

Occurrence of methicillin resistant staphylococcus aureus (MRSA) in patients requiring reconstructive surgery

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Abstract

Objectives: Staphylococcus aureus is a significant nosocomial pathogen and the development of resistance to methicillin poses a major threat to its control. This study was conducted to determine the incidence of methicillin resistant staphylococcus aureus in outdoor patients and its susceptibility to different anti-staphylococcal antibiotics.

Study design: Descriptive prospective study.

Setting and duration: Outpatient department, Plastic Surgery & Burn Unit, Khyber Teaching Hospital Peshawar from August 2011 to July 2014.

Methods: A total of 210 patients, of either gender, who presented with septic wounds were included in the study. Swabs were collected from infected wounds and transported in Stuart's medium. The specimens were inoculated on Blood agar, MacConkey's agar and nutrient agar and incubated at 37°C for 24 hours. The clinical specimens submitted at the microbiology laboratory were processed and all methicillin resistant staphylococcus aureus (MRSA) isolates were identified morphologically and biochemically by standard laboratory procedures. All the isolates were studied for their susceptibility and resistance pattern.

Results: Out of 210 patients, 123 (58.57%) were male and 87 (41.42%) female with mean age of 28.5 years. The frequency of culture positive cases was 127 (60.47%), of which the frequency of MRSA was 81 (63.77%). The frequency of culture negative cases was 83 (39.52%). The MRSA were 100% sensitive to linezolid, vancomycin and teicoplanin. Out of them 49.38% were sensitive to fusidic acid, 19.75% to cotrimoxazole and 30.86% to tetracycline group of antibiotic. The organism was found to be 100% resistant to most of commonly prescribed antibiotics.

Conclusions: The emergence of MRSA is on the rise. The organism spreads easily in hospital settings and causes higher mortality, morbidity and increased costs. Specific precautions and infection control measures must be adopted to prevent and interrupt the spread of MRSA.

Keywords: MRSA, Nosocomial infection, Antibiotic resistance

Introduction:

Staphylococcus aureus is a gram positive bacterium that causes various infections in human beings. The microorganism is capable of producing infectious conditions like cutaneous infections, pneumonia, toxic shock syndrome and life threatening blood stream infections¹. The control of this organism is difficult because of its ability to develop resistance against multiple antimicrobial agents. This multidrug-resistant

nature of staph aureus limits the treatment options². To almost every new drug which is introduced, resistance follows soon. S. aureus strains have developed resistance to virtually all antibiotic classes that are currently in practice. These include β -lactams and glycopeptides, aminoglycosides, tetracyclines, fusidic acid, quinolones, trimethoprim sulfamethoxazole etc.²⁻⁴. Penicillin was the first beta lactam antibiotic introduced in 1940. Soon resistance to it emerged in 1942. β -

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lactamase (Penicillinase) was extracted in 1944. Penicillinase resistant β -lactams such as cephalosporins and semi synthetic penicillins such as methicillin and nafcillin became available in the late 1950s⁵. Methicillin was introduced in 1959 but soon the *S. aureus* developed resistant to it⁶.

Methicillin resistance staph aureus (MRSA) was first reported in 1961⁶. The resistance of staph aureus to methicillin confers cross resistance to other broad spectrum beta-lactam antibiotics like cephalosporins. The emergence of MRSA is admitted as a very serious health problem because of the difficulty in controlling these strains¹⁰. Infections with antibiotic resistant organisms generally result in higher morbidity and mortality rates than the susceptible microorganisms⁷⁻¹¹.

Variations in the pattern of antimicrobial susceptibility of *S. aureus* have been reported worldwide. In developing countries the antimicrobial agents are becoming less effective in treating bacterial infections. The magnitude of MRSA incidence in Asia occupies a lower level in contrast to Europe and the United States¹². The difference in prevalence may be due to different practices and policies prevailing in different hospitals, even, in given areas¹³. Many studies have shown an increase in the number of MRSA cases and thus posing a challenge to the current healthcare system. For the past 20 years there has been a major increase in the number of infections caused by MRSA in some countries, especially the United Kingdom¹⁴.

The resistant strain of staph aureus is typically introduced into an institution by an inhabitant (i.e. harboring the pathogen but without discernable signs of disease) or infected patient or a health care worker¹⁵. It is recognized that colonization with MRSA precedes infection¹⁶. Several modes of transmission include the transient colonization of hospital staff and contact with heavily contaminated fomites and environmental surfaces around infected patients¹⁷. Certain causative factors that subsidize the transmission and dissemination of this organism include prolonged hospital stay and the use of several broad

spectrum antimicrobial agents. The healthcare worker harboring the pathogen can transmit the infection to the patients with whom they have contact and directly contribute to the continuance of the problem¹⁸.

