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ANTIBIOTIC SUSCEPTIBILITY PATTERN OF METHICILLIN RESISTANCE *STAPHYLOCOCCOUS AUREUS* IN POST OPERATIVE SURGICAL WOUND INFECTIONS

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ABSTRACT

Methicillin Resistant *Staphylococcus aureus* (MRSA) are life threatening to the hospitalized patients and leads to endocarditis, skin and other wound infections especially in post operative surgical wounds. This study conducted to determine the prevalence and antibiotic susceptibility pattern of MRSA isolates in post-operative surgical wound infections from tertiary care hospital, Peshawar, Khyber Pakhtunkhwa province of Pakistan. A descriptive cross-sectional study was carried out in tertiary care hospitals Peshawar. Total of 3906 pus specimen were collected from nosocomial surgical wounded patients and antibiotic susceptibility pattern were determined through disc diffusion method in duration from January to September 2018. Out of total, S. *aureus* isolates were obtained from 827 (21.2%) samples. The overall proportions of Methicillin Resistant *Staphylococcus aureus* were 17.2% (n=142). Frequently infected patients were adults (83%) with high percentage of male (73.2%). For MRSA isolates, drug resistance was commonly observed while only few antibiotics (Vancomycin and Linezolid) were highly sensitive drug to MRSA. Moreover, Ciprofloxacin

were least sensitive to *Staphylococcus aureus* isolates. MSSA isolates were sensitive nearly to all antimicrobial agents. This study determined the current prevalence of MRSA in surgical wounds along with the antibiotic susceptibility pattern of *Staphylococcus aureus* isolates from Peshawar. MRSA is associated with drug resistance, therefore imperative to monitor and control the spread of this lethal infection.

Keywords: Antibiotics, MRSA, Post operative, Surgical Wounds

INTRODUCTION

Staphylococcus aureus (S. aureus) is recognized as one of the most virulent acquired pathogen and increased dramatically since last two decades in both hospital and community **[1]**. Anti-microbial drug resistance of *S. aureus* and other microorganism have great public health concern throughout the world particularly revealed from developing countries **[1, 2]**. Methicillin Resistant *Staphylococcus aureus* (MRSA) is serious nosocomial infectious pathogen with high fatality level **[3]**. The most serious infection cause by MRSA including bacteriaemia, hospital acquired post surgical wounds infections, pneumonia, urinary tract infections, endocarditis, skin infections, septic arthritis and lower respiratory tract infections **[2, 3]**. The National Nosocomial Infection Surveillance (NNIS) report revealed that MRSA is responsible for approximately 40% of nosocomial acquired infection in tertiary care centers **[3]**. Whereas, 2-50% MRSA reported from Europe **[1]**. Anti-MRSA efficacy continuously decreasing with the increase of MRSA incidence **[4]**.

Surgical site infections (SSIs) or postoperative infection is a serious and devastating issue of hospitalization. SSIs were defined as discharge of pus from the wound sites, based on inflammatory signs and symptoms like redness, raised temperature and tenderness of the wound sites. SSIs are responsible for about 16% of nosocomial infection and vary from 14-40% in developing countries **[5]**. A large number of variety surgical procedures are carry out in United States every year, and an approximately 0.3-0.5 million SSIs occur each year **[6]**. Individuals undergoing surgical procedure are more prone to SSIs in hospitals as compared to community acquired **[7]**. *S.aureus* is most frequently observed in surgical wounds and primary nosocomial pathogen comprised 20% of SSIs **[6]**. The prevalence of SSIs caused by *S.aureus* subsequently increasing from last few decades **[8]**. Isolation of MRSA from surgical wounds has statistical important contribution in delayed healing of wound sites **[3]**. Despite using a potent anti-Staphylococcal drugs before operation (peri-operative prophylaxis), *S. aureus* still

the frequent infective bacteria in surgical wounds **[9]**. MRSA has a crucial role in nosocomial and postoperative infection **[3]**. Various factors (susceptible host, overuse of antibiotic in hospitals and inappropriate infection control practices) are involved in the emergence of nosocomial infections **[9]**. An urgent base controlling of hospital infections are necessary due to the emergence of antibiotic resistant MRSA isolates. Therefore, the primary important to know the epidemiology of MRSA and decrease with suitable methods such as reliable, accurate and rapid detection of the organisms, isolation, antibiotic susceptibility patterns and treatment of infected individuals **[2]**.

