ORIGINAL ARTICLE

Colonizer to Drug Resistant isolate, What is Happening to our Staphylococcus Aureus?

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ABSTRACT

Objective: To evaluate resistant trend of multiple antimicrobial agents against *Staphylococcus aureus* isolates along with its prevalence.

Material and Methods: This prospective descriptive study was carried out in the department of microbiology Allama Iqbal Medical College Lahore from 1st January 2015 to 25 may 2016. Simple random technique was used, and 4570 clinical samples (Pus, blood, pleural fluid, tracheal aspirate, urine, sputum, HVS) were received from ICU, Surgical Unit, Medical Unit and OPD for culture sensitivity testing, antimicrobial resistant trend was tested according to CLSI guidelines

Results: Maximum isolates were recovered from surgical unit 31.9%, sample-wise maximum isolates were recovered from pus samples 26.8%. age group and gender-based distribution showed among male's high isolation rate was observed in 21-40 years while in females 41-60-year age group. Every isolate was (100%) susceptible to linezolid, vancomycin and teicoplanin, cotrimoxazole also showed very low rate of drug resistance only 8.3%, while penicillin Doxycycline, Ciprofloxacin, Erythromycin showed 95.9%,69.8%55.4% and 48.2% drug resistance respectively, 43-45% drug-resistant rate observed in case of Co-amoxiclave, Methicillin, Gentamicin, Fusidic Acid, Amikacin, and Clindamycin

Conclusion: Linezolid, Vancomycin, and Teicoplanin are best therapeutic Choices against Staphylococcus aureus associated infections.

Keywords: Staph aureus, Drug-resistant, MRSA

Introduction

In spite of solid steps taken to switch and reduce the encumbrance of infectious diseases, still, it is a pronounced dilemma for the civilized world. Antimicrobial agents are working as a critical element of the therapeutic armamentarium of modern medicine. The emergence of drug-resistant bacteria founds a major problematic in antibiotic drugs therapy.[1] This could be credited to the widespread and inappropriate use of antibiotics. [2] Presence of vast array of effective antimicrobials enhances this confidence that every bacterial infection can be treatable, but in early in the 1970s, this belief was abandoned. Their confidence was shaken by the emergence of resistance to multiple antimicrobial agents among such pathogens as *Staphylococcus aureus (S. aureus)*, *Streptococcus pneumonia*, *Mycobacterium tuberculosis, and Pseudomonas aeruginosa*.[3] Antimicrobial resistance is now the norm between these microbes.

S. aureus is perhaps the pathogen of utmost concern, because of its virulence and ability to cause a varied array of life-threatening infections in humans including impetigo, osteomyelitis, mastitis, pneumonia, septicemia, endocarditis, post-operative toxic shock syndrome. Since many years Infections caused by *S. aureus* remains a significant cause of morbidity and mortality of millions of patients every year around the globe. Its mechanism of action includes toxin production, direct invasion, and tissue destruction. Therefore, treatment of staphylococcal infections is still a big challenge for clinicians. Several studies have reported that *S. aureus* is one of the most often isolated microbes in the microbiology laboratory.[4]

S. aureus is known to be tarnished, because of drug resistance acquirement. Many strains carry a varied variety of drug-resistant genes on plasmids. It's great variability arising at different eras and places with diverse clonal types and antibiotic drug resistance patterns within regions and countries. It has a remarkable capability of evolving different mechanisms of resistance to most antimicrobial agents.[5]

Persistence of *S.auereus* as a nosocomial and community-acquired pathogen is a global health concern. The primary site of staphylococcal colonization in humans is the anterior nares. Amplified nasal colonization rates have been observed in diabetes, hemodialysis patients, intravenous drug abusers and patients on the injectable treatment of allergy([6]). *S. aureus* has a well-developed ability to withstand high salt concentration (7.5-10%), high pH and in extreme temperatures (up to60 ^{0}C). Therefore, out of all non-spores forming bacteria, it is a most resistant isolate. It can survive for a long time and resist the action of most commonly used disinfectants and antimicrobial agents. Therefore present plane was decided to explain the antimicrobial resistance pattern of *S.aureus* along with its prevalence.

Methodology

This prospective descriptive study was carried out in the department of microbiology Allama Iqbal Medical College (AIMC) Lahore from 1st January 2015 to 25 May 2016.

Simple random technique was used and 4570 clinical sample (Pus, blood, pleural fluid, tracheal aspirate, urine, sputum , HVS) were received in microbiology lab from ICU, Surgical Unit, Medical Unit, and OPD. Every sample was processed for culture sensitivity testing according to standard guidelines. Bacterial identification was done with help of colonial morphology, Gram stain, Catalase test, Coagulase test, and DNase test. Every coagulase positive Staphylococcus was further processed for antimicrobial testing according to CLSI guidelines

Results

Over all distribution of culture positive and *S.aureus* depicted in Figure: 1.

