolid, gentamycin, clindamycin, tetracycline, doxycycline, erythromycin, and nitrofurantoin (for urine culture only).

Statistical analysis

A Chi-square test was utilized for statistical analysis.

III. Results

A total of 514 S. aureus bacteria were isolated from 19,329 culture samples. Of these, MRSA were (n=290, 56.5%), MSSA (n=200, 38.9%), and SoSA /CoNS (Staphylococcus other than Staphylococcus aureus /oagulase-negative Staphylococcus) [n=24, 4.6%] isolates. According to Table 1, the predominant age group was >60 years (67, 23%), followed by 51–60 years (64, 22%), 21–30 years (60, 21%), and < 1–20 years (22, 7.5%). MRSA is more prevalent among the elderly due to weakened immunity, underlying conditions, frequent health-care exposure, and longer hospital stays, necessitating stringent infection control measures. The p-values for the age group 11–20 years are < 0.0001, which is statistically significant.

According to Fig. 1, out of a total of 290 isolates of MRSA, (n=97, 33%) were from females, and (n=193, 67%) were from males. MRSA is more common in males due to biological differences in immune response, behavioral patterns favoring higher-risk activities, and potentially delayed healthcare-seeking behavior.

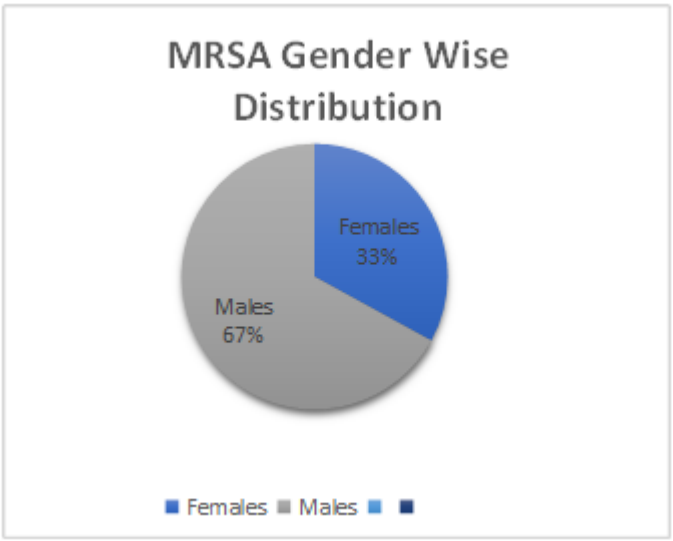

Fig. 1

MRSA was predominantly found in pus samples (n=232, 80%), followed by blood (n=22, 7.5%), sputum (n=13,4.5 %), Urine (n=11,3.8 %), and ET aspirates (n=8, 2.8%). Surgical wards had the highest MRSA isolation rate (n=120, 41.4%), trailed by orthopedics (n=55, 17.9%) and Obstetrics ward (n=29, 10 %). This preference for pus samples aligns with MRSA's association with skin and soft-tissue infections, where pus formation is common. The MRSA were susceptible to vancomycin (n=290, 100%), trailed by linezolid (n=278, 96%), and doxycycline (n=255, 88%). Only 11 MRSA strains were isolated from urine samples; among these, only one strain was sensitive to urine-specific drugs such as nitrofurantoin and nalidixic acid (n=4, 33%).

IV. Discussion

Methicillin-resistant S. aureus (MRSA) represents a substantial contribution to mortality and morbidity in both nosocomial and community-acquired infections [7]. The rise of MRSA, demonstrating resistance to non-β-lactam antibiotics have exacerbated the gravity of this pervasive worldwide issue. This phenomenon significantly complicates the management and containment of MRSA infections,

Table 1: Distribution of MRSA isolates by age

Age-wise distribution	Number and %	p-value
<10	22(7.5)	0.262
11–20	13(4.5)	<0.0001
21–30	60(21)	0.502
31–40	23(8)	0.292
41–50	41(14)	0.462
51–60	64(22)	0.512
>61	67(23)	0.572
Total	290	

