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Research Article

BACTERIOLOGICAL PROFILE OF *STAPHYLOCOCCUS AUREUS*: A TEACHING HOSPITAL BASED STUDY

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Abstract- Background: Multidrug resistant *Staphylococcus aureus* is major cause of serious from of infection, especially in hospital acquired infection. The increasing incidence of infections due to methicillin resistance staphylococci, reliable & accurate testing of methicillin resistance is crucial for both antimicrobial therapy and infection control. **Materials and methods**: All the clinical specimens received in the department of microbiology were subjected to culture and sensitivity of the pathogen as per standard guidelines. Cefoxitin disc was used to rule out methicillin resistant *Staphylococcus aureus* (MRSA) and the D-test was used to for the detection of inducible clindamycin resistant *Staphylococcus aureus*. **Results**: A total of 392 *Staphylococcus aureus* isolated from various clinical samples. Majority of pathogen was isolated from pus samples (52.6%) followed by sputum (14.8%), Blood (14.5%) and 7.1% from endotracheal secretion. Out of which 307(78.3%) isolates were MRSA, majority of isolates were sensitive to linezolid (71.7) followed by Amikacin(65.8%) and Doxycyclin(65.3%). Inducible resistant was noted in 46(11.7%) of isolates. **Conclusion**: The resistance pattern varies from different geographical area, hence continuous study on *Staphylococcus aureus* is crucial and local data related to pattern of infection can be useful to deal with serious form of infection.

Keywords- *Staphylococcus aureus, MRSA*

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Introduction

The *Staphylococcus aureus* bacteria have ability to cause verity of infections and acquisition of antimicrobial drug resistance through different mechanisms. Multidrug resistant strains of *Staphylococcus aureus* are major concern [1]. The human host factors are major contributor to acquire such infections like diabetes, cancer, and some other immune-compromised conditions [2]. The human host factors increases the risk of getting a staphylococcal infection, hence evaluation of co-morbid conditions are also necessary for effective therapy. In diabetic patients, cellulitis is more common and if not treated in time, surgical debridement may be required especially in methicillin resistant *Staphylococcus aureus* (MRSA) strains [3]. The source of infection is anterior nares of human beings and health care workers are sometimes responsible for transmission of organism in hospital setup that leads to appearance of multi-drug resistance strains [4]. *Staphylococcus aureus* spread by direct contact with an infected person, by using a contaminated inanimate object, or by inhalation of infected droplets dispersed by sneezing or coughing [5]. Skin and soft tissue infections caused by *Staphylococcus aureus* are frequent worldwide, such as folliculitis, furuncle, carbuncle, impetigo, mastitis, and various wound infections [6]. The superficial infection can be treated effectively if diagnosed on time, failure to do so, leads to serious type of deep infections that spread from skin to cause bacteremia to involve bones, joints, deep organs, scalded skin syndrome in neonates, toxic shock syndrome, and food poisoning [7, 8]. Emergence of methicillin resistance strains are major threat that leads to treatment failure with common antibiotics. The increasing incidence of infections due to methicillin resistance staphylococci, reliable & accurate testing of methicillin resistance is crucial for both antimicrobial therapy and infection control [9]. Acquisition of mecA or mecC gene leads to occurrence of methicillin resistant strains of *Staphylococcus aureus*. The mecA gene reduces affinity to all beta-lactam antibiotics by altering penicillin-binding protein-2a (PBP2a) except fifth generation cephalosporins that is ceftaroline & ceftobiprole [10].

The prevalence of MRSA is range from 20-80% throughout the world [11, 12]. Clindamycin is good option in the treatment of skin and soft tissue infections (SSTIs) and serious infections due to its efficacy against MRSA and MSSA [13]. Emergence of inducible clindamycin resistant strains questioning the efficacy of clindamycin use against any erythromycin-resistant Staphylococcal species [14]. However, if inducible resistance detected on a routine basis in clinically significant isolates, clindamycin can safely use in patients with true clindamycin-susceptible strains [15]. The clinical laboratory standard institution recommends finding out inducible clindamycin resistant strains on routine basis [16, 17]. Effective vaccine against *Staphylococcus aureus* is not available [18], development of vaccine is still in pipeline, although spread of infection is simply be achieved by thoroughly washing the hands. As per the current scenario and notoriousness of such kind of superbug, local data about trend and susceptibility pattern of different geographical area is crucial step to prevent the infection up to certain limit.