Antimicrobial agents such as Tigecycline (TG), Daptomycin (DP), Vancomycin (VAN), Linezolid (LZD), Doxycycline (DO), Clindamycin (DA), Fusidic Acid (FD), Amikacin (AK), Gentamicin (CN), Erythromycin (ER), Trimethoprim/ Sulfametaxazole (SXT) and Ciprofloxacin (CIP) are frequently used for treatment of MRSA and S. aureus. Depsite anti-staphylococcus therapy, resistance against these agents is commonly reported from different regions of the world **[5]**.

This present study was undertaken to determine the current antibiotic susceptibility pattern of Methicillin Resistant S*taphylococcus aureus* in surgical wounds at tertiary care hospitals, Peshawar, Khyber Pakhtunkhwa province of Pakistan.

METHODOLOGY

Study Design and Setting

This study was carried out on surgical wounded patients at tertiary care hospital, Lady Reading Hospital (LRH), Khyber Pakhtunkhwa province of Pakistan.

Study Duration

All the data were collected from post operative surgical wound infected patients in period of January to September 2018.

Participants Criteria

All the patients with a positive surgical site infection admitted to any ward of the hospital were included irrespective of age and gender.

Ethical Consideration

This study was approved by hospital ethical committee while consent form was also taken from all included patients of SSIs.

Procedure

A total of 3906 pus specimens were collected through sterile cotton wound swab with suspected infected site from each admitted patient. The collected samples were inoculated on the available media including the Blood, Cysteine Lactose Electrolyte Deficient (CLED) and MacConkey's agar, incubated for 24 hours at 37%. All the positive culture was recorded and identifies the pathogens. *S. aureus* isolates were pinpoint through colonial morphology, tube coagulase,

DNAse reaction, catalase tests and mannitol salt agar, subsequently processed for MRSA detection by disc diffusion assay using Oxacillin 1mg disc according to Clinical and Laboratory Standards Institute (CLSI) guidelines. *S. aureus* strain were considered resistant to Oxacillin (Ox) if the diameter (zone) of inhibition <10mm around a single disk. *S. aureus* ATCC 29213 (American Typing Culture Collection) and MRSA ATTC 49476 were used as a reference control strains. Antibiotic susceptibility testing was carried out for Vancomycin, Linezolid, Doxycycline, Clindamycin, Fusidic Acid, Amikacin, Gentamicin, Erythromycin, Trimethoprim/ Sulfametaxazole and Ciprofloxacin on Muellar-Hinton Agar (MH agar) through Kirby Bauer method according to the CLSI and National Committee for Clinical Laboratory Standard (NCCLS) guidelines using disks diffusion antibiotics (Oxoid).

Statistical Analysis

Data were analyzed by Statistical Package for Social Sciences (SPSS) software version 21 to compute the burden of MRSA.

RESULTS

During study period, a total of 3906 wound pus swab specimen was collected from surgical site of patients after surgical procedure. Collected samples were inoculated on culture and yielded organism on culture media. Out of total, 827 (21.2%) patients were infected with *S.aureus* isolates whereas remaining were various types of organism such as gram negative bacteria and fungus isolates as shown in figure no.1. Antibiotic resistance is increasing all over the world particularly in developing countries as compared to developed countries **[10]**. The present study revealed the important data regarding the *S. aureus* and MRSA in surgical site infection which is 21% and 17% respectively. The prevalence of *S. aureus* is similar to study reported by Shagufta et.al and Maida *et al* **9]**. While the burden of MRSA is 17% in post operation patients in current study which is lower than prevalence reported by Shagufta *et al* and Deverick *et al* as shown in **Table 1**. Nearly similar result like study reported by Paul *et al* from South Jamaica (23% *S. aureus*) **[5]**. High prevalence (39% and 53%) of MRSA in surgical wound was also reported from different regions **[6, 9]**. High prevalence could be due to consistent and unnecessary use of the Oxacillin antibiotics by physician and health technicians **[10]**. High burden of MRSA reported in adults and male in current study. It could be due to high number of male patients.

Present study revealed that vancomycin and Linezolid are highly sensitive (93.5% and 91.3% respectively) than other anti-staphylococcus agents as mentioned earlier. Nearly, same report of (97%) like current study reported by

Kulshrestha et.al from India **[12]**. Whereas, some reports shows 100% sensitivity of MRSA to Vancomycin and Linezolid **[13, 14]**.

Current study explored that MRSA shows high resistance to Ciprofloxacin and Trimethoprim/Sulfamethoxazole.

Ciprofloxacin resistance to MRSA also reported by Kulshrestha A. et.al from India **[12, 13]**. Rehman *et al* reported similar like present study result that MRSA are resistant to both Ciprofloxacin and Trimethoprim/Sulfamethoxazole **[14]**. The resistance to Ciprofloxacin and Trimethoprim/Sulfamethoxazole could be due to over and misuse in our setting.