The current investigation reveals a notable prevalence of MRSA infection (n=290, 56.5%), consistent with findings from Mao et al.'s study on risk factors associated with HA-MRSA, which reported a 56% incidence of MRSA. However, Garoy et al. reported a higher incidence of 72% in this multicentric study on MRSA prevalence [3,5]. This discrepancy underscores the significant geographical variability observed in MRSA infection frequencies globally, influenced by factors such as comorbidities, length of hospital stays, and adherence to standard precautions [9]. Our study observed a higher prevalence of MRSA among males, which aligns with the observations documented by Adhikari et al. [10]. In addition, comparable outcomes were detected in a study conducted by Choudhury et al. [11] focusing on MRSA antibiotic susceptibility analysis. This male predominance may be attributed to factors such as occupational exposure, behavioral practices, and potential differences in the immune response. According to Table 1, the largest population of the samples was obtained from the age group > 60 years (n=67, 23%), followed by 51–60 years (64, 22%), 21–30 years (60, 21%), and < 1–20 years (22, 7.5%). Our study is concordant with a study by Garoy et al. on MRSA antibiotic susceptibility analysis, a multicentric study.

Staphylococcus infections are more commonly observed in individuals aged above 50 due to factors such as underlying health conditions, healthcare exposure, occupational/lifestyle factors, and age-related

changes in skin integrity, and 21–30 years females due to hygiene practices following LSCS. Most MRSA was isolated from pus samples (n=232, 80 %), followed by blood (n=22, 7.5%), sputum (n=13,4.5 %), Urine (n=11,3.8 %) and ET aspirates (n=8, 2.8%). These results are concordant with research conducted by Choudhury et al., Al-Zoubi et al., and Upreti et al., which also testified pus is the most common source of MRSA isolation, followed by blood [11-13]. S. aureus is frequently found in pus samples and blood due to its pyogenic properties, the tendency to induce skin and soft-tissue infections, the capacity to cause systemic infections such as bacteremia and nosocomial infections, and the rise of resistance to antibiotics.

Our research indicates that the maximum number of MRSA originated from the surgery ward rate (n=120, 41.4%), trailed by orthopedics (n=55, 17.9%) and Obstetrics ward (n=29, 10 %). [Table 2].

Table -2 Ward-wise Distribution of MRSA		
1	Surgery	120 (41.4%)
2	Orthopedics	55 (18.9%)
3	ENT	3 (1.1%)
4	Medicine	26 (8.9%)
5	OBG	29 (10%)
6	Urology	24(8.3%)
7	Pediatrics	27(9.3%)
8	Neurosurgery	06 (2.1)
	Total(n)	290

This observation can be attributed to the colonization of MRSA on the skin, with increased chances of invasion due to invasive procedures commonly performed in surgical departments and the use of indwelling devices in intensive care units of Surgery & Medicine. Comparable patterns were noted by Sanjana et al. [14].

