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Detection of Antimicrobial Susceptibility Pattern of Staphylococcus aureus among Clinical Samples Received in Department of Microbiology in Integral Institute of Medical Sciences and Research, Lucknow, Uttar Pradesh: A Retrospective Analysis

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Abstract: ***Background: Staphylococcus aureus is the most significant species of staphylococci which has been recognized as an important cause of human disease for more than 100 years. It produces infections which range from localized pyogenic infections to life threatening systemic infections in man. Material & Methods: A retrospective study was done over a period of 12 months from April 2018- March 2019 in the Department of Microbiology at Integral Institute of Medical Sciences and Research, Hospital, Lucknow, India. The study was approved by the Ethical Research Committee (ERC) of the Institute. Data entry and statistical analysis were performed using the Microsoft Excel. Result: Total samples were 3, 322 out of which 306 (9.2%) were positive culture of staphylococcus aureus. In this study, females 164 (53.6%) were more affected than male 142 (46.4%). Maximum number of patients belong to age group 0-9 (27.8%) followed by 30-39 age group (19.9%). Conclusions: Out of 306 positive staphylococcus aureus, 33 were MRSA which was followed by 25 of CoNS. The Antimicrobial susceptibility pattern shows that s. aureus was susceptible to Vancomycin (VA), Teicoplanin (TEI) & linezolid (LZ) (100%) followed by Tobramycin (TOB) 98.8%& Amikacin (AK, 97.6%).***

Keywords: Methicillin Resistant Staphylococcus aureus, Coagulase Negative Staphylococcus

1. Introduction

Staphylococcus aureus is the most clinically significant species of staphylococci which has been recognised as an important cause of human disease for more than 100 years [1]. It is responsible for community and hospital acquired infections causing diseases ranging from relatively minor skin and soft tissue infections primarily to life threatening systemic infections throughout the world [2-4].

Infections caused by S. aureus are difficult to treat as they need the power to destroy neutrophils and also show antibiotic resistance. Staphylococcus aureus has overcome most of the therapeutic agents that are developed within the recent years and hence the antimicrobial chemotherapy of this species has always been empirical [5]. The most notable example of this phenomenon was the emergence of this MRSA, which was reported just one year after the launch of Methicillin [6]

The correct diagnosis of Staphylococcus aureus (S. aureus) from Coagulase Negative Staphylococci (CoNS) is vital for patient mortality and morbidity [7]

The full identification of S. aureus usually takes 24 h by using the normal methods [8]. S. aureus is differentiated from CoNS most reliable by tube coagulase test (TCT), which is a cheap method in routine laboratory practice [9]. Multiple studies have evaluated the utilization of rapid tests for detection of S. aureus directly from blood cultures [10].

2. Material and Methods

The retrospective study was conducted at Integral Institute of Medical Sciences and Research, Hospital for a period of 12 months from April 2018- March 2019. The study was approved by Ethical Research Committee (ERC).

Inclusion criteria: Total 306 staphylococcus aureus samples obtained for culture and sensitivity from IPDs & OPDs were sent to the Microbiology laboratory for bacteriological examination.

Specimen collection: Samples were collected from the hospital of Integral Institute of Medical Sciences and Research with sterile disposable cotton swabs and aspirates in syringe and were transported and processed in the microbiology laboratory immediately.

Gram Staining: Spread the smear evenly on a clean grease-free glass slide and then stained by Gram stain technique.

Culture: The samples were inoculated on CLED Agar, Blood Agar & MacConkey Agar. The culture plates had been inoculated at 37°C for 24-28 hours and isolates identified by their Morphology and Biochemical Characteristics.

After Culture, the bacteria were obtained in pure sub-culture.

The identification of isolates was done basis of colony morphology, motility motility testing by hanging drop preparation, and biochemical reactions such as Catalase, Coagulase, Oxidative fermentation (OF) and DNase tests.

Identification of MRSA: Methicillin Resistant staphylococcus aureus was determined by cefoxitin disk diffusion test and inducible Clindamycin Resistance i.e., D-test.

The antibiotic sensitivity testing of all isolates was performed by Kirby Bauer's disc diffusion method on Muller Hinton agar [11] and interpreted as per CLSI guidelines [12]. Depending on the isolate, antibiotics discs were selected from the following: Penicillin, Cefoxitin, Vancomycin, Teicoplanin, Gentamicin, Amikacin, Tobramycin, Tetracycline, Doxycycline, Ciprofloxacin, Levofloxacin, Linezolid, Nitrofurantoin, Norfloxacin.

