**Original Research Article**

# Prevalence and sensitivity pattern of Staphylococcus aureus from different clinical samples in a Medical College Hospital

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## Abstract

Staphylococcus aureus is important organism responsible for wide variety of infections. The present study was conducted to find the prevalence of Staphylococcus aureus in various clinical samples received at the department of Microbiology, Darbhanga Medical College and to assess its sensitivity pattern. It was observed that 20.9% of the samples were positive and 42.2% of the isolated Staphylococcus aureus were methicillin resistant (MRSA). Most common sample was pus (38.4%) followed by urine (20.9%). 42.2% of the samples were resistant to Cefoxitin, Cefotaxime and Amoxicillin. 60.9% were resistant to Erythromycin and 24.4% to Gentamicin. Monitoring of antibiotic sensitivity is essential for better clinical management and preventing antibiotic resistance.

## Key words

Prevalence, Antimicrobial Sensitivity, Staphylococcus aureus, Medical College.

## Introduction

Staphylococcus aureus is gram positive coccus first identified by Scottish surgeon Alexander Ogston [1]. It is facultative anaerobic in nature and is normal commensal on skin and in nasal passage. It is the common cause of purulent infections including boils, carbuncles, furuncles, sinusitis, otitis media, food poisoning, osteomyelitis, pneumonia and sepsis [2]. It is also a common cause of postoperative and hospital acquired infections and causes high levels of morbidity and mortality [3].

It produces golden yellow colonies in culture and is coagulase positive. It produces a variety of toxins and enzymes including alpha, beta, gamma and delta toxins [4]. It easily becomes resistant to different antibiotics [5]. Methicillin-resistant Staphylococcus aureus is the classical example which was reported in 1961 and as of now various levels of resistance to different antibiotics is being reported from different parts of the country [6]. Indian network for Surveillance of Antimicrobial Resistance (INSAR) group, India in the study conducted in leading hospitals of India found the prevalence of MRSA to be 42% in 2008 and 40% in 2009. They have reported high resistance in MRSA and MSSA isolates to different antibiotics [7].

Continuous monitoring of prevalence and antibiotic sensitivity pattern is vital to control the problem and helps in prevention of emergence of resistance. Since similar study has not been done in this place, hence this study was proposed.

## Aim and objectives

The objectives of the present study were to find the prevalence of Staphylococcus aureus in various clinical samples and to assess its sensitivity pattern.

## Materials and methods

The present study was descriptive cross-sectional in nature conducted at the Department of Microbiology, Darbhanga Medical College between July 2009 to June 2010. All clinical samples submitted in the department for microbiological analysis during data collection period were included in this study e.g. blood, urine, sputum, other body fluids and devices. Ideal aseptic conditions were maintained during collection of sample.

First step included isolation of the organisms from the samples. The specimens were inoculated and cultured on Blood Agar, Nutrient Agar and Mac Conkey Agar by aerobically incubating in the incubator at 37 ˚C for 24 hours. Next step involved identification of isolates by colony morphology, Gram staining, catalase, slide & tube and coagulase tests to confirm for presence of Staph. aureus. Then, the sample was inoculated on culture plates by four flame method and incubated in incubator at 37 ˚C for 24 hours.

Antibiotic sensitivity test was done by Kirby Bauer disc diffusion method according to the recommendations of the Antibiotic Committee of French Society of Microbiology (CA-SFM) [8]. Using the sterile cotton swab, the surface of Mueller Hinton agar plates were streaked. It was allowed to dry. Then, commercially available filter paper disks containing designated amount of antibiotics were gently and firmly applied over the agar plates. It was left at room temperature for one hour to allow diffusion of antibiotics into the agar plate. The plates were incubated at $37^{O}$C for 24 hours. Presence on inhibition zone in the agar plates indicated antimicrobial activity. At 24 hours, the diameter of the inhibition zone was measured in millimetres using a scale. The diameter of the inhibition zone of more than 19 mm indicated the organism to be highly susceptible, that between 14-18 mm to be intermediate and those less than 13 mm indicated the organism to be resistant. The interpretation of antibiotic sensitivity testing was as per CLSI – 2011 guidelines [9].

Data was entered in SPSS v 16.0 and also analyzed using the same. Proportions were expressed as percentages. Difference in proportion was calculated using chi-square test.

The test was considered to be significant for the value of $p \leq 0.05$.

## Results and Discussion

The present cross-sectional study was conducted upon 1233 clinical samples received at the department of Microbiology, Darbhanga Medical College. The prevalence of staphylococcus among all clinical samples was found to be 20.9%. Singh, et al. [10] found the prevalence to be 42.7% while Debnath, et al. [11] found it to be 48.1%. Heyar, et al. [12] found the same to be 17.3%. Among the samples positive for staphylococcus aureus, 57.8% were methicillin sensitive and the remaining 42.2% were methicillin-resistant. In the INSAR study, 40% of the isolates were found to be MRSA [7]. The details are shown in **Table - 1**.

