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Study of the prevalence and antimicrobial Susceptibility Patterns of *Staphylococcus aureus* in Garhwal Region, India

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Abstract

Staphylococcus aureus is a ubiquitous commensal bacterium on human skins and anterior nares, but frequently causes severe infections in humans. It is commonest cause of infection in hospitals and is most liable to infect newborn babies, surgical patients, old and malnourished persons and patients with diabetes and other chronic diseases .Aim of this paper is to study the prevalence and detection of antimicrobial susceptibility patterns of *Staphylococcus aureus* at the Garhwal Region, India. Samples are collected from Veer Chandra Singh Government medical science and research institute HNB Base Hospital Srinagar Garhwal. Data obtained about the study subjects included basic demographics, reasons for admission, medical history(underlying diseases) , medication history, site of infection, culture site, social history and isolate characterization (e. g. antimicrobial susceptibility pattern results). P-value less than 0.05 were considered as statistically significant.During the two years period, 300 patients with clinical presentation of septicemia admitted in different units, namely Medicine, Nursery, Pediatrics, ICU, Orthopedic, Dialysis and Surgery, 309 of them were positive for S. aureus. The overall prevalence of S. aureus was 15.3% and the prevalence in the type of samples cultured were: blood (0.3%), followed by body fluids (12.4%), ear swabs (0.8%), FNAC (4.2%), PEDIA (3.5%), pleural fluid (4%), pus (0.8), pus aspirate (0.8), semen (28), sputum (0.8), urine (45.2%), vag (0.8%) and wound (2%). The sensitivity rates of the various antibiotics are as follows: ampicillin (16%), amoxicillin (39%), amikacin (86.3%), chiloroamhenicol (78.6%), cotrimoxazole (49.6%), cephoxitin/oxac (18.3%), ciprofloxacin (52.6%), eryhromycin (55.3%), gentamicin (70.6%), penicillin (5.3%), clindamycin (56.3%), rifampicin (38.4%), linezolid (41%), teicoplanin (46.3%) & vancomycin (48.6%). A total of 146 samples showed multi-resistance to antimicrobial antibiotics. *Staphylococcus aureus* isolates in this study showed higher multi-drug resistance patterns to several antimicrobials and thus further studies should be conducted in the hospital.

1. Introduction

Staphylococcus aureus is a pervasive commensal bacterium on human skins and front nares, yet as often as possible causes serious infections in humans [1]. Rapid and direct identification of S. aureus is critical for appropriate administration of patients with skin diseases, abscesses, septicemia/bacteremia, gastroenteritis, endocarditis, harmful stun disorder and certain sustenance inebriations [2, 3].Methicillin-safe Staphylococcus aureus (MSSA) and methicillin-sensitive *Staphylococcus aureus* (MSSA) strains can without much of a stretch spread from tainted patients to medicinal staffs, who frequently wind up noticeably transient transporters. Since MSSA, are normally likewise impervious to other non-β-lactam anti-infection antibiotics, diseases with them are life-undermining in immune compromised patients, regularly hard to oversee, and dangerous to annihilate. The essential significance is to diminish the prevalence of MSSA by measures of MSSA by measures, for example, fast and dependable identification of the organisms along with their susceptibility patterns to other antibiotics, treatment of patients and carriers, isolation and strict adherence to proper hand washing practices by health care providers [4].

Staphylococcus is non-motile, non-sporing framing faculative anaerobes aging. Most species have relative complex nourishing prerequisites. Be that as it may, all in all they require natural source nitrogen, provided by 5 to to 12 fundamental amino acids, B vitamins, Arginine, valine and including thiamine and nicotinamide. Individuals from this family are Catalase positive and oxidase negative, recognizing them from the sort Streptococcus, which are Catalase negative and have an alternate cell wall composition to *Staphylococci* [5].

Staphylococcus aureus and coagulase negative Staphylococci (CONS) are known to bring about an assortment of contaminations which go from minor skin and delicate tissue diseases to life undermining conditions, for example, endocarditis, pneumonia and septicaemia [6]. The rise of drug resistance among Staphylococci is an expanding issue. Methicillin safe S. aureus (MSSA) is a famous nosocomial pathogen and its rate has drastically expanded in the current years [7]. The expanding recurrence of the diseases with MSSA and the changing drug susceptibility patterns have led to a renewed interest for the utilization of macrolide lincosamide streptogramin-B (MLSB) anti-microbials to treat such contaminations, with clindamycin being the favored operator because of its excellent pharmacokinetic properties [6,14]. In any case, their across the board utilize has expanded the quantity of the Staphylococcus strains which are impervious to the MLSB anti-infection antibiotics. The MLSB anti-infection antibiotics are basically disconnected however they are connected microbiologically due to their comparative method of activity [8].