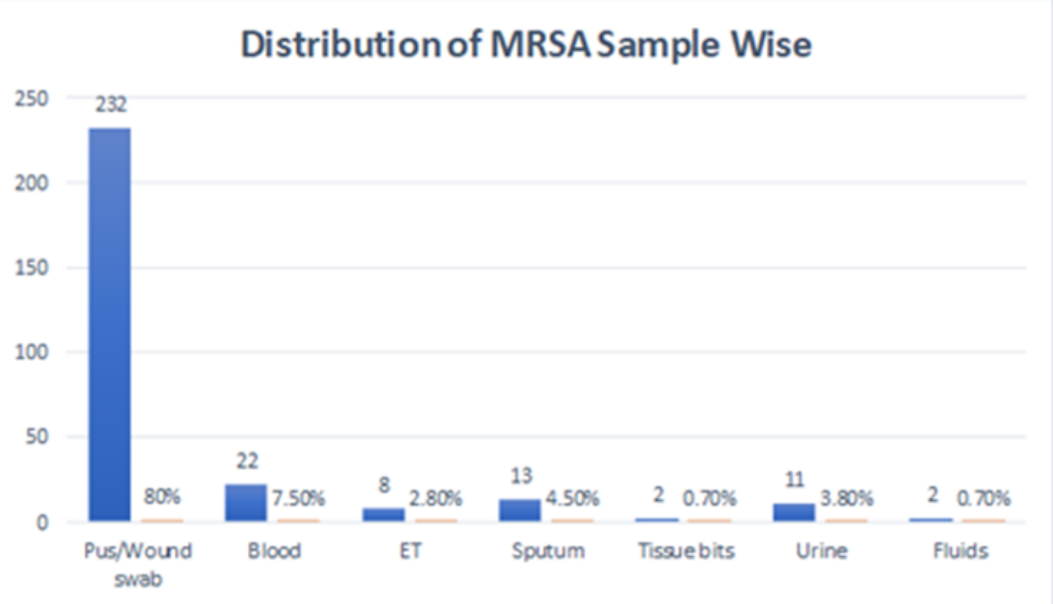

Table 3: Antimicrobial susceptibility profile of MRSA (n=290)			
S. No.	Antibiotic	Sensitive and %	Resistance and %
1	Vancomycin	290(100)	0 (0)
2	Linezolid	278(96)	12 (4)
3	Tetracycline	260 (90)	30 (10)
4	Doxycycline	253 (88)	37 (12)
5	Clindamycin	177 (61)	113 (39)
6	Gentamycin	157 (54)	133 (46)
7	Erythromycin	52 (18)	238 (82)
8	Amoxicillin and clavulanic acid	0 (0)	290 (100)
9	Nitrofurantoin ([only for urine] n=11)	4(36)	7 (64)
10	Nalidixic acid ([only for urine]) n=11)	4(36)	7 (64)

Most MRSA strains were all susceptible to vancomycin, linezolid, doxycycline, and tetracycline according to our findings. In addition, most of the isolates showed gentamycin and clindamycin sensitivity. However, the number of isolates that demonstrated erythromycin susceptibility is small. Only four isolates

exhibited nitrofurantoin sensitivity from urine specimens (Table 3). Our study results were comparable to a similar study performed by Adhikari et al.

The majority of isolates also showed sensitivity to gentamicin and clindamycin, as per Nabi et al., and Naimi et al. with little variations in linezolid susceptibility [10,13,15]. Hospital environments, HCWs, and colonized patients were the main sources of MRSA in hospitals. The principal mode of patient-to-patient spread occurs through the transient carriage of the organism by healthcare workers. Numerous infection regulatory practices, including routine hand hygiene training, compliance evaluations, and heightened MRSA scrutiny of healthcare workers was put in place to address this problem. In addition, strict adherence to the antimicrobial policy was desired. We anticipate a future in which our institute's MRSA numbers will decline as a result of these actions.

V. Conclusion

Our study reveals the antimicrobial susceptibility patterns of MRSA. We discovered that MRSA strains were common and were multidrug-resistant. However, certain antibiotics such as linezolid, vancomycin, and doxycycline remained effective against MRSA. Despite this, the rise of resistant strains underscores the importance of continued surveillance and cautious antibiotic use to effectively combat this global health threat. These findings offer valuable insights for antibiotic stewardship programs and guide clinical strategies to formulate empirical therapy for managing MRSA infections in healthcare settings.

References

[1]. Hassoun A, Linden PK, Friedman B. Incidence, Prevalence, And Management Of MRSA Bacteremia Across Patient Populations: A Review Of Recent Developments In MRSA Management And Treatment. Crit Care. 2017 Aug 14;21(1):211. Doi: 10.1186/S13054-017-1801-3. PMID: 28807042; PMCID: PMC5557425

[2]. Thampi N, Showler A, Burry L, Bai AD, Steinberg M, Ricciuto DR, Et Al. Multicenter Study Of Health Care Costs Of Patients Admitted To Hospital With Staphylococcus Aureus Bacteremia: Impact Of Length Of Stay And Intensity Of Care. Am J Infect Control. 2015 Jul 1;43(7):739 44. Doi: 10.1016/J.Ajic.2015.01.031. PMID: 25769617

[3]. Garoy EY, Gebreab YB, Achila OO, Tekeste DG, Kesete R, Ghirmay R, Et Al. Methicillin-Resistant Staphylococcus Aureus (MRSA): Prevalence And Antimicrobial Sensitivity Pattern Among Patients-A Multicenter Study In Asmara, Eritrea. Can J Infect Dis Med Microbiol. 2019 Feb 6;2019:8321834. Doi: 10.1155/2019/8321834. PMID: 30881532; PMCID: PMC6381584

[4]. Grema HA, Geidam YA, Gadzama GB, Ameh JA, Suleiman A. Methicillin-Resistant Staphylococcus Aureus (MRSA): A Review. Adv Anim Vet Sci. 2015;3(2):79-98. Doi: 10.14737/Journal. Aavs/2015/3.2.79.98