MRSA with limited treatment options is particularly difficult to treat. The control of this organism is therefore very important so that it does not spread to other patients. The present study was conducted to assess the incidence of MRSA in the outdoor patients presenting to plastic surgery department at tertiary care hospital in Peshawar.

Methodology:

This study was conducted over a period of three years from August 2011 to July 2014 at the department of plastic surgery, Khyber Teaching Hospital, Peshawar. The study was conducted after approval by the Hospital ethical committee. A total of 210 patients were included in this study. Informed consent was taken from each patient. All these patients presented with septic wounds involving various regions of the body. Irrespective of age, sex, cause of sepsis, region involved, and any previous surgical intervention, all the presenting patients, for various plastic and reconstructive procedures, were included. The patient's comorbid conditions, previous treatment including antibiotics and the length of treatment were not taken into account however the referral source and duration of previous hospitalization were recorded. 164 patients remained admitted in various hospitals and their duration of stay ranged from 7 to 21 days. The patients were either discharged or referred from various allied specialties like orthopedics, general surgery, maxillofacial surgery, pediatric surgery and gynecology. Wound swabs were taken from all patients registered in the study. Swabs were collected from infected wound following cleansing of any scrap of previously applied topical remedy. Swabs were immersed in Stuart's transport medium. After collection, all swabs were inoculated on Blood agar, MacConkey's agar and nutrient agar and incubated at 37°C for 24 hours. Morphological Examination of pus smear and culture smear, colonial mor-

phology, production of β hemolysis on blood agar and production of pigmentation on Nutrient agar and biochemical tests like catalase, coagulase Mannitol fermentation and Novobiocin sensitivity were performed for the isolation of methicillin resistant strains of staph aureus. Antimicrobial susceptibility test was performed by disc diffusion method as per National Committee of Clinical Laboratory standards (NCCLS).

Statistical software SPSS- 17 was used to analyse the data

Results:

Atotal of two hundred and ten outdoor patients presenting to the Plastic surgery unit were screened for the incidence of MRSA. Out of total patients 123 were males and 87 females. The age of the patients ranged from one and half year to seventy one years(1.5-71years) and the mean age was 28.5 years. The frequency of microbial culture positive cases was 127(60.47%). Of the total culture positive cases the frequency of MRSA was 81 (63.77%). Out of 81 MRSA cases 52 (64.19%) were male and 29 (35.80%) were female.The frequency of other bacteria was 46 (36.22%). All the MRSA showed 100% sensitivity to linezolid and vancomycin.Sixteen (19.75%) of the strains showed sensitivity to cotrimoxazole, 40 (49.38%) to fucidic acid and 25(30.86%) to tetracycline. The MRSAgrown was 100% resistant to major groups of antibiotics such penicillins, cephalosporins, macrolides, flouroquinolones, imipenem, meropenem, gentamicin and piperacillin/tazobactum (Table 1).

Table 1: Sensitivity pattern of MRSA

Antibiotic	Sensitive	Resistant	Total
Linezolid	81 (100%)	0	81
Vancomycin	81 (100%)	0	81
Teicoplanin	81 (100%)	0	81
Fuscidic acid	40 (49.38%)	41 (50.61%)	81
Cotrimoxazole	16 (19.75%)	65 (80.24%)	81
Tetracycline	25 (30.86%)	56 (69.13%)	81
Penicillin	0	81 (100%)	81
Cephalosporins	0	81 (100%)	81
Macrolides	0	81 (100%)	81
Flouroquinolones	0	81 (100%)	81
Gentamycin	0	81 (100%)	81
Imipenem	0	81 (100%)	81
Meropenem	0	81 (100%)	81
Piperacillin/tazobactum	0	81 (100%)	81

Table 2: Referring source of MRSA positive cases

Referral source	No. of Patients	%age
Orthopedics	26	30.09%
General surgery	21	25.92%
Pediatric surgery	17	20.98%
Gynecology	3	3.70%
Maxillofacial surgery	4	4.93%
Neurosurgery	1	1.23%
ENT	4	4.90%
Periphery	5	6.17%
Total	81	100%

Table 3: Etiology of Wound Sepsis

Etiology	No. of patients	%age
Burns	35	43.20%
Road traffic accident	14	17.28%
Firearm injury	8	9.87%
Necrotizing fasciitis	11	13.58%
Post tumor ablation surgery	5	6.17%
Pressure sore	8	9.87%
Total	81	100%

Of the total 81 MRSApatients more than 50% were referred from orthopedics and general surgical units and the rest from other allied specialties like pediatric surgery,Gynecology,maxillofacial surgery, ENT and neurosurgery (Table 2).The causes of septic wound in MRSA positive cases are given in table 3.

