

## DETECTION OF MRSA FROM THE WOUND SWAB IN TERTIARY CARE HOSPITAL IN EASTERN INDIA

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## Abstract

**Background:** Staphylococcus aureus is a human pathogen with a wide range of disease spectrum which encompasses mild skin and soft tissue infections to severe life-threatening sepsis. With the advent of methicillin-resistant strains, especially in the hospital environment, treatment options have become limited. These strains, being Multidrug Resistant (MDR), lead to higher morbidity and mortality. **Materials and Methods:** This study was conducted in Department of Microbiology at Jagannath Gupta Institute of Medical Sciences and Hospital, Budge, Budge, Kolkata, India. **Result:** This study included a total of 95 cases, comprising 65 males and 30 females. Among the gram-positive isolates, Staphylococcus aureus was the most frequently identified organism, whereas Escherichia coli was the most common among the gram-negative isolates. Additionally, the study found that 86.3% of the Staphylococcus aureus isolates were methicillin-resistant (MRSA). **Conclusion:** This study concludes that continuous surveillance on antimicrobial susceptibility of S. aureus is essential for the detection of emerging trends and the development of appropriate therapeutic strategies.

## INTRODUCTION

Staphylococcus aureus is a common human pathogen responsible for a broad spectrum of diseases, ranging from mild skin and soft tissue infections to severe, life-threatening sepsis. The emergence of methicillin-resistant strains, particularly in hospital settings, has significantly narrowed treatment options. These methicillin-resistant S. aureus (MRSA) strains are often multidrug-resistant (MDR), leading to increased morbidity and mortality rates.<sup>[1]</sup> The World Health Organization (WHO) identifies Hospital Acquired Infections (HAIs) as a growing public health concern with substantial economic implications for both individuals and healthcare systems. Despite advancements in HAI prevention and control over the past decade, the persistence of resilient pathogens continues to hinder eradication efforts and contributes to rising healthcare costs.<sup>[2]</sup> The bacterial flora within hospitals typically includes MDR organisms, which can vary by time and location. A thorough understanding of the hospital's antibiogram is crucial for effectively managing these infections. Rapid diagnostic testing is also essential for identifying the causative agents of HAIs, allowing timely and targeted antibiotic therapy.<sup>[3]</sup> S. aureus is particularly notorious for its diverse resistance mechanisms, with methicillin resistance being the most problematic. MRSA develops through the acquisition of novel DNA that triggers the production

of penicillin-binding protein 2a (PBP2a), which has a low affinity for methicillin and other  $\beta$ -lactam antibiotics.<sup>[4]</sup>

The prevalence of hospital-acquired MRSA (HA-MRSA) within an institution often reflects the overall infection rate and is influenced by factors such as patient influx, ward overcrowding, and healthcare worker (HCW) workload. A key route of MRSA transmission is via the hands of HCWs.<sup>[5]</sup> The primary reservoirs of HA-MRSA are infected and colonized patients. Colonization risk increases with prolonged hospital stays, poor nutritional status, recent or repeated antibiotic use, and the presence of wounds or invasive devices.<sup>[6]</sup> Wound infections are characterized by pus discharge or clinical signs of inflammation—such as elevated temperature, redness, and tenderness—and those caused by HA-MRSA are linked to high rates of morbidity and mortality.<sup>[7]</sup>

This study aimed to detect Methicillin-Resistant Staphylococcus aureus (MRSA) from wound swab samples collected at a tertiary care hospital.

## MATERIALS AND METHODS

**Study Area:** This study was conducted in Department of Microbiology at Jagannath Gupta Institute of Medical Sciences and Hospital, Budge, Budge, Kolkata, India