Materials and Methods

Present study conducted at Department of microbiology in tertiary care hospital with the clearance of institutional ethical committee for the period of two years. All the clinical specimens received for culture and sensitivity were included in the study. All the specimens inoculated on Blood agar and McConkey's agar and then direct smear made for gram stain. The inoculated plates kept in incubator at 37ºC for 24 hours, the isolated colony was identified based on their pigmentation, hemolysis, catalase test, coagulase test, and gram stain reaction as per standard guidelines [14, 17]. A well-isolated colony of *Staphylococcus aureus* taken and suspended into peptone water and incubated at 37ºC for 4 hours, the turbid inoculums were compared with 0.5 McFarland suspensions that were used for antimicrobial susceptibility testing. The antimicrobial susceptibility was done by using Kirbey-bauer disc diffusion method on Mueller Hinton agar as per CLSI guideline [19, 20].

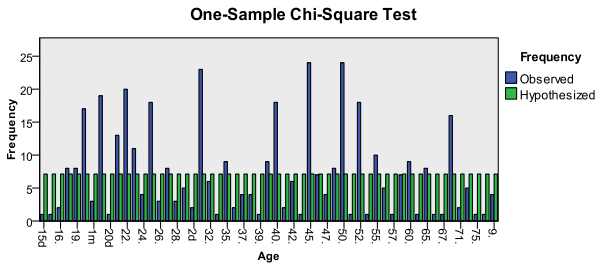
The D-test was performed for erythromycin resistant and clindamycin sensitive strains to rule out inducible clindamycin resistant strains and interpreted as three different phenotypes (Inducible, constitutive and MS phenotypes) as per CLSI guidelines [14, 17].

Statistical analysis: The data were analyses by using SPSS 20 software and p value <0.005 considered as statistically significant.

Observation and Result

Table-: Sex-wise distribution of infection

Gender	Frequency	Percent
Female	188	48.0
Male	204	52.0
Total	392	100.0



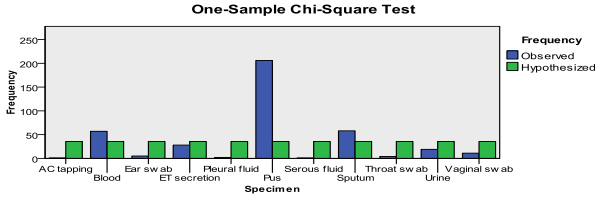
Total N	392
Test Statistic	351.342
Degrees of Freedom	54
Asymptotic Sig. (2-sided test)	.000

1. There are 0 cells (0%) with expected values less than 5. The minimum expected value is 7.127.

Graph-1 Age-wise distribution of isolates

Table-2 Frequency of *S. aureus* among clinical specimens

Clinical specimens	Frequency	Percent
Anterior Chamber of eyes, tapping	1	0.3
Blood	57	14.5
Ear swab	5	1.3
Endo-tracheal secretion	28	7.1
Pleural fluid	2	0.5
Pus	206	52.6
Serous fluid	1	0.3
Sputum	58	14.8
Throat swab	4	1.0
Urine	19	4.8
Vaginal swab	11	2.8
Total	392	100.0



Total N	392
Test Statistic	1,021.219
Degrees of Freedom	10
Asymptotic Sig. (2-sided test)	.000

1. There are 0 cells (0%) with expected values less than 5. The minimum expected value is 35.636.

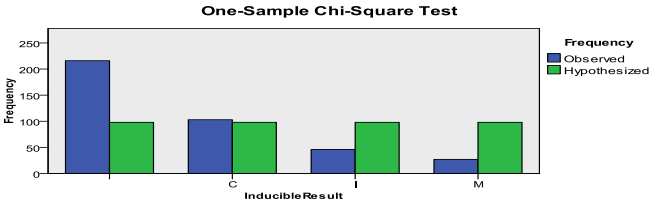
Graph-2 Distribution of *S.aureus* among clinical specimens