Forty (49.38%) MRSA were present as the only microbes in the infected wounds while 41(50.61%) were associated with other bacteria as a primary pathogens. E.coli, pseudomonas aeroginosa and candida albicans were the associated microorganism revealed by the culture reports.

Of the total 81 MRSA patients 77 (95.06%) patients gave the history of previous hospitalization and 65 (84.41%) out of them remained hospitalized for more than a week time.

Discussion:

In the recent years the bacteria have evolved nu-

merous defenses against antimicrobial agents. The incidence of multidrug resistance in pathogenic and opportunistic bacteria is on the rise. For long time penicillin group of antibiotics was the mainstay of treatment of various infections caused by staphylococcus aureus. The genus has gradually acquired resistance to antibiotics and a proportion of organisms have become resistant to methicillin and cloxacillin. The emergence of such resistance raises question about the future of these drugs in chemotherapy, as the transmission of such resistance plasmid to other bacteria will help in the fast dissemination of resistance genes¹⁹.

The methicillin resistant staphylococcus aureus has caused problems in most hospitals all over the world. Since its discovery in 1961 the pathogen has been recognized as a very serious health problem because of difficulties in combatting these strains. The resurging MRSA problem seems to be based on the lack of potent therapeutic agents having a cell killing effect and capable of eliminating the MRSA from the patient's body. Hospitals and the community face challenge to control and eradicate this microorganism because these infections are associated with an increase in mortality, longer hospital stay and higher inpatient costs compared to patients with methicillin susceptible staphylococcus aureus²⁰.

The present study reveals a significant number of MRSA positive cases among the patients studied over a period of three years. About 64% of the subjects were the carriers of MRSA. A study conducted by Khan T in 2013 reported the frequency of MRSA positive cases to be 60.71%¹. In 2002 Hafiz S. et al revealed the prevalence of MRSA strains to be 42 % among the various cities of our country²¹. This elucidates that the emergence of MRSA is on the rise. An incidence of 43.16% was reported by Hassan N. in a survey at a tertiary care hospital in Lahore²². The study of Rehman S. shows an increase of 54.2% in the occurrence of MRSA over a period of two years²³. Naqvi ZA has reported an incidence of 24.11% among burn patients in Karachi²⁴. The study of Orret AF showed a steady increase in

the prevalence rate of MRSA 18.6% over the previous study of 9.8%²⁵. In year 2010 Sanjana RK and her colleagues reported the prevalence of MRSA to be 39.6% in a teaching hospital at Nepal²⁶. While comparing the results of present study with the aforementioned figures it is quite evident that there is an increase in the occurrence of MRSA.

The current study shows the pattern of susceptibility as all MRSA were susceptible to linezolid, vancomycin and teicoplanin. The sensitivity declined for the cotrimoxazole, fucidic acid and doxycycline respectively. All the MRSA isolates were resistant to certain antibiotics like penicillin, cephalosporins, chloramphenicol, macrolides, fluoroquinolones, imipenem and getamicin. Although the same observations were made by Khan T. in his study where the culture grown strains were sensitive to Linezolid, vancomycin and teicoplanin however with slight variations in the resistant pattern was also identical¹. In our study we found that most of the patients MRSA were males and majority of them had either undergone surgical interventions or remained hospitalized for more than a week time.

While studying the incidence of MRSA, Khan TA come up with the conclusion that majority of the patients with infected wounds were referred from orthopedic unit and general surgical wards¹. Our study predicted the same observations where more than 50% of the patients were those who remained admitted either in orthopedics or general surgery units. It demonstrates that MRSA is more prevalent in patients having orthopedic problem or if they have undergone any surgical procedure. We observed that almost 21% of patients referred from pediatric surgery were harboring MRSA. Certain patients with infected wounds being referred from maxillofacial surgery and ENT units were also positive for MRSA.

The long duration of hospitalization could also be a factor for getting an MRSA infection. The study of Sanjana RK depicts that the prevalence of MRSA was higher in admitted patients

(41.1%) as compare to the outdoor patients (37.4%)²⁶. She concluded this difference to be due to prolonged hospital stay and invasive procedures. We also noticed that the incidence of MRSA was higher in the patients who either remained hospitalized or underwent surgical procedure.

Conclusion:

The treatment of MRSA is challenging. The organism spread easily in hospital settings and causes higher mortality, morbidity and increased costs. Every positive case in the individual units should be reported to the concerned authorities and specific precautions and infection control measures must be adopted to prevent and interrupt the spread of MRSA. Although a consistent check on the susceptibility or resistance patterns may help to bring a decline in the occurrence of MRSA infection however extensive studies are required to come up with the development of guidelines to control and eradicate the organism.

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