Multidrug resistance pattern of Staphylococcus aureus isolated from human clinical samples in different age and sex groups in Mirpur area, Dhaka City, Bangladesh

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ABSTRACT:

There is a high degree of antibiotic resistance, poses a regional and global threat. Mortality and economic burden have increased worldwide due to antibiotic resistance. Bangladesh is a developing country of Southeast Asia and facing challenges of multi-drug resistance. *Staphylococcus aureus* is an important human pathogen that causes skin and soft tissue infection especially abscess formation. The present study was conducted to find out multi-drug resistance pattern of isolated *Staphylococcus aureus* from pus samples. A prospective study was carried out at Mirpur, Dhaka, Bangladesh and 80 samples were collected by using Purposive sampling technique. The antibiotic susceptibility of the S. aureus isolates was determined using the standard disc-diffusion (Kirby-Bauer) method. Antibiotics Amoxicillin + Clavulanic acid (Amo+CA), Co-trimoxazole (COT), Doxycycline (DO), Azithromycin (AZM), Cefixime (CFX), Ceftriaxone (CTR), Ciprofloxacin (CIP), Nalidixic acid (NA), Gentamycin (GEN), Chloramphenicol (C), Nitrofurantoin (NIT), Meconium (MEC), Levofloxacin (LEVO) and Meropenem (MEM) were used for the study. It was seen that 0 % (Cefixime) to 82.5% (Mecilinam) of the S. aureus is resistant to the antibiotics used against them. Ceftriaxone (96.25% sensitive) is the best drug for the treatment of *S. aureus* infection followed by meropenem (95 % sensitive). Due to some limitation it could not be come in concrete conclusion. It is necessary to conduct further large scale study considering present study scenario.

Key words: Antibiotics, Multi-drugs, Resistance, Staphylococcus aureus

INTRODUCTION

Bangladesh is a developing country of Southeast Asia. There is a high degree of antibiotic resistance, poses a regional and global threat. Mortality and economic burden have increased worldwide due to antibiotic resistance. Developing countries like Bangladesh are more vulnerable because of the widespread misuse of antibiotics, non-human antibiotic use, poor quality of drugs, inadequate surveillance, and factors associated with individual and national poverty.[1] World Health Organization claimed that Bangladesh is one of the vulnerable countries responsible for multidrug resistant.[2] Numerous reports suggest that absolute numbers of infections due to resistant microbes are increasing globally.[3] *Staphylococcus aureus* is an important human pathogen that causes skin and soft tissue infection especially abscess formation. Abscess formation is not unique to Staphylococcal infection and purulent discharge has been widely considered a physiological feature of healing and tissue repair. *Staphylococcus aureus* is also an important pathogen due to a combination of toxin-mediated virulence, invasiveness and antibiotic resistance. As a life threatening infectious disease, Staphylococcus aureus infection has been turned into a global health concern recently. In a

developing country like Bangladesh, the situation is vulnerable because of inadequate and inappropriate practices of control measures to prevent the spread of nosocomial infection. [4]

Mirpur is a very population dense area in Dhaka city. Multi-occupational people live in Mirpur, specially numbers of slum area are situated in vasantak area of Mirpur who depend on chemist for their primary treatment without going to qualified physician. That is why Multidrug resistance against *Staphylococcus aureus* is very challenging issue in Mirpur area. Although some previous researches have been conducted on *Staphylococcus aureus* in Bangladesh using cultural methods, the result is not updated because the antibiotic resistance pattern of nosocomial microorganisms including *Staphylococcus aureus* has been changed in the last couple of years.[3]

The present study was conducted to find out multidrug resistance pattern of isolated *Staphylococcus aureus* from pus samples.

MATERIAL AND METHODS

The present prospective study was carried out in Padma Patho Lab, Mirpur, Dhaka, Bangladesh and samples were collected by using Purposive sampling technique.

Bacterial isolates

The study analysed a total of 80 preserved bacterial isolates. All equipment and glass wares were sterilized by autoclaving at 121°C, 15lbs p.s.i pressure for 15 min and isolates were collected from patients with acute respiratory infections (nasopharyngeal swab), wound infections (wound swab), Pus from localized abscess in 2017. The strains were preserved at −70°C as glycerol stock. Bacterial identification and reconfirmation were performed by routine conventional microbial cultures and biochemical tests using standard recommended techniques.[5] Catalase test was used to differentiate those bacteria that produce the enzyme catalase from non-catalase producing ones and Indole production test was performed to determine the ability of microorganisms to degrade the amino acid tryptophan. Finally the antibiotic susceptibility of the *Staphylococcus aureus* isolates was determined using the standard disc-diffusion (Kirby-Bauer) method. Antibiotics Amoxicillin + Clavulanic acid (Amo+CA), Co-trimoxazole (COT), Doxycycline (DO), Azithromycin (AZM), Cefixime (CFX), Ceftriaxone (CTR), Ciprofloxacin (CIP), Nalidixic acid (NA), Gentamycin (GEN), Chloramphenicol (C), Nitrofurantoin (NIT), Meconium (MEC), Levofloxacin (LEVO) and Meropenem (MEM) were used for the study.