Statistical Analysis

Entry of data and statistical analysis were performed using the Microsoft Excel. The values were represented in number, percentage and bar diagram.

3. Results

During the study period, the total number of 3, 322 samples were processed out of which 306 (9.2%) were showing the positive culture of Staphylococcus aureus out of which 25 were CONS and 33 were MRSA. Out of 306 positive samples, 181 (59.12%) samples were of pus, 53 (17.32%) samples were urine & others were 72 (23.53) that includes sputum, vaginal swab, BACTEC.

Table 1: Distribution of Patients according to gender

Male/Female	Number of patients	Percentage
Male	142	46.4%
Female	164	53.6%
Total	306	100%

Out of 306 patients who were included in this study, 142 (46.40%) were males and 164 (53.60%) were female patients

Table 2: Distribution of Patients According to Age Group

Age group (In years)	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	Total
No. of patients	85	35	53	61	18	22	25	7	306
Percentage	27.78%	11.44%	17.32%	19.93%	5.88%	7.19%	8.17%	2.29%	100%

Table 3: Antimicrobial Sensitivity & Resistivity of Staphylococcus Aureus among Clinical Samples

Antibiotics	*Sensitivity*	*Resistivity*
CEFOXITIN	83.72%	16.27%
VANCOMYCIN	100%	0%
TEICOPLANIN	100%	0%
GENTAMYCIN	96.51%	3.49%
AMIKACIN	97.67%	2.33%
TOBRAMYCIN	98.84%	1.16%
ERYTHROMYCIN	79.07%	20.93%
CLINDAMYCIN	84.88%	15.12%
TETRACYCLINE	94.19%	5.81%
DOXYCYCLINE	95.16%	4.84%
CIPROFLOXACIN	53.49%	46.51%
OFLOXACIN	66.28%	33.72%
LEVOFLOXACIN	87.21%	12.79%
COTRIMOXAZOLE	91.86%	8.14%
LINEZOLID	100%	0%

This table shows that staphylococcus aureus is sensitive to following drugs- Vancomycin, Teicoplanin, Linezolid & Tobramycin.

4. Discussion

The study is carried out in Clinical laboratory, Department of Microbiology, IIMS&R, Lucknow, Uttar Pradesh. Staphylococcus aureus major causes nosocomial infection. It has various components or factors that possess a potential to destroy host defence mechanism. It possesses capsular polysaccharide that induces inflammatory responses and shows high level in the person which is infected to the staphylococcus aureus.

In our study total samples were 3, 322 out of which 306 were showing the positive culture of staphylococcus aureus & the prevalence rate of 9.2%, this positivity rate was almost similar with the study of **K Rajaduraipandi et al (2006)** which shows the prevalence rate of 12.6%.

In a study done by **Manjusha et al (2017)** among Gram positive bacteria Daptomycin shows 100% sensitivity in staphylococcus aureus followed by vancomycin, teicoplanin and tigcyclin 96% sensitive. Similarly, in this study, staphylococcus aureus shows 100% sensitivity in Vancomycin, Teicoplanin and linezolid followed by Tobramycin.

In a study done by **Vaishali Gupta et al (2017)** MRSA is of serious therapeutic concern not only due to its resistance to Methicillin, but also because of resistance to many other antimicrobials that are used on regular basis in Hospitals.

In our study, the Antimicrobial susceptibility pattern shows that 46.51% samples were resistant to Ciprofloxacin (TOB) followed by Ofloxacin (OF) (33.72%).

We observed that, out of 306 patients maximum number of patients belongs to 0-9 years age group (27.78%). This study shows that out of 306 patients, 33 patients were MRSA (10.78%) and 25 patients having CONS (8.17%).

This study concludes that 306 positive clinical samples for staphylococcus aureus out of which 181 samples were pus, 53 samples were urine and clinical samples included were sputum, vaginal swab and BACTEC.

It has various components or factors that possess a potential to destroy host defense mechanism. It possesses capsular polysaccharide that induces inflammatory responses and shows high level in the person which is infected to the

staphylococcus aureus. Next one is Protein A, that a cause mitogenic, anti-complementary, induction of platelet damage, regulates coagglutination reaction i.e., any IgG antibody binds to fc region of Protein A. It also secretes various toxins like hemolysin (α, β, γ, δ), leucocidin, enterotoxins, TSST, epidermolytic toxins (responsible for staphylococcal scalded skin syndrome). Enterotoxin causes staphylococcal food poisoning.

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