**Study population:** Total 95 clinical specimens were included in this study.

**Study Duration:** The Duration of study was over a period of one year.

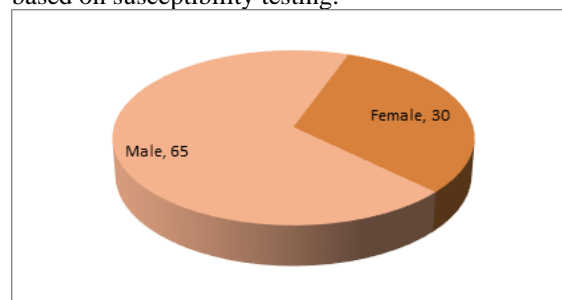
**Data collection:** All clinical specimens were inoculated onto blood agar and MacConkey agar, then incubated at 37°C for 16-18 hours. Bacterial isolates were identified based on colony morphology, microscopic examination, and biochemical tests, including the catalase and coagulase tests (both slide and tube methods). Isolates that appeared as Gram-positive cocci arranged in grape-like clusters on Gram staining and tested positive for both catalase and coagulase were identified as *Staphylococcus aureus*. These isolates were then subjected to antibiotic susceptibility testing.

**Data Analysis:** Data were analyzed by using Microsoft Excel.

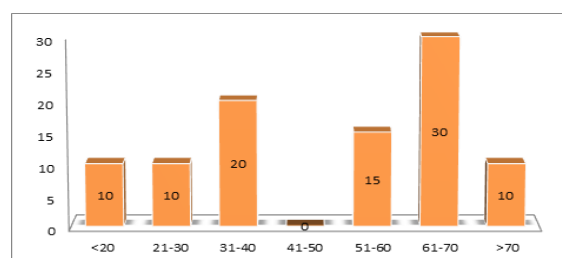
## RESULTS

This study included a total of 95 cases, comprising 65 males and 30 females. Participants ranged in age from under 20 to over 70 years, with the highest number of cases occurring in the 61–70 age group, followed by the 31–40 and 51–60 age groups. Of the 95 clinical specimens collected, 78 were wound swabs and 17 were pus aspirates. Bacterial growth was observed in 36 (37.8%) of the samples, while the remaining showed no growth. Among the positive cultures, 26 isolates were identified as Gram-positive bacteria and 16 as Gram-negative bacteria. *Staphylococcus aureus* was the most commonly isolated Gram-positive organism, whereas *Escherichia coli* was the predominant Gram-negative isolate. Notably, 86.3% of the *Staphylococcus aureus* isolates were found to be methicillin-resistant (MRSA). The antibiotic susceptibility data indicates that Gentamicin is the most effective among the tested antibiotics, with 16 isolates showing susceptibility and only 4 showing resistance. Ciprofloxacin and Levofloxacin also show relatively good effectiveness, each with 11 susceptible isolates, though both have a moderate number of resistant cases (9 and 8 respectively). Linezolid was susceptible for all *Staphylococcus aureus* (22). In contrast, Penicillin and Cefoxitin exhibit the highest resistance rates, with 20 and 19 resistant isolates respectively, and minimal susceptibility. Similarly, Clindamycin, Amoxicillin, and Erythromycin show

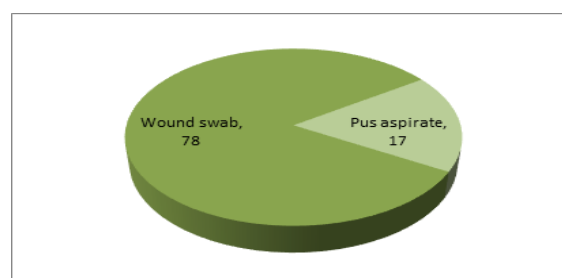
high resistance levels, suggesting limited effectiveness. Overall, the data suggests a concerning level of resistance to several commonly used antibiotics, highlighting the need for careful selection based on susceptibility testing.