RESULTS

Table 1: Antibiotic Sensitivity pattern of Staphylococcus aureus isolated from pus of young mlae to each of the following antibiotics at Mirpur, Dhaka

Pts	Amo+CA	COT	DO	AZM	CFX	CTR	CIP	NA	GEN	C	NIT	MEC	LEV	MEM
P-1	R	R	M	R	S	S	S	M	M	R	S	R	S	S
P-2	M	R	R	M	S	S	S	M	M	R	S	R	R	S
P-3	R	R	M	S	S	S	S	R	S	R	R	R	M	S
P-4	R	R	M	M	S	S	R	M	S	R	S	R	R	S
P-5	R	M	R	M	S	S	S	M	R	R	R	R	R	S
P-6	M	R	R	S	S	S	R	R	S	S	R	S	R	S

P-7	R	S	R	S	S	S	S	R	S	R	M	R	M	S
P-8	S	R	M	S	S	S	S	R	R	S	M	R	R	S
P-9	R	M	R	S	S	S	S	R	S	S	S	R	S	R
P-10	R	R	R	M	S	S	S	M	S	R	R	R	R	S
P-11	R	R	M	S	S	S	S	M	S	R	R	R	R	S
P-12	S	R	R	R	S	S	S	M	S	M	R	R	R	S
P-13	R	R	M	M	S	S	S	R	R	M	S	R	R	S
P-14	M	R	R	M	S	M	S	R	S	R	S	R	R	S
P-15	S	R	M	M	S	S	S	R	S	S	R	R	R	S
P-16	R	R	R	S	S	S	R	S	R	S	R	S	S	S
P-17	R	R	R	M	S	S	S	R	S	S	S	M	R	S
P-18	S	R	R	M	S	S	S	R	S	R	S	R	S	S
P-19	R	R	R	M	S	S	M	R	R	R	S	R	S	M
P-20	S	S	M	S	S	R	M	S	S	R	R	S	S	S

Note: S= Sensitive, M= moderately sensitive, R= Resistant.

Table 2: Antibiotic Sensitivity pattern of *Staphylococcus aureus* isolated from pus of young female to each of the following antibiotics at Mirpur, Dhaka

Pts	Amo+CA	COT	DO	AZM	CFX	CTR	CIP	NA	GEN	C	NIT	MEC	LEV	MEM
P-1	R	R	R	M	S	S	R	R	M	R	R	R	S	S
P-2	R	R	R	M	S	S	R	R	S	R	S	R	S	S
P-3	R	R	R	S	M	S	S	R	S	S	R	R	S	S
P-4	M	R	R	S	S	S	R	R	M	R	M	R	M	S
P-5	S	M	R	M	S	S	M	R	M	R	M	R	S	S
P-6	R	R	R	M	S	S	S	M	S	R	R	M	S	S
P-7	M	M	R	S	S	S	M	R	S	R	R	R	S	S
P-8	M	R	R	S	S	S	R	R	S	R	M	R	S	S
P-9	S	R	R	S	S	S	M	R	S	R	R	R	S	S
P-10	M	R	R	S	S	S	R	R	M	R	R	R	S	S
P-11	M	R	R	M	S	S	M	S	S	S	S	S	M	S
P-12	M	R	R	S	S	S	M	R	M	R	R	M	S	S
P-13	S	R	R	S	M	S	M	R	M	R	R	M	S	S
P-14	R	R	M	M	S	S	S	M	M	R	R	R	M	S
P-15	M	R	R	M	S	S	S	S	M	R	R	R	S	S
P-16	S	M	R	M	S	S	R	R	S	R	M	R	S	S
P-17	S	M	R	R	S	S	R	R	M	M	R	R	S	S
P-18	R	R	R	S	S	S	S	M	R	R	R	R	S	S
P-19	M	M	R	S	S	S	M	S	S	R	R	R	M	S
P-20	M	R	R	M	S	S	S	R	S	R	M	R	S	S

Note: S= Sensitive, M= moderately sensitive, R= Resistant.