[5]. Mao P, Peng P, Liu Z, Xue Z, Yao C. Risk Factors And Clinical Outcomes Of Hospital-Acquired MRSA Infections In Chongqing, China. Infect Drug Resist. 2019 Nov 27;12:3709-3717. Doi: 10.2147/IDR.S223536. PMID: 31819553; PMCID: PMC6885554

[6]. Tiwari HK, Sapkota D, Sen MR. High Prevalence Of Multidrug-Resistant MRSA In A Tertiary Care Hospital Of Northern India. Infect Drug Resist. 2008;1:57-61. Doi: 10.2147/Idr.S4105. 0. PMID: 21694881; PMCID: PMC3108723

[7]. Dilnessa T, Bitew A. Prevalence And Antimicrobial Susceptibility Pattern Of Methicillin-Resistant Staphylococcus Aureus Isolated From Clinical Samples At Yekatit 12 Hospital Medical College, Addis Ababa, Ethiopia. BMC Infect Dis. 2016 Aug 9;16:398. Doi: 10.1186/S12879-016-1742-5. PMID: 27506613; PMCID: PMC4977752

[8]. Kaur DC, Chate SS. Study Of Antibiotic Resistance Pattern In Methicillin-Resistant Staphylococcus Aureus With Special Reference To Newer Antibiotics. J Glob Infect Dis. 2015 Apr-Jun;7(2):78-84. Doi: 10.4103/0974-777X.157245. PMID: 26069428; PMCID: PMC4448330

[9]. Lee AS, De Lencastre H, Garau J, Kluytmans J, Malhotra-Kumar S, Peschel A, Et Al. Methicillin-Resistant Staphylococcus Aureus. Nat Rev Dis Primers. 2018 May 31;4:18033. Doi: 10.1038/Nrdp. 2018.33. PMID: 29849094

[10]. Adhikari P, Basyal D, Rai JR, Bharati L, Budthapa A, Gharti KP, Et Al. Prevalence, Antimicrobial Susceptibility Pattern, And Multidrug Resistance Of Methicillin-Resistant Staphylococcus Aureus Isolated From Clinical Samples At A Tertiary Care Teaching Hospital: An Observational, Cross-Sectional Study From The Himalayan Country, Nepal. BMJ Open. 2023 May 10;13(5):E067384. Doi: 10.1136/Bmjopen-2022-067384. PMID: 37164471; PMCID: PMC10174000

[11]. Saikia L, Nath R, Choudhury B, Sarkar M. Prevalence And Antimicrobial Susceptibility Pattern Of Methicillin-Resistant Staphylococcus Aureus In Assam. Indian J Crit Care Med. 2009 Jul Sep;13(3):156-8. Doi: 10.4103/0972-5229.58542. PMID: 20040814; PMCID: PMC2823098

[12]. Al-Zoubi MS, Al-Tayyar IA, Hussein E, Jabali AA, Khudairat S. Antimicrobial Susceptibility Pattern Of Staphylococcus Aureus Isolated From Clinical Specimens In The Northern Area Of Jordan. Iran J Microbiol. 2015 Oct;7(5):265-72. PMID: 26719783; PMCID: PMC4695508

[13]. Upreti N, Rayamajhee B, Sherchan SP, Choudhari MK, Banjara MR. Prevalence Of Methicillin-Resistant Staphylococcus Aureus, Multidrug-Resistant And Extended-Spectrum B-Lactamase-Producing Gram-Negative Bacilli Causing Wound Infections At A Tertiary Care Hospital Of Nepal. Antimicrob Resist Infect Control. 2018 Oct 8;7:121. Doi: 10.1186/S13756-018-0408-Z. PMID: 30338059; PMCID: PMC6174564

[14]. Pai V, Rao VI, Rao SP. Prevalence And Antimicrobial Susceptibility Pattern Of Methicillin-Resistant Staphylococcus Aureus [MRSA] Isolates At A Tertiary Care Hospital In Mangalore, South India. J Lab Physicians. 2010 Jul;2(2):82-4. Doi: 10.4103/0974-2727.72155. PMID: 21346902; PMCID: PMC3040090

[15]. Naimi HM, Rasekh H, Noori AZ, Bahaduri MA. Determination Of Antimicrobial Susceptibility Patterns In Staphylococcus Aureus Strains Recovered From Patients At Two Main Health Facilities In Kabul, Afghanistan. BMC Infect Dis. 2017 Nov 29;17(1):737. Doi: 10.1186/S12879-017 2844-4. PMID: 29187146; PMCID: PMC5707873