S. aureus as the causative agent of wide variety of disease of supporative infections such as boils and, wound infections, superficial infection such as skin pustule, subcutaneous and sub-mucosa obscesses, ostemyelitis, bronchopneumonia and food poisoning, a common cause of vomiting and diarrhea. It is the commonest cause of infection in hospitals and is most liable to infect newborn babies, surgical patients, old and malnourished persons, and patients with diabetes and other chronic diseases [9, 10]. The skin and mucous membrane is excellent barrier against local tissue invasion by *S. aureus*. However, if either of these is breached due to trauma or surgery *S. aureus* can enter the underlying tissues, creating its characteristic local abscess lesion and if it reaches the lymphatic channels or blood can cause septicemia. The fundamental skin leison brought about by S. aureus disease is a pyogenic sore. However S. aureus can likewise deliver a scope of extracellular poisons, for example, Enterotoxins. Colonization of the nares is a powerful and progressively pervasive risk factor for subsequent *S. aureus* infection [11, 15]. In at least 80% of S. aureus bacteremia cases in colonized subjects, the contaminating strain is indistinguishable to a nasal colonizing strain distinguished preceding onset of bacteremia. Followed longitudinally, around 20–30% of people are colonized perseveringly with S. aureus, 30% are colonized irregularly, and 50% never, or rarely, are colonized. Why a few people clearly are impervious to colonization, and along these lines at lower danger of

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contamination, remains an open question. Understanding the science of this pathogen, particularly its environmental specialty in people and the initial step in infection, colonization, may thusly give new modalities to limit pathogenesis [8, 12, 17].

2. Material and Methods

2.1 Study area

The study area of this research i.e. to analyze the prevalence and antimicrobial susceptility pattern of staphylococcus aureus is done in Garhwal region. Samples were collected from Veer Chandra Singh Government medical science and research institute HNB Base Hospital Srinagar Garhwal.

2.2 Study design and period

Information of patient will be extracted from the electronic medical records and by traditional chart review and record on a standard data collection sheet. Duration of study was two year from 2015 to 2017.

2.3 Population

During the two years period, about 500 patients with clinical presentation of septicemia admitted in different units, namely Medicine, Nursery, Pediatrics, ICU, Orthopedic, Dialysis and Surgery at Veer Chandra Singh Government medical science and research institute HNB Base Hospital Srinagar Garhwal were evaluated.

2.4 Inclusion criteria

Patients of all age groups which require osteo-reconstruction using bone log blood problems and include cases of surgery.

2.5 Exclusion criteria

Patients having active osteoarticular infection at surgical site will be excluded.

2.6 Variables

Dependent variable

- Prevalence of *Staphylococcus aureus*
- Methicillin resistant pattern of *S. aureus* (Susceptible and Resistance)
- Antimicrobial susceptibility pattern of *Staphylococcus aureus*

Independent variable

- Age
- Sex
- Specimen type

2.7 Data analysis and interpretation

Data was cleaned, coded; double entered and analyzed using SPSS, version 20. Descriptive statistics, binary and multiple logistical regressions were used to estimate crude and adjusted odds ratio (ORs) with 95% confidence interval (CI) to the different variables. P-value < 0.05 was considered significant. Tables were used to describe the results [13].

Table 1: showing distribution patients under age variable

Age Groups	Number of patients		P value
	Frequency	%	
0-6 month	36	12	0.161
6 month-5 years	13	4.3	
6 years-25 years	96	32	
26 years-50 years	106	35.3	
51 years-75 years	47	15.6	
76 years-100 years	11	3.6	
Total	309	100	
Mean ± SD	25 ± 3.83		0.160

3. Result & Discussions

3.1 Socio-Demographic characteristics

Out of 500 patients, 300 patients with clinical presentation of septicemia admitted in different units. Data obtained about the study subjects included basic demographics, reasons for admission, medical history (underlying diseases), medication history, site of infection, culture site, length of hospital stay, social history and isolate characterization (e.g. antimicrobial susceptibility pattern results) [16].

3.2 Age: Age varied from the lowest of 1 day to a highest of 98 years. The mean age in all groups was comparable (p value = 0.160) with it being 36.07 ± 13.65 years. The maximum numbers of patients were in the age group 26-50 years.