Table 3: Antibiotic Sensitivity pattern of *Staphylococcus aureus* isolated from pus of elder male to each of the following antibiotics at Mirpur, Dhaka

Pts	Amo+CA	COT	DO	AZM	CFX	CTR	CIP	NA	GEN	C	NIT	MEC	LEV	MEM
P-1	S	R	M	S	S	S	S	M	S	R	R	R	S	S

P-2	M	M	R	S	S	S	R	M	S	R	R	R	S	S
P-3	S	M	R	S	S	S	R	M	S	M	R	R	R	S
P-4	S	M	M	S	S	S	S	M	R	S	R	R	S	S
P-5	S	M	R	S	M	S	S	M	S	R	R	R	S	S
P-6	M	R	M	R	S	S	S	M	S	R	R	R	S	S
P-7	R	R	R	M	S	S	S	M	S	R	R	R	S	M
P-8	M	R	R	M	M	S	S	M	R	S	S	S	R	S
P-9	R	R	R	M	S	S	R	R	S	S	S	S	S	S
P-10	S	R	R	S	S	S	R	M	S	R	S	R	S	S
P-11	S	M	R	S	S	S	M	R	S	R	R	S	S	M
P-12	S	M	R	S	M	S	R	R	S	M	R	R	M	S
P-13	S	M	M	S	S	S	R	R	S	R	R	R	S	S
P-14	S	M	S	S	S	R	S	M	S	R	R	S	S	S
P-15	S	R	R	S	S	S	R	M	R	S	S	R	S	S
P-16	S	R	R	S	S	S	S	M	R	S	R	S	R	S
P-17	S	M	R	S	S	S	S	M	S	R	R	R	S	S
P-18	S	R	R	S	S	S	S	M	S	R	R	R	S	S
P-19	S	R	R	S	S	S	R	M	R	R	S	M	R	S
P-20	S	R	R	S	S	S	S	S	S	R	R	R	S	S

Note: S= Sensitive, M= moderately sensitive, R= Resistant.

Table 4: Antibiotic Sensitivity pattern of *Staphylococcus aureus* isolated from pus of elder female to each of the following antibiotics at Mirpur, Dhaka

Pts	Amo+CA	COT	DO	AZM	CFX	CTR	CIP	NA	GEN	C	NIT	MEC	LEV	MEM
P-1	S	R	R	S	S	S	M	S	M	M	R	R	S	S
P-2	S	R	R	S	S	S	R	M	M	M	R	R	S	S
P-3	S	R	R	S	S	S	M	M	S	R	R	R	S	S
P-4	S	M	R	S	S	S	M	M	R	M	S	R	S	S
P-5	S	M	R	S	S	S	S	R	S	M	R	R	S	S
P-6	R	R	M	S	S	S	R	M	S	M	M	R	S	S
P-7	R	R	M	S	S	S	R	M	S	M	S	R	S	S
P-8	R	R	R	S	S	S	M	S	S	M	R	R	S	S
P-9	R	R	S	S	S	S	R	R	S	R	M	R	S	S
P-10	S	M	R	S	S	S	R	R	M	S	M	R	S	S
P-11	M	M	R	S	S	S	M	S	M	S	R	R	S	S
P-12	S	M	R	S	S	S	R	S	R	M	R	R	S	S
P-13	S	R	R	S	S	R	S	R	R	S	R	R	R	S
P-14	S	R	R	S	S	S	S	M	S	R	R	S	S	S
P-15	M	R	M	S	S	S	S	M	R	R	R	R	S	S
P-16	S	R	R	S	S	S	S	R	M	S	R	S	S	S
P-17	M	M	R	S	S	S	R	S	S	R	R	R	S	S
P-18	M	R	R	S	S	S	M	S	S	M	R	R	R	S
P-19	S	M	R	S	S	S	M	M	R	S	R	M	M	S
P-20	S	M	R	M	S	S	S	R	S	R	R	R	S	S

Note: S= Sensitive, M= moderately sensitive, R= Resistant.

