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Research Article

TRENDS OF METHICILLIN RESISTANT *Staphylococcus aureus* (MRSA) IN SURGICAL SITE INFECTION AND ITS ANTIBIOTIC SUSCEPTIBILITY PATTERN IN A TERTIARY CARE HOSPITAL, JAMNAGAR, GUJARAT, INDIA

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Abstract- Introduction: *Staphylococci* play major role in surgical site infections. Methicillin-resistant *Staphylococcus aureus* (MRSA) is prevalent worldwide and is an important cause of nosocomial infections, resulting in an increased morbidity and mortality in the hospital settings worldwide. Aims & Objective: To study the prevalence of Methicillin-Resistant *Staphylococcus aureus* (MRSA) in surgical site infections (SSIs). Materials & Methods: This study was carried out in our institute from January to December 2017. Pus samples from surgical sites included for culture sensitivity examination were collected. *Staphylococcus* was identified using standard methods. Then, methicillin-resistant strains were identified by using screening and confirmatory techniques recommended by the Clinical and Laboratory Standards Institute (CLSI). Result: We collected a total of 3,958 samples, and *Staphylococcus* was identified from 300 (7.57%) samples. Of the 300 samples containing *S. aureus* recovered from the pus samples, 37.66% (113) of them were found to be methicillin resistant. All MRSA are sensitive to Vancomycin, Linezolid, and Teicoplanin. Conclusion: Minimizing the emergence of this organism and its spread remain to be the challenges that need to be addressed. A regular surveillance of hospital-associated infections is mandatory. For decreasing the MRSA infection, we need to monitoring the antibiotic sensitivity pattern of MRSA.

Keywords- *Methicillin resistant, antibiotic, prevalence, Staphylococcus, surgical site infections (SSIs)*

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Introduction

Surgical infections which are acquired in the hospital are recognized to be associated with an extended length of hospital stay, pain, discomfort and sometimes prolonged or permanent disability [1]. Surgical site infections (SSIs) are common complications that follow all types of operative procedures [1]. These infections are usually caused by the exogenous and endogenous microorganisms that enter the operative wound during the course of the surgery [1]. Methicillin resistant strains of *Staphylococcus aureus* (MRSA) are implicated in serious infections and nosocomial outbreaks. The choices of treatment are reduced, as they are resistant to various antibiotics. *Staphylococci* are the normal inhabitants of human skin and mucous membranes. *Staphylococci* play a role in bacteremia, endocarditis, urinary tract infections, surgical site infections, and so on. The common pathogenic bacteria in SSIs include *Staphylococci, Pseudomonas, Streptococci, Enterococci, E.coli, Klebsiella, Enterobacter, Citrobacter, Acinetobacter, Proteus, etc. S. aureus* forms a part of the normal flora and can be isolated from the noses of up to 60% of the healthy individuals. It is readily transmitted from person to person onto the hands and clothes of the health care staff, onto objects and into the air [1,2]. The older beta lactams, penicillin and ampicillin are ineffective against more than 80% of isolated strains and resistance to many of the non beta lactam groups such as tetracyclines, gentamicin, erythromycin and clindamycin has gradually increased and reached alarming levels in many parts of the world. [3,4]. The incidence of MRSA in India ranges from 30-70% [5,6]. The incidence of nosocomial infections which are caused by MRSA continues to increase; therefore, the importance of their detection, especially for treatment and epidemiological purposes, arises [7-9].

The present study was done to determine the incidence of *S. aureus* and MRSA in surgical site infections.

Materials and Methods:

Inclusion criteria

- Pus Samples from surgical sites

Exclusion criteria

- Wounds with cellulitis and no drainage were not included in the study.
- Samples other than pus were not included in the study.

Specimen collection and transport

Pus samples were collected from each patient with the help of two sterile swabs under aseptic precautions of which one was used for smear preparation and the other was used for culture and transport to Microbiology laboratory immediately and processed within 30 minutes of collection for smear preparation and culture.

Sample Processing

All the samples were processed and inoculated on blood agar, nutrient agar, and MacConkey agar were incubated at 37°C for 24 hours and blood agar in 7-10% CO_2 concentration. *S. aureus* was diagnosed by their growth characteristics on MacConkey agar (pink color colony), on nutrient agar (large, circular, and opaque colony), and on blood agar; (grayish white colony), gram-stain morphology (gram-positive cocci in clusters); positive catalase test; positive coagulase test (slide and tube coagulase test); growth on mannitol salt agar; and pigment characteristics (golden yellow) [7, 8].