MRSA in surgical sites are predominantly observed in hospitalized patients due to prolonged antibiotics exposure, peripheral vascular disease, in old age, receipt of dialysis, prolongs stay in hospital, cancer and diabetes patients are the risk factors for MRSA in SSIs **[6]**. MRSA frequently transmit by cross contamination between patients through direct contact of infected patients or health care worker **[3]**.

Several different ways to decreased the burden of SSIs e.g. awareness of hygiene as well as careful use of antibiotic by **[9]**. Prevention and control of nosocomial MRSA infections depends on manual planning including strict adherence to aseptic practices, proper surveillance, disinfectant policies, prohibiting the colonized health care staff and judicious antibiotics **[10]**. Hand washing between attending patients may prevent the transmission of MRSA infection in hospital **[10]**. Additionally, antibiotic prophylaxis should be recommended before an hour of surgery along with the pre-operative showering to reduce the microbial load on skin surface **[15]**.

Adults and old age group people are prone to MRSA infection after surgery than younger **[16]**, therefore more age patients and his previous history of hospitalization should be screened for MRSA prior to elective surgical procedures. MRSA infection in surgical wound patients increased the treatment cost and prolonged the stay in hospital which leads to poor outcome in these patients **[17]**. The adverse impact of antibiotics can be overcome with the use of appropriate antimicrobial agents against MRSA in surgical wounds **[10]**.

Site of infection, duration of patients in hospitals and molecular characterization was not reported in current study. Despite the mentioned limitations, current study provides novel epidemiology information of *S. aureus* and MRSA infections in surgical wounds in our setting. Prospective study required to follow surgical patients before and after surgery.

According to the present study, MRSA isolates are frequently identified in adults

(83%) surgical wound patients as compared to children (17%) as shown in **Figure 3**. Comparison of gender wise MRSA, male (73.2%) were frequently infected with the MRSA infection than female (26.8%) as shown in **Figure 4**.