Figure 1: Comparative analysis of sensitivity (%) of *S. aureus* to antibiotics among age and sex groups at Mirpur, Dhaka
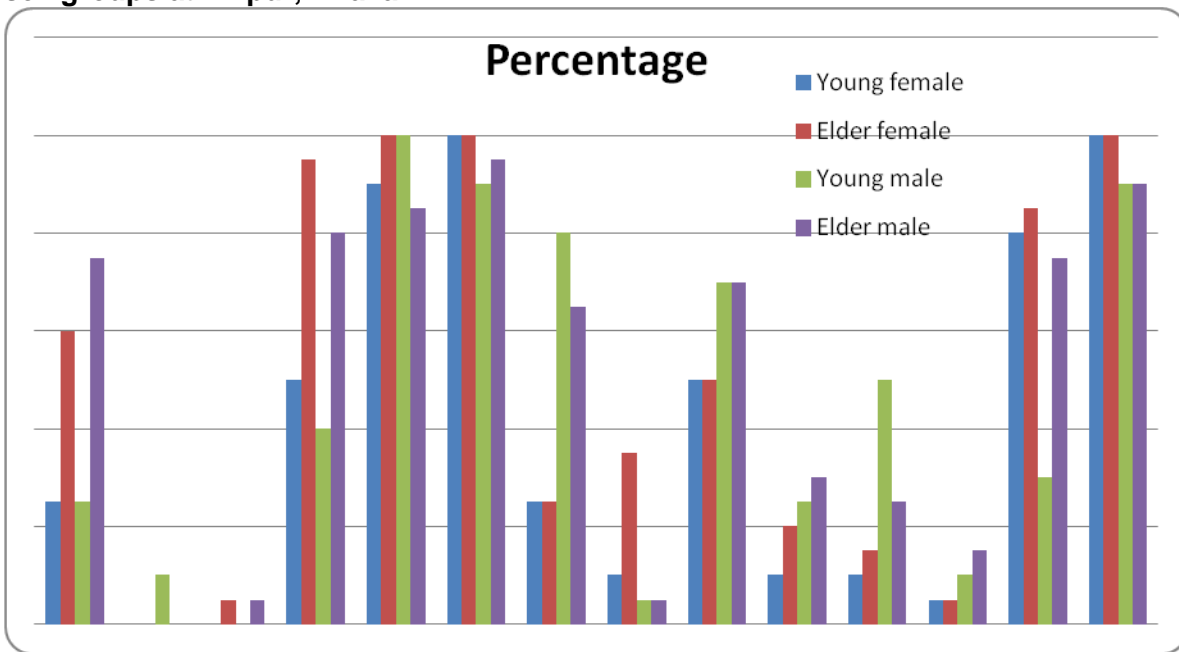