Antibiotics Susceptibility Testing

The antibiotic susceptibility pattern of all the *S. aureus* strains were determined by modified Kirby–Bauer disc diffusion method against the following antibiotics: cotrimoxazole (25 µg), tetracycline (30 µg), ciprofloxacin (5 µg), erythromycin (15 µg), clindamycin (2 µg), and linezolid (2 µg), teicoplanin and Vancomycin MIC (2 µg/ml). All the tests were performed on Mueller– Hinton agar and were interpreted after incubation for 18-24 hours at 37°C; the diameter of the inhibitory zone was measured by using a millimeter scale. The zone size around each antimicrobial disc was interpreted as sensitive (S), intermediate (I) or resistant (R), according to the Clinical and Laboratory Standards Institute (CLSI) criteria. The test of diffusion in the agar was applied according to the CLSI recommendations (CLSI, 2017), by using Mueller-Hinton Agar and antibiotic discs.

Detection Method for MRSA

Screening was performed according to the CLSI guide- lines using cefoxitin disc (30 µg) diffusion testing method. From each strain, a suspension equivalent to 0.5 McFarland was prepared. Then, a swab was dipped and streaked on the surface of a Mueller–Hilton agar supplemented after incubation for 24 h at 35°C. If the zone of inhibition was ≤21 mm in diameter, the isolate was considered as MRSA [Fig-1]. Confirmation was done by oxacillin minimum inhibitory concentration (MIC) test, Epsilometer test (E-test) on 2% NaCl Mueller–Hinton agar plates; MIC > 4 was considered as methicillin resistance [Fig-2].

Quality controls: For disc diffusion method:

- ATCC 25923 *S. aureus* as negative control
- ATCC 43300 *S. aureus* as positive control

For agar and microdilution method:

- ATCC 29213 *S. aureus* as negative control
- ATCC 43300 *S. aureus* as positive control

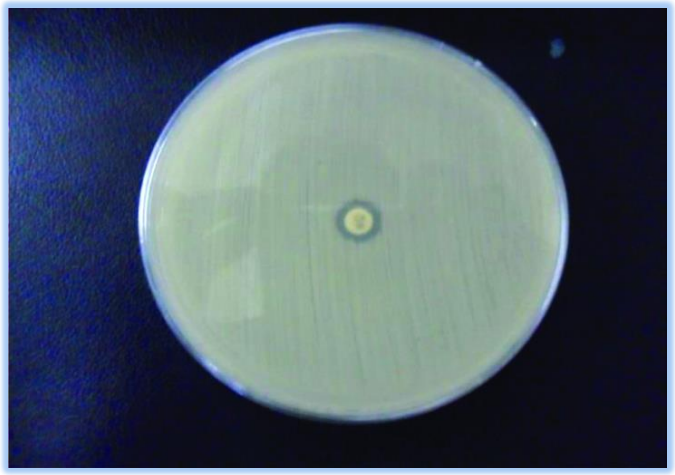

Fig-1 Cefoxitin disc diffusion test

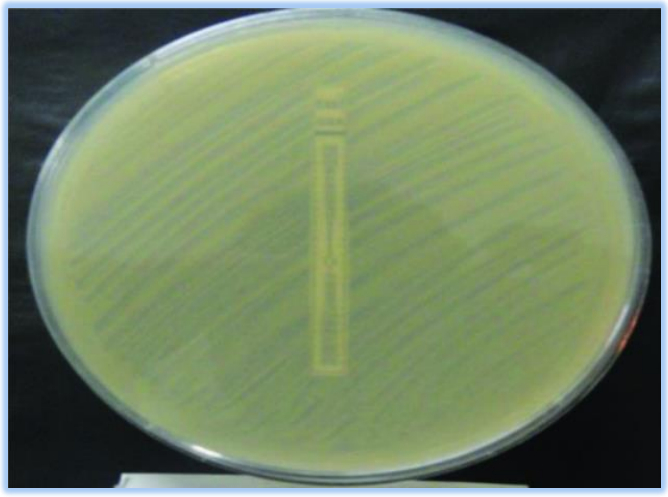

Fig-2 Oxacillin E-test

Results: We collected a total of 3,958 samples, and *Staphylococcus* was identified from 300 (7.57%) samples. Of the 300 samples containing *S. aureus* recovered from the pus samples, 37.66% (113) of them were found to be methicillin resistant (MRSA). All MRSA are 100% sensitive to Vancomycin, Linezolid, and Teicoplanin, followed 83.18% to Tetracyclin, 78.76% to Erythromycin & Clindamycin, 22.12% to Cotrimoxazole and 16% to Ciprofloxacin.