**Table – 1:** Prevalence of Staph aureus.

| **Criteria** | **Number** | **%** |
|---|---|---|
| Total number of samples tested | 1233 | 100% |
| Total number of samples positive for Staph aureus (%) | 258 | 20.9% |
| MSSA (%) | 149 | 57.8% |
| MRSA (%) | 109 | 42.2% |

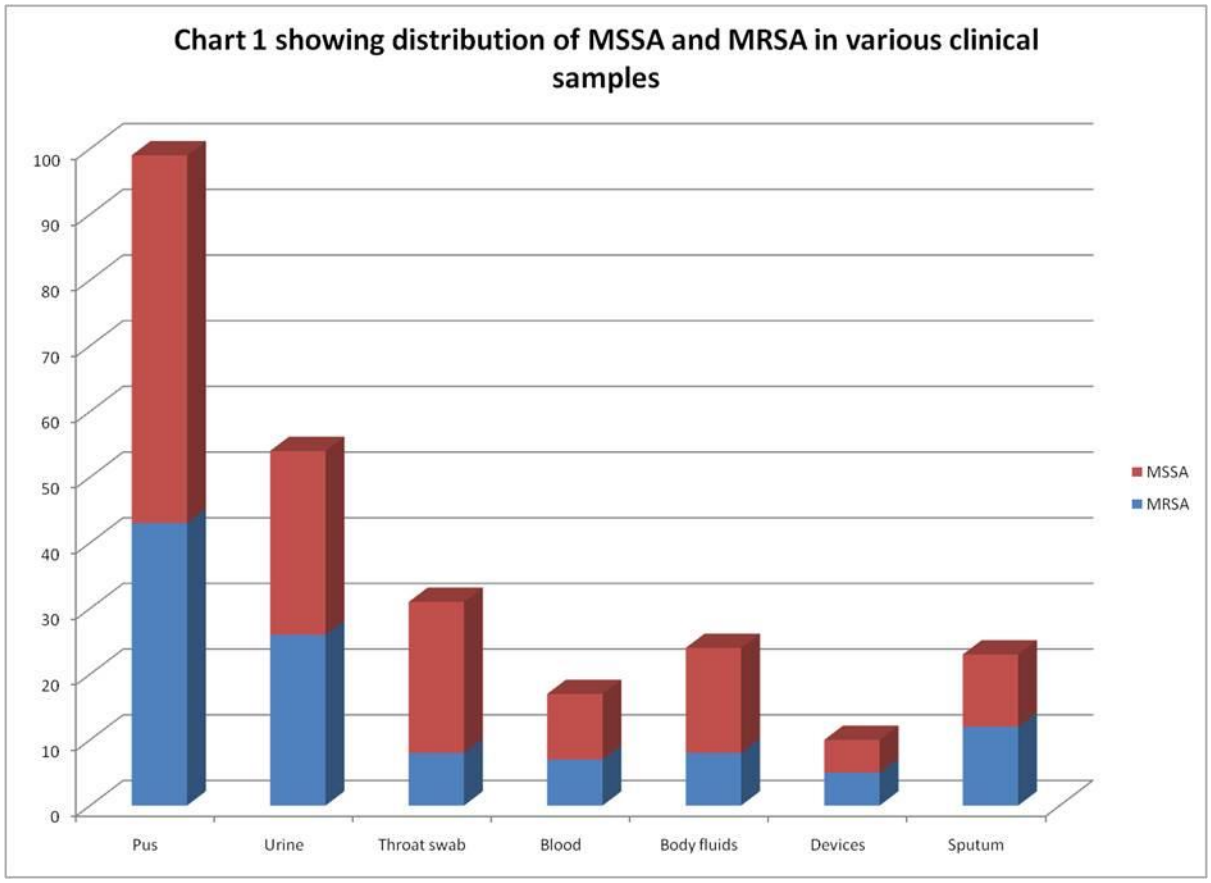
**Table – 2:** Distribution of Staph aureus among various clinical samples.

| **Specimen** | **Sample size** | **% of samples positive for Staph aureus** | **MRSA (%)** | **MSSA (%)** | **Significance** |
|---|---|---|---|---|---|
| Pus | 99 | 38.4 | 43 (43.4%) | 56 (56.6%) | $Chi^2 = 6.22$ |
| Urine | 54 | 20.9 | 26 (48.1%) | 28 (51.9%) | $p = 0.39$ |
| Throat swab | 31 | 12 | 8 (25.8%) | 23 (74.2%) | |
| Blood | 17 | 6.6 | 7 (41.2%) | 10 (58.8%) | |
| Body fluids | 24 | 9.3 | 8 (33.3%) | 16 (66.7%) | |
| Devices | 10 | 3.9 | 5 (50%) | 5 (50%) | |
| Sputum | 23 | 8.9 | 12 (52.2%) | 11 (47.8%) | |
| Total | 258 | 100 | 109 | 149 | |