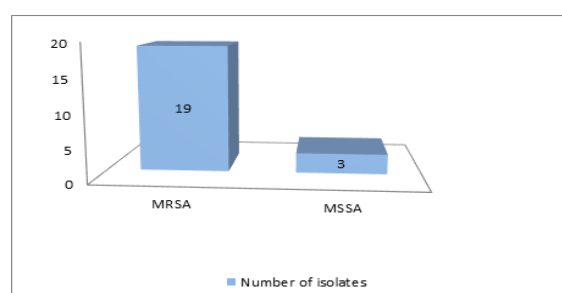
**Figure 1: Distribution of cases according to gender (n=95)**



**Figure 2: Distribution of cases according to age (n=95)**



**Figure 3: Distribution of cases according to specimen (n=95)**



**Figure 4: Distribution of cases according to MRSA**

**Table 1: Distribution of cases according to Growth**

Growth	Number of isolates	
Positive growth	36	37.8%
Negative growth	59	62.2%
Total	95	100%

**Table 2: Distribution of cases according to organism.**

Organism	Number of isolates	
Gram positive bacteria	26	72.3%
Gram negative bacteria	10	27.7%
Total	36	100%

**Table 3: Distribution of cases according to isolate**

Gram positive bacteria	Number	Percentage
Staphylococcus aureus	24	92.3%
Enterococcus	2	7.7%
Gram negative bacteria		
Escherichia coli	6	60%
Proteus spp	2	20%
Pseudomonas spp.	2	20%

**Table 4: Antibiotic Susceptibility pattern of Staphylococcus aureus**

Antibiotics	S	I	R
Cefoxitin	3	0	19
Ciprofloxacin	11	2	9
Clindamycin	6	0	16
Erythromycin	4	2	16
Levofloxacin	11	3	8
Gentamicin	16	2	4
Penicillin	2	0	20
Amoxicillin	5	0	17
Linezolid	22	0	0

## DISCUSSION

Methicillin-Resistant *Staphylococcus aureus* (MRSA) has emerged as a significant global public health concern. Due to the remarkable ability of *Staphylococcus* species to acquire antimicrobial resistance over time, MRSA remains a persistent and evolving challenge. Currently, most MRSA strains are multidrug-resistant, posing substantial clinical difficulties as many antibiotic therapies become ineffective. In light of this, the present study was conducted to determine the prevalence of *S. aureus* and MRSA, along with their antibiotic susceptibility patterns.

Out of 95 clinical specimens analyzed, 36 (37.8%) yielded positive cultures, with *S. aureus* accounting for 24 (25.2%) of the total cases, making it the most predominant pathogen associated with wound infections. These findings are consistent with previous studies by Pandey et al. (2012) and Hussain et al. (2005), who reported bacterial growth rates of 26.1% and 20%, respectively. Such consistency reinforces the notion that *S. aureus* is a frequently isolated pathogen in hospital environments, highlighting the need for ongoing infection control measures.<sup>[8,9]</sup>

Antibiotic susceptibility testing revealed a high rate of resistance to cefoxitin (76%) among *S. aureus* isolates, indicating a substantial prevalence of MRSA. Most isolates also exhibited resistance to  $\beta$ -lactam antibiotics, rendering these drugs largely ineffective. These findings align with global data, where *S. aureus* typically shows high resistance to penicillin but remains uniformly susceptible to vancomycin (Adhikari et al., 2017).<sup>[10]</sup> Resistance to  $\beta$ -lactam antibiotics is primarily attributed to the production of  $\beta$ -lactamase enzymes, which hydrolyze the  $\beta$ -lactam ring, and to the expression of an altered penicillin-binding protein (PBP2a), which has reduced affinity for  $\beta$ -lactams (Richmond, 2000).<sup>[11]</sup> Notably, none of the isolates in this study exhibited resistance to Linezolid. This observation was not similar to other study in which showed 8 isolates

resistant out of 159 isolates. (Asmaa I. AbdAlhafiz et al).<sup>[12]</sup>

To mitigate the impact of MRSA in healthcare settings, it is essential to raise awareness among healthcare workers about MRSA and carrier status. Consistent implementation of infection control strategies is crucial to reduce the burden of MRSA transmission within hospital environments (Holmes et al., 2005).<sup>[13]</sup>

## CONCLUSION

*Staphylococcus aureus* was identified as the most common pathogen responsible for wound infections, with a methicillin resistance prevalence of 76%. Most isolates exhibited susceptibility to gentamicin, while showing resistance to penicillin and amoxicillin. Ongoing surveillance of the antimicrobial susceptibility patterns of *S. aureus* is crucial for monitoring emerging resistance trends and guiding the development of effective treatment strategies.

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