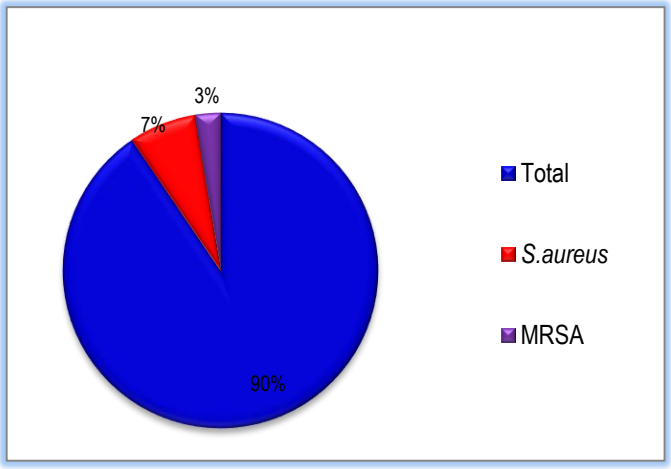

Fig-3 MRSA isolates

Table-1 Antibiotic Sensitivity of MRSA isolates

Antibiotics	Sensitivity
Vancomycin	100%
Linezolid	100%
Teicoplanin	100%
Tetracyclin	83.18%
Erythromycin	78.76%
Clindamycin	78.76%
Cotrimoxazole	22.12%
Ciprofloxacin	16%

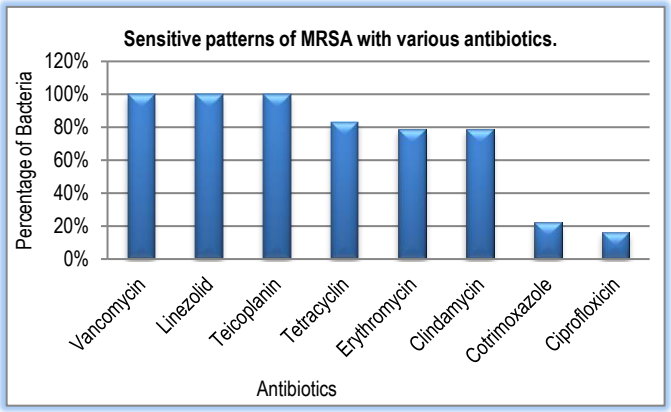

Fig-4 Comparison of Sensitive patterns of MRSA with various antibiotics

Discussion

MRSA is a major nosocomial pathogen causing significant morbidity and mortality. MRSA is a persistent and ever-growing problem for health-care institutions. Data on prevalence of MRSA are variable. Our study showed the prevalence of MRSA as 37.66% in our hospital. In our study, MRSA isolated were in majority from pus samples surgical site infection. Which comparable with Tesring, *et al*., 38.14% [10], Lahari Saikia, *et al*., 34.76% [11] but slight lower than Arti Tyagi *et al*. 44% [12], Joshi, *et al*., 41% [13] and higher than Harshan, *et al*., 29.7% [14]. All MRSA are mostly sensitive to Vancomycin, Linezolid, and Teicoplanin which comparable with Trivedi Minal, *et al*., [15] and Akhi, *et al*., [16]. When compared with few studies described earlier, the prevalence of MRSA in our hospital was found to be quite less.

On the basis that regular surveillance of hospital-associated infections including antimicrobial susceptibility pattern of MRSA is performed, and infection control measures are taken to prevent the spread of MRSA. No random samples were selected from patients to detect the presence of MRSA who were not clinically suspected. Thus, this study only detects the prevalence of MRSA in clinically suspected cases whose samples were received for culture and sensitivity examination and not prevalence of MRSA as whole. With the help of this study, we found out the prevalence of MRSA in our hospital setup. These data will help us further to formulate a better antibiotic policy and to take appropriate infection control measures.

Conclusion

The health-care institutions face constant and evermore problems, because of MRSA. Minimizing the emergence of this organism and its spread remain to be the challenges that need to be addressed. A regular surveillance of hospital-associated infections is mandatory. Frequent monitoring of susceptibility patterns of MRSA and the formulation of a definite antibiotic policy may be helpful in decreasing the incidence of MRSA infection. Vancomycin use should be limited to those cases where they are clearly needed. However, owing to the increasing use of vancomycin, regular monitoring of vancomycin sensitivity by MIC for MRSA and routine testing of other new glycopeptides should be carried out further. Prevention and infection control strategies should be applied in tertiary-care hospitals such as general measures (hand hygiene, cleanliness, and proper disinfection, use of contact precautions, and education and training of all health-care workers) and specific measures (patient isolation and cohorting, eradication of MRSA carriage, and surveillance and screening of patients and health-care workers) [16].

Application of research: To reduce MRSA prevalence by frequent monitoring of antibiotics susceptibility pattern

Research Category: Microbiology

Abbreviations:

MRSA: Methicillin resistant *Staphylococcus aureus*
SSIs: Surgical site infections

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Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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