Figure 2: Overall Resistance percentage and Sensitivity percentage of *S. aureus* to each antibiotic in different age & sex groups at Mirpur, Dhaka
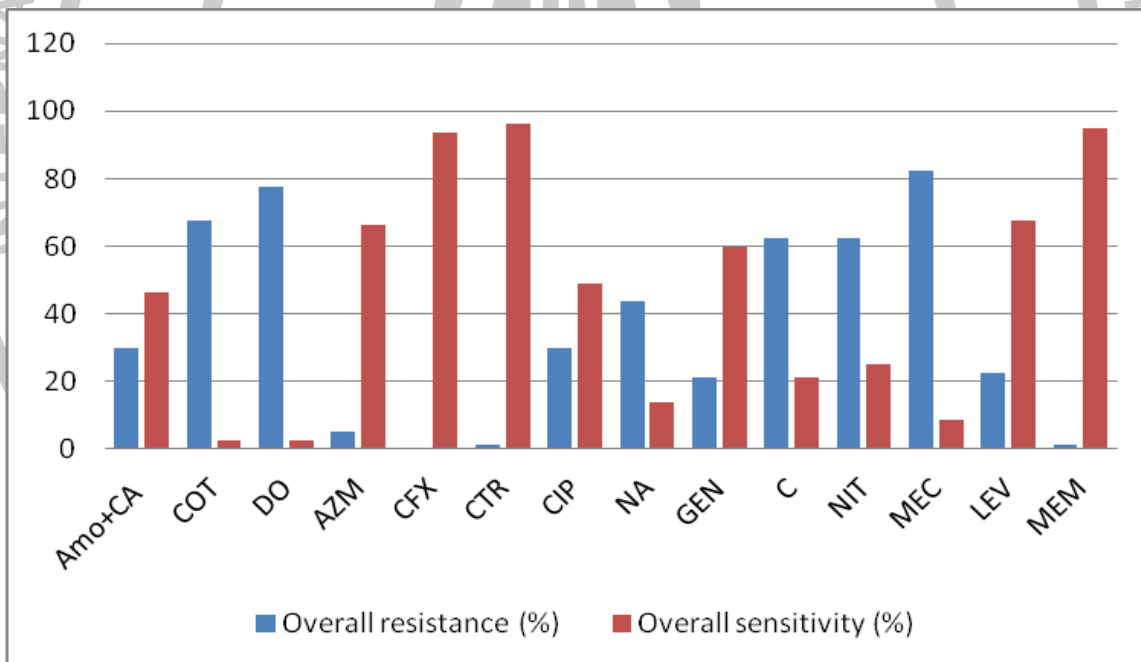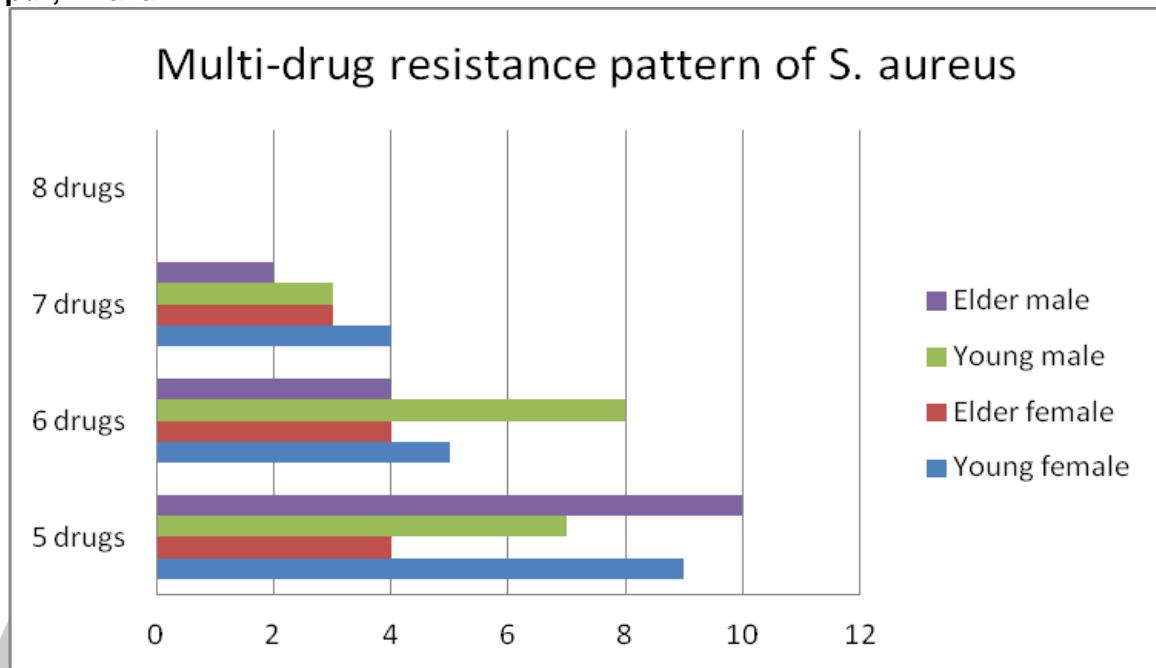
Figure 3: Multi-drug resistance percentage patterns of *S. aureus* in different age & sex groups at Mirpur, Dhaka

DISCUSSION

A total of 80, *S. aureus* were identified from the pus sample collected from Mirpur area to observe the antibiotics susceptibility having significant growth. From the figure 2 it was seen that 0 % (Cefixime) to 82.5% (Mecilinam) of the *S. aureus* is resistant to the antibiotics used against them and Ceftriaxone (96.25% sensitive) was the best drug for the treatment of *S. aureus* infection followed by meropenem (95 % sensitive). From the table 1 -4 it was found that 18 of the samples (90%) were multi-drug resistant found in the sample of elder male, young male and young female, 16 samples (80%) were multi-drug resistant found in the sample of elder male, 8 samples (40%) were multidrug resistant found in the sample of elder female.

Resistant to 5 or more of the antibiotics were tested and it was found that overall 75% of S. aureus were Multi-drug resistant.

CONCLUSION

Pus infection has been a major concern among health care practitioners not only in terms of increased trauma to the patient but also in view of its burden on financial resources and increasing requirement for cost-effective management within the health care system. S. aureus is the most frequently isolated microorganism from pus caused by incision to reach pus or fluid collection under the skin surface and from wound types observed in this study. Throughout the study it was assumed that the multi-drug resistant pattern in Mirpur, Dhaka was alarming. We did not investigate the cause-effect of resistant. Since, there was some limitation like sample size, financial constrain; hence it was come in concrete conclusion. It is necessary to conduct further large scale study considering present study scenario.

ETHICAL CONSIDERATION

Ethical clearance was sought from the department of Microbiology, Primeasia University.

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Competing interests

There is no competing interest.

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