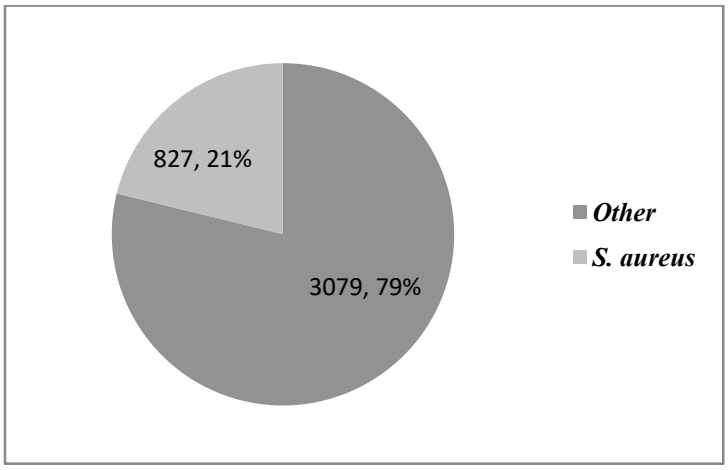

Figure 1: Prevalence of *S. aureus* in surgical wound sites

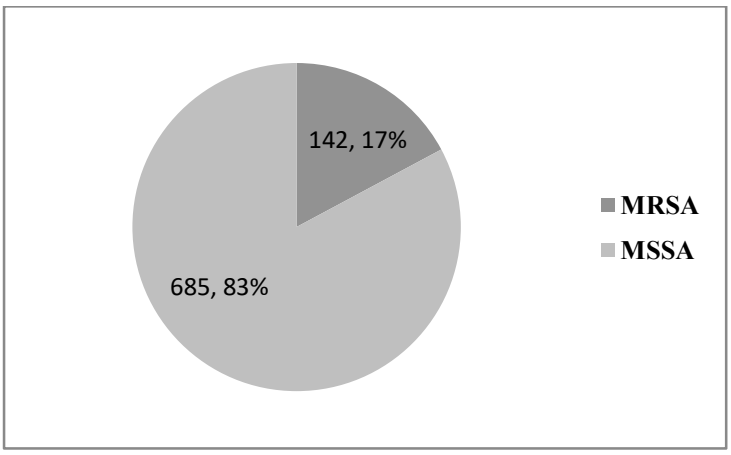

Figure 2: Frequency of MRSA and MSSA in surgical sites

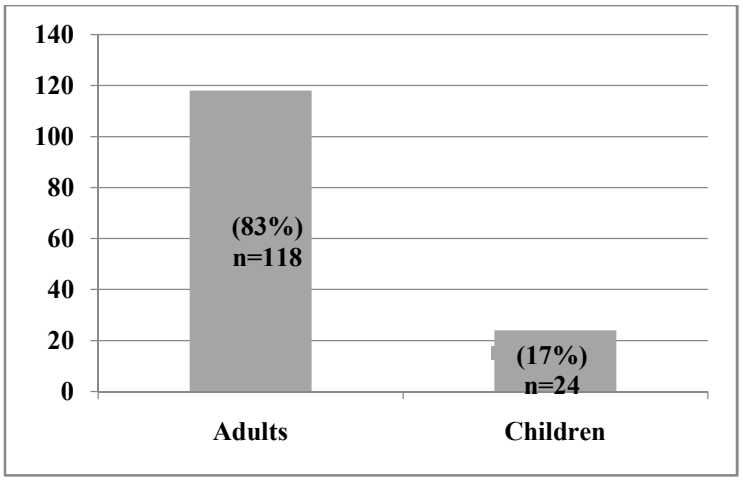

Figure 3: Distribution of MRSA in the children and Adults

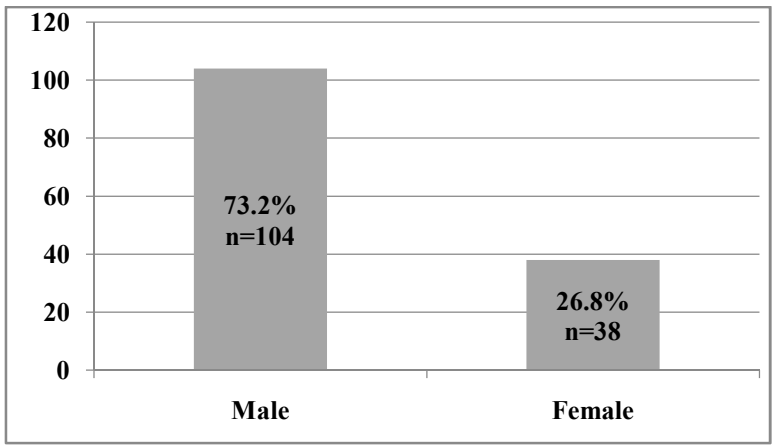

Figure 4: Distribution of MRSA according to the gender wise

Table 1: Antibiotic susceptibility pattern of MRSA of surgical site infections

Antibiotics	Symbols	Concentration of Antibiotics (ug)	Sensitive (%)	Resistance (%)
Vancomycin	VAN	30	93.5	06.5
Linezolid	LZD	1-16	91.3	08.7
Fusidic Acid	FD	10	70.5	29.5
Doxycycline	DO	30	69.1	30.9
Clindamycin	DA	30	64.5	35.5
Amikacin	AM	30	48.3	51.7
Gentamicin	CN	10	33.7	66.3
Erythromycin	ER	15	33.2	66.8
Trimethoprim/ Sulfametaxazole	SXT	1.25-23.75	25.9	74.1
Ciprofloxacin	CIP	5 1.25-23.75	17.8	82.2

Table 2: Comparison of present study results with other studies

Pathogen	*S. aureus*	MRSA	MSSA	Reference
Present study	21%	17%	83%	
John et.al. (2004)	46%	13.7%	86.3%	(11)
Maida et.al. (2010)	22%	7.9%	92. 1	(5)
Deverick et.al. (2007)	33%	53%	47%	(6)
Shagufta et.al. (2005)	20%	39%	61%	(9)

CONCLUSION

The study had determined the burden of *S. aureus* (21%) in post operative wound site infection along with the antibiotic sensitivity pattern. Our report evaluates that vancomycin resistant *staphylococcus aureus* (VRSA) are progressively in our setting. In addition, our study finding also elaborates the life threatening MRSA patient wounds with resistance to majority available therapy regimen. However, after comparison with other studies reports the rate of MRSA prevalence is low in current study. MRSA infection is usually multi-drug resistant and their therapy a huge economical drain on patients as well as on government. Strict control hygienic practices during wound dressing and other control measures may help in arresting the nosocomial spread of MRSA in surgical sites. Earlier detection of MRSA in carrier along with proper treatment can trim down the transmission and infection of MRSA. Antibiotic policy and monitoring of

susceptibility patterns may help in decreasing the MRSA burden and to antibiotics. Molecular characterization of MRSA is recommended for future studies both hospital and community.

Conflict of interest: The author(s) declare no conflict of interest.

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