**Table – 3:** Antibiotic sensitivity pattern.

| **Antibiotic** | **Number of samples sensitive (%)** | **Number of samples resistant (%)** |
|---|---|---|
| Gentamicin | 195(75.6%) | 63(24.4%) |
| Cloxacillin | 169(65.5%) | 89(34.5%) |
| Clindamycin | 203(78.7%) | 55(21.3%) |
| Vancomycin | 244(94.6%) | 14(5.4%) |
| Chloramphenicol | 175(67.8%) | 83(32.2%) |
| Ampicillin | 150(58.1%) | 108(41.9%) |
| Cefotaxime | 161(62.4%) | 97(37.6%) |
| Ciprofloxacin | 126(48.8%) | 132(51.2%) |
| Cotrimoxazole | 95(36.8%) | 163(63.2%) |
| Amoxicillin | 88(34.1%) | 170(65.9%) |
| Penicillin-G | 44(17.1%) | 214(82.9%) |
| Erythromycin | 101(39.1%) | 157(60.9%) |

**Table – 2** and **Figure – 1** show the distribution of Staphylococcus aureus among various clinical samples and its sensitivity to methicillin. It was observed that Staphylococcus aureus was most commonly seen in pus (38.4%) followed by urine (20.9%). Sputum constituted 8.9% while devices comprised of 3.9%. Pus was found to be most common sample by other researchers also including Debnath, et al. [11] (68.7%), Heyar, et al. [12] (45.1%) and Sharma, et al. [13] (39.8%).




MRSA proportion was highest with sputum (52.2%) followed by devices (50%). 48.1 percent of positive urine sample and 41.2 percent of positive blood sample had MRSA. The difference among various samples regarding distribution of MRSA and MSSA was not significant statistically (Chi square=6.22, p=0.39). In the INSAR study [7], proportion of MRSA among Staph aureus samples was similar to the present study including urine (41%), pus (36%), blood (44%) and body fluids (34%). Heyar, et al. [12] also found similar results with proportion of MRSA in Staph aureus positive urine samples being 50.7%, pus (47.4%), blood (40%), sputum (100%) and body fluids (28.5%).

**Table-3** shows antibiotic sensitivity pattern of isolated Staphylococcus aureus. CLSI guidelines [9] indicate that cefoxitin should be used in disc diffusion method as indicator drug for testing for methicillin resistance. In the present study, 42.2% of the samples were MRSA and were resistant to Cefoxitin, Cefotaxime and Amoxicillin. In the INSAR study [7], proportion of MRSA was found to be 40%.

Rate of penicillin resistance was 82.9%. It is similar to the findings of Heyar, et al. [12] (86.4%), Sharma, et al. [13] (81.1%) and Dhanalakshmi, et al. (85.6%). 24.4% samples were resistant to Gentamicin in the present study. Dhanalakshmi, et al. [14] (33.6%) and Heyar, et al. [12] (36.4%) also found similar results while Sharma, et al. [13] in Rajasthan found lower value (13.8%).

In the present study, 51.2% of the samples were resistant to Ciprofloxacin as also found by Sharma, et al. [13] (41.5%) and Heyar, et al. [12] (40.3%). 21.3% samples were resistant to Cindamycin which was similar to the findings of Sharma, et al. [13] (9.7%), Dhanalakshmi, et al. [14] (14%) and Heyar, et al. [12] (17.5%).

An important finding of this study was that 5.4% of the samples were resistant to Vancomycin. However, Heyar, et al. [12], Sharma, et al. [13]

and Arora, et al. [15] found that all the samples were sensitive to Vancomycin (100%). Additionally, 60.9% samples were resistant to Erythromycin which is similar to the findings of Sharma, et al. [13] (56.9%) and Kumar, et al. [2] (54.8%) but very different from the findings of Heyar, et al. [12] (32.5%).

INSAR study [7] has been significant to demonstrate the prevalence and susceptibility pattern of MRSA in India and to emphasize the importance of conducting such studies. It is commented by various scientists that prevalence and sensitivity studies must be done regularly to track the trends of emergence of antibiotic resistance [16-18].

The present study has given new insights related to this problem in our place. The prevalence of staphylococcus aureus and distribution of MSSA and MRSA in this area is similar to findings of other researchers. The drug sensitivity pattern needs continuous monitoring. It was seen that the resistance to Vancomycin has emerged among Staphylococcus aureus in this area which is critical. Additionally, higher rate of resistance to erythromycin is seen. The findings need to be shared with clinicians and researchers working in this area, so that, rationale prescription of antibiotics can be emphasized and efforts need to be put to prevent emergence of resistance in further cases.

## Conclusion

It is apparent from the above discussion that the MRSA prevalence pattern is similar to other area but the antimicrobial resistance rates are higher which needs close monitoring and action.

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