3.3 Gender: Out of total 309 patients 159 patients were males and 151 patients were females. The distribution of sex among the study group was comparable (p value = 0.161)

Table 2: shows distribution of patients under sex variable

Sex	Number of patient		P value
Sex	Frequency	%	
Female	152	50.6	0.161
Male	159	53	
Total	309	100%	

Table 3: shows patient distribution using type of sample

Sample based distribution		
Items	Frequency	Percentage
Blood	43	0.3
Body Fluid	2	12.4
Ear swab	9	0.8
FNAC	2	4.2
Pedia	1	3.5
Pleural fluid	2	4
PUS	137	0.8
PUS aspirate	43	0.8
Semen	5	28
Sputum	16	0.8
Urine	48	45.2
VAG	1	0.8
Wound	1	2

The overall prevalence of S. aureus was 15.3% and the prevalence in the type of samples cultured were: blood (0.3%), followed by body fluids (12.4%), ear swabs (0.8%), FNAC (4.2%), PEDIA (3.5%), pleural fluid (4%), pus (0.8), pus aspirate (0.8), semen (28), sputum (0.8), urine (45.2%), vag (0.8%) and wound (2%).

Table 4: shows patient distribution using sensitive or resistance evaluation result of antibiotics

Antibiotics	**Sensitivity (%)**	**Resistance (%)**
Ampicillin	16	16.6
Amoxicillin	39	39
Amikacin	86.3	5.6
Chiloroamphenicol	78.6	4
Cotrimoxazole	49.6	39
Cephoxitin/Oxac	18.3	6
Ciprofloxacin	52.6	30.3
Erythromycin	55.3	28
Gentamicin	70.6	17
Peniciilin	5.3	48.3
Clindamycin	56.3	9.3
Rifampicin	38.4	3
Linezolid	41	0
Teicoplanin	46.3	0.05
Vancomycin	48.6	0

Sensitivity and resistance rates of the various antibiotics are as follows (sensitivity, resistance): ampicillin (16%, 16.6%), amoxicillin (39%, 39%), amikacin (86.3%, 5.6), chiloroamhenicol (78.6%, 4%), cotrimoxazole (49.6%, 39%), cephoxitin/oxac (18.3%, 6%), ciprofloxacin (52.6%, 30.3%), eryhromycin (55.3%, 28%), gentamicin (70.6%, 17%), penicillin (5.3%, 48.3), clindamycin (56.3%, 9.3%), rifampicin (38.4%, 3%) linezolid (41%, 0) teicoplanin (46.3%, 0.05%) & vancomycin (48.6%, 0).

Table 5: shows patient distribution using organism

Organism based distribution

Items	Frequency	Percentage
CLOPS	1	0.05
CONS	38	12.6
Contaminated	2	0.6
COPS	13	4.3
Heavy/ growth of MSSA	10	3.3
Moderate/Growth of MSSA	12	4
Moderate/Growth of S. Aureus	2	0.6
MSA	2	0.6
MSSA	84	28
Scanity MSSA	2	0.6
Staphylococcus aureus	136	45.3
Staphylococcus aureus SPP	2	0.6
Sterile 48 hours	6	2

The present study showed that males had a higher isolation rate of Staphylococcus aureus than females. Rate of isolation of S. aureus was also the highest in 26-50 years of age group. Prevalence of MSSA in the present study, however, did not vary significantly by gender ($p = 0.87$) and age group ($p > 0.05$) and this is in agreement with earlier reports by Geyid et al.[22] indicating that gender and age are not risk factor for the acquisition or colonization of MSSA.

Drug susceptibility test on all the 309 S. aureus isolates against 15 commonly used antibiotics indicated that 145 (48.3 %) were resistant to penicillin. The lowest drug resistant was observed for linezolid 0 & vancomycin 0. Furthermore, 98 (50.5%) of the isolates were multi-drug resistant (resistant to three or more antibiotics).

4. Conclusions

The prevalence of S. aureus and MSSA varies appreciably based on type of clinical samples. Pus/abscess is the main source of S. aureus and MSSA than other samples in hospital settings. The prevalence of MSSA stains obtained in this study was low when compared with the prevalence rates obtained in previous studies conducted in Ethiopia. However, the prevalence rate is considerable high when compared to other similar studies conducted elsewhere. Many MSSA strains were multidrug-resistant and a good number of the isolates were also resistant to vancomycin, the drug of choice for treating multidrug resistant MSSA infections.

4.1 Limitation

Main limitations are as follows:

- More sensitive and specific molecular techniques could not be used to identify the species and strain typing of S. aureus
- The infection is due to community or hospital acquired strains could not be identified
- The study was hospital based which may decrease/increase the detection rate of S. aureus. It is better including the community as well.
- Clinical data could not be taken which might be important to characterize the association of S. aureus to it.

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