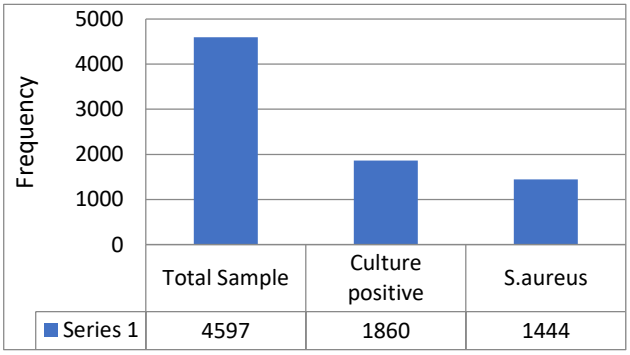

Figure:1 Isolation rate of S.aureus (n=4597)

Sample wise isolation rate of S.aureus mentioned in Table:I.

Maximum isolates were recovered from surgical unit 31.9% and maximum isolates were recovered from pus samples

Table:1 Department and sample wise distribution of *S.aureus* isolates (n=4597)

Departments	***S.aureus***	**Culture Positive**	**Total samples**
	f +%	f +%	f +%
ICU	415 (28.7%)	550 (29.5%)	1135 (24.6%)
Surgical Unit	640 (44.3%)	750 (40.3%)	1470 (31.9%)
Medical Unit	220 (15.2%)	316 (16.9%)	1017 (22.1%)
Gynae	169 (11.7%)	244 (13.1%)	975 (21.2%)
Pus	785 (54.3%)	922 (49.5	1235 (26.8%)
Blood	299 (20.7%)	441 (23.7%)	1065 (23.1%)
Tracheal Aspirate	169 (11.7%)	181 (9.7%)	749 (16.2%)
Sputum	78 (5.4%)	78 (4.1%)	330 (7.1%)
Pleural fluid	27 (1.8%)	27 (1.4%)	313 (6.8%)
Urine	62 (4.2%)	187 (10.0%)	678 (14.7%)
HVS	24 (1.6%)	24 (1.2%)	227 (4.9%)
Total	**1444 (100%)**	**1860 (100%)**	**4597 (100%)**

26.8%. Age group and gender-based distribution explored in Table: 2 High burdens of *S.aureus* infection is found in males as compared to females. High frequency of *S.aureus* isolate was found in the age group of 21-40 and in females, high rate was found in the age group of 41-60. Table: II.

Department wise *S.aureus* resistant pattern against commonly used antimicrobial agents showed in Table: III.

Alarmingly 45.3% isolates were MRSA, 100% susceptibility observed for Linezolid, Vancomycin, and Teicoplanin. Cot-trimaxazole also showed very low rate of drug resistance 8.3%, while penicillin Doxycycline, Ciprofloxacin, Erythromycin showed 95.9%, 69.8% 55.4% and 48.2% drug resistance respectively. Almost 43-45% drug-resistant rate observed in case of Co-amoxiclave, Methicillin, Gentamycin, Fusidic Acid, Amikacin, and Clindamycin. Table: III

Discussion

Aggressive infection control techniques are hampered by drug-resistant strains, especially methicillin resistant staph aureus (MRSA) the most common cause of nosocomial infections as well as infectious disease burden around the globe. As staphylococcal infection is associated with age and sex [7, 8], the present study also highlighted high rate of staphylococcal infection among male as compared to females, 21-40 year age group were more frequently infected among males while in females 41-60 years age group was most commonly involved Table II. Our results are supported by multiple previous studies, Marshall, C., et al (9) reported young age and 60 year patients more susceptible to *S.aureus* infections, furthermore Hafeez et all (Hafeez et al) reported similar distribution among different age group with exception in newborns and old age patients[10] on the side

Table II: Gender and age group based distribution of *S.aureus*

Age Group	***S.aureus* (n=1444)**		**Total isolates (n=1860)**		**Total samples (n=4597)**	
	Male	Female	Male	Female	Male	Female
0-20 (n=685) 14.9%	117 13.8%	67 11.2%	135 13.8%	89 10.0%	574 19.3%	111 6.8%
21-40 (n=1322) 28.7%	394 46.5%	201 33.6%	405 41.6%	269 30.3%	832 27.9%	490 30.1%
41-60 (n=1383) 30.0%	185 21.8%	270 45.2%	212 21.7%	331 37.3%	735 24.7%	648 39.9%
61-80 (n=941) 20.4%	130 15.3%	22 3.6%	189 19.4%	116 13.0%	679 22.8%	262 16.1%
81-100 (n=266) 5.7%	21 2.4%	37 6.1%	32 3.2%	82 9.2%	153 5.1%	113 6.9%
Total n=4597 100.0%	**847 100.0%**	**597 100.0%**	**973 100.0%**	**887 100.0%**	**2973 100.0%**	**1624 100.0%**