Table-3 Antimicrobial susceptibility pattern of *S.aureus*

Antibiotics	Sensitive		Resistant	
	Frequency	Percentage	Frequency	Percentage
Erythromycin	216	55.1	176	44.9
Clindamycin	285	72.7	107	27.3
Cefoxitin	85	21.7	307	78.3
Levofloxacin	214	54.6	178	45.4
Doxycycline	256	65.3	136	34.7
Amikacin	258	65.8	134	34.2
Cotrimoxazole	79	20.2	313	79.8
Peniciliin	15	3.8	377	96.2
Linezolid	281	71.7	111	28.3
Ciprofloxacin	88	22.4	304	77.6

Table-4 Inducible clindamycin resistant strains of *S.aureus*

Phenotypes	Frequency	Percent
Erythromycin(S)	216	55.1
cMLSb phenotype	103	26.3
iMLSb phenotype	46	11.7
MSb phenotype	27	6.9
Total	392	100.0



Total N	392
Test Statistic	221.367
Degrees of Freedom	3
Asymptotic Sig. (2-sided test)	.000

1. There are 0 cells (0%) with expected values less than 5. The minimum expected value is 98.

Graph-3 Inducible clindamycin resistant strains of *S.aureus*.

Discussion

The frequencies of Staphylococcal aureus associated with different clinical conditions are often crucial when it comes to multidrug resistance. The details about pathogenesis, co-morbid conditions, source of infection and microbiological interpretation are important factors before dealing with such notorious pathogen. The ability of the pathogens causing serious form of infection is alarming and clinician should aware about the importance of antimicrobial susceptibility testing to prevent occurrence of multidrug resistant strains. The management of infectious diseases are depends on judicial use of the drugs and it should be mandatory for clinicians to check and use antimicrobial susceptibility report. The course of infection and antimicrobial susceptibility of pathogen varies from different geographical area, even hospital to hospital and place to place; taking in account present study was carried out to see the bacteriological profile of *Staphylococcus aureus* in our area. In present study, there were no significant differences noted among males and females, and the middle age group individuals are more frequent to be infected with *Staphylococcus aureus* followed by younger age group. The clinical implications are also helpful to treat the infections especially the site of infection. Majority of pathogen was isolated from pus samples (52.6%) followed by sputum (14.8%), Blood (14.5%) and 7.1% from endotracheal secretion. Similar incidence noted by Shah V P *et.al* (2012) [21], pus samples (74.13%), followed by blood cultures (18.97%). The cefoxitin disc diffusion method was used to rule out methicillin resistant *Staphylococcus aureus* (MRSA), 307(78.3%) were resistant to cefoxitin indicating high incidence of MRSA strains. Several studies carried out in India and abroad, and they reported the incidence of MRSA ranging from 30% to 80%, which is a serious note and alarming to form a strict policy when dealing with Staphylococcal infections[12].

Majority of isolates were sensitive to linezolid(71.7%) followed by Amikacin(65.8%) and Doxycyclin (65.3%), that can be compared with Shah Bhattacharya *et.al* (2016)[22]. The clindamycin is the good alternative to treat such infection if true susceptibility ruled out. In present study 72.7 % strains were susceptible to clindamycin without knowing the inducible resistance. Those isolates which where sensitive to Clindamycin and resistant to erythromycin were further subjected to D-test to rule out inducible clindamycin resistant strains of *Staphylococcus aureus*. It was observed that 11.7% of clindamycin sensitive isolates were inducible resistant strains, which means detection of inducible resistant strain on routine basis can help to treat the staphylococcal infection very effectively. Several studies carried out throughout the world, and observed the inducible resistance range from 10 percent to 40 percent [7, 14, 23].

Conclusion

The capacity and nature of infection caused by *Staphylococcus aureus* with the occurrence of multi-drug resistant strains are serious concern. Prompt and strict guidelines for prevention and treatment are necessary to overcome the situation. The resistance pattern varies from different geographical area, hence continuous study on *Staphylococcus aureus* is crucial and local data related to pattern of infection can be useful to deal with serious form of infection.

Application of research: To form antibiotic policy and prevention of hospital acquired infections

Research Category: Medical microbiology

Abbreviations:

MRSA-methicillin resistant *Staphylococcus aureus*
MSSA- methicillin sensitive *Staphylococcus aureus*
iMLSb- Inducible microlide-lincosamide-streptograminB phenotypes
cMLSb- Constitutive microlide-lincosamide-streptograminB phenotypes
MSb- microlide-streptograminB phenotypes

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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.

Sample Collection: Clinical specimens received in the Department of Microbiology were included in study.

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