Table III: Department wise Drug resistance pattern of *S.aureus*

Antibiotic	ICU n=415		Surgical n=640		Medical n=220		Gynae n=169		Total n=1444	
	f	%	f	%	f	%	F	%	f	%
Penicillin	415	100%	589	92%	220	100%	162	96%	1386	95.9%
Co-amoxiclave	244	59%	251	39%	90	41%	77	45%	662	45.3%
Methicillin	244	59%	251	39%	90	41%	77	45%	662	45.3%
Erythromycin	340	82%	211	33%	51	23%	95	56%	697	48.2%
Gentamycin	266	64%	269	42%	51	23%	64	38%	650	45.0%
Ciprofloxacin	319	77%	346	54%	84	38%	52	31%	801	55.4%
Fusidic acid	179	42%	294	46%	108	49%	66	39%	642	44.4%
Co-trimaxazole	357	86%	512	80%	194	88%	144	85%	120	8.3%
Doxycycline	278	67%	448	70%	158	72%	125	74%	1009	69.8%
Amikacin	232	56%	275	43%	73	33%	51	30%	631	43.6%
Clindamycin	332	80%	218	34%	84	38%	89	53%	623	43.1%
Linezolid	0	0%	0	0%	0	0%	0	0%	0	0.0%
Vancomycin	0	0%	0	0%	0	0%	0	0%	0	0.0%
Teicoplanin	0	0%	0	0%	0	0%	0	0%	0	0.0%

Bukhari et al [11] reported 20-39 year age group patients are more vulnerable to these infections.[11] Present study highlighted decline trend of staphylococcal infection similar trend is reported by previous studies.[10-12] We observed that maximum number of staphylococcal isolates were recovered from pus samples 26.8% followed by blood, 23.1%, tracheal aspirate 16.2%, urine 14.7%, sputum 7.1%, pleural fluids, 6.8%, and HVS 4.9% Table: I. Almost similar distribution and similar isolation rates are also reported from other studies around the globe.[12-16] The present study reported 45.3% MRSA, furthermore very high rate of resistant also observed against another group of antibiotics, which may be accredited to methicillin resistant, because multiple studies has reported relationship between methicillin and resistant to another group of antibiotics is reported in multiple previous studies. [16-18] Present study reported 100% susceptibility for Linezolid, vancomycin and teicoplanin, Cotrimaxazolealso showed very low rate of drug resistance only 8.3%, while penicilli Doxycycline, Ciprofloxacin, Erythromycin showed 95.9%,69.8%55.4% and 48.2% drug resistance respectively 43-45% drug-resistant rate observed in case of Co-amoxiclave, Methicillin, Gentamycin, Fusidic Acid, Amikacin, and Clindamycin. Pandey, S et al [19] reported among 111 staphylococcal isolates 26.1% were MRSA, very lower than present study while susceptibility pattern was similar to present study, high rate of penicillin resistant observed while Vancomycin showed 100 % sensitivity against staphylococcal isolates. A similar study from Jordan [20] reported 31.6% MRSA, while 31% MDR and 42.7% were Oxacillin-resistant (ORSA). Very good sensitivity for vancomycin (100%). All these isolates were also susceptible >80% to chloramphenicol, linezolid, Nitrofurantoin, rifampicin and teicoplanin while erythromycin and penicillin showed very high resistant similar to the present study

Bhatt, C. P., et al. [21] reported among 1173 specimens received for the bacteriological culture of *S.aureus* was isolated from only 100 specimens with 19% MRSA isolates 100% sensitivity was observed for Vancomycin. Amikacin also showed very good 90% sensitivity similarly Gentamycin (83%), and tetracycline (81%), while peniciline showed a very high rate of drug-resistant. Amisha, et al. [22] reported among 184 patient undergoing a different type of surgical procedures 39.7% were infected by *S.aureus* of which 49.7% MRSA isolates. The drug-resistant pattern was as followed > 80% level of resistance was observed against penicillin G, erythromycin, gentamicin ampicillin, amoxicillin, and co-trimoxazole whereas less than 50% level of resistance was observed against clindamycin, oxacillin, tetracycline, and vancomycin long sentence.

Conclusion

We concluded Linezolid, Vancomycin, and Teicoplanin are best therapeutic Choices against Staphylococcus aureus associated infections. Emergence of drug resistance is observed, therefore surveillance for drug-resistant pattern is need of the time especially for commonly isolated pathogen like *S.aureus* greater control and rational use of drugs need to review to abolish emergence of drug resistance, otherwise spread of drug resistance organism is on the way.

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