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Original Article

Carriage of Methicillin-Resistant Staphylococcus Aureus (MRSA) among Health Care Workers of a Tertiary Care Hospital in Non-Outbreak Setting during Routine Infection Control Exercise

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ABSTRACT

Introduction: Methicillin-resistant *Staphylococcus aureus* (MRSA) is a type of Staphylococcus that shows resistance to antibiotics like methicillin itself and others such as flucloxacillin, amoxicillin-clavulanate, penicillin, oxacillin and some cephalosporin e.g. cephalexin.

Objective: This paper gives an overview of Methicillin-resistant *Staphylococcus aureus* (MRSA) carriage among health care workers of a tertiary care hospital in order to improve the quality ofpatient care and to determine the effectiveness of decolonization regime.

Materials and Methods: This cross sectional study was conducted in Peshawar institute of Cardiology from February 2022 till August 2022. Our study included 751 staff members both from the clinical and non-clinical areas. After informed consent, nasal sampling was done and MRSA identification was carried outbyinoculation on MacConkey agar and blood agar and incubation at 37 °C and final reports were obtained within 48 hours. Statistical analyses were performed with Microsoft Excel.

Results: MRSA was positive in 116 (15.4%) cases out of 147 (19.5%) Staff members positive for *Staphylococcus aureus*. In these 116 cases, MRSA positivity was found in 70(60.9%) clinical staff and in 46(38.8%) non-clinical staff cases. Pearson chi square test showed significant p value of 0.01 in relation to MRSA positivity in clinical staff. Decolonization of MRSA positive cases was done with topical mupirocin which showed 99.1% cases completely decolonized and gave negative cultures.

Conclusion: It is suggested MRSA should be recommended in every new patient admissionprotocol and in every new employee pre-appointment medical examination. Proper hygiene practices and compliance with infection control measures should be strictly followed for the prevention of MRSA dissemination.

Key words: Methicillin-resistant *Staphylococcus aureus* (MRSA), Decolonization, infection control.

Introduction

Methicillin Resistant *Staphylococcus aureus* (MRSA) was first identified by Ogston in the 1880s in a fluid sample from a leg abscess. MRSA was first formally isolated in 1960s from hospitalized patients, but its spread was rapidly observed in the community since 1990s and several predominant strains started to emerge in waves globally.[1]

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Methicillin-resistant *Staphylococcus aureus* (MRSA) is a type of Staphylococcus that shows resistance to antibiotics like methicillin itself and others such as flucloxacillin, amoxicillin-clavulanate, penicillin, oxacillin and some cephalosporin e.g. cephalexin. Staphylococcus infections, including MRSA, occur most frequently among persons including healthcare staff, patients and others exposed in hospital settings and healthcare facilities.[2] Soon MRSA became the notorious bacteria globally and is still a challenge to deal with, in hospitals, old-age care centers and community settings worldwide.[3,4] The Methicillin resistance gene (mecA) carries a Methicillin resistant penicillin protein. This protein is not observed in other strains of *Staphylococcus aureus*.[5] MecA lies on a mobile

gene called the staphylococcal cassette chromosome mec (SCCmec). SCCmec have different compositions and varies in sizes acquiring four different types.[1]
Moreover, persistent carriers were reported in a study showing around 20% of people carrying different type of the strains while another large group of intermittent carriers, 60%, had strains with varying frequencies. Finally, the remaining 20% of people almost never carry S. aureus and are called non-carriers. For reasons unknown to variation in colonization, children are suspected to be intermittent carries more frequently than adults, and many people change their pattern of carriage between the age of 10 and 20 years. Symptomatic or asymptomatic patients who carry the strain persistently seem to have a protective effect on the acquisition of other strains, specifically during hospitalization. However, once treated, the decolonization effect reduces the protection from the acquisition of other bacteria. S. aureus habitats in the anterior nares of the human being.[5, 6]
The health care workers are exposed to MRSA on daily basis and play the role of a vector in transmission and spread of the organism. In healthcare institutions, MRSA can be transmitted among healthcare workers and patients or vice versa, or through contact, handling, and use of equipment of healthcare workers (HCWs) as well as through environment.[7] The implementation of MRSA screening among HCWs has been shown to have a positive impact on outbreak management.[8] HCWs are usually screened at their induction and start of their new role in healthcare institutions, but there is no set standards for interim or yearly MRSA screening for the permanent staff as they can get colonized at any time and can potentially be a source and vector of MRSA transmission. We therefore conducted this study to improve the quality of patient care by evaluating the carriage of MRSA in the nasal cavity among the healthcare workers working in a tertiary care hospital in non-infection outbreak situation at Peshawar, Pakistan and to determine the effectiveness of decolonization regimen.

Materials and Methods

We conducted a cross-sectional study to determine the frequency and carriage of MRSA colonization among healthcare workers in non-outbreak situation, working in Peshawar Institute of Cardiology, Peshawar, Pakistan. Study duration was from February 2022 till august 2022. 751 staff members were included both from the clinical and non- clinical areas of the hospital. Nasal sampling was done by a pre-trained technician. The sample was labeled and sent immediately for testing. Laboratory reports were obtained within 48 hours after inoculation on MacConkey agar and blood agar media and incubation at 37Ċfor 24 hours. Gram-positive cocci were isolated after performing catalase test. The isolates were further inoculated on DNase agar for 24 hrs at 37Ċ and Cefoxitin disk having strength of 30 µg with <21mm zone diameter was used to check sensitivity for Methicillin, and when growth was observed it was labeled as MRSA. Decolonization treatment was prescribed for MRSA-positive carriers that included mupirocin nasal ointment 3 times daily with chlorhexidine body washes once daily for 6 days. A break was given on 7th day and test was repeated on 8th day.
Statistical analyses were performed with Microsoft Excel and Predictive Analysis Software (PASW) using Pearson chi square test in relation to gender and distribution of staff among departments. Ethical approval was obtained from the ethical committee of Peshawar Institute of Cardiology, Peshawar.

Results

Out of 751 patients, 616 (82%) were males and 135 (18%) were females. A total of 147(19.5%) samples tested positive for S. aureus. MRSA positivity was seen in 116 (15.4%) cases. However, no growth was found in 604(80.4%) samples (fig 1). Among positive MRSA cases, only 17(14.7%) of the positive cases had active symptoms like fever,muscle pain, chest pain and skin abscesses. MRSA positive cases among clinicalstaff members were 60.9% whereas non-clinical staff shows 38.8% positivity (fig.2a, 2b respectively). Figure 3a & b explains the positive MRSA cases in the critical areas like ICU and OTs. Pearson chi-square was applied to check the prevalence of MRSA and *Staphylococcus aureus* in relation to gender and profession. Insignificant results of p-value i.e., 0.02 for profession and 0.043 for gender showing that there is no relation of MRSA or staph aureus prevalence with any gender or profession. This valuable data of our study findings showed *Staphylococcus aureus* in 147(19.5%)cases, out of them 116(15.4%) show MRSA positivity in healthcare workers screening program for MRSA identification. Pearson chi square test was applied which showed significant p value of 0.001 in relation to MRSA positivity in clinical staff (figure 4).
MRSA positive cases were decolonized and repeat sample was obtained on day 8th which showed no growth in 115(99.1%) cases and positivity in only one

out of 116 cases. This case was decolonized for the second time and no growth was obtained after 2nd decolonization. Pearson chi square test was applied which showed significant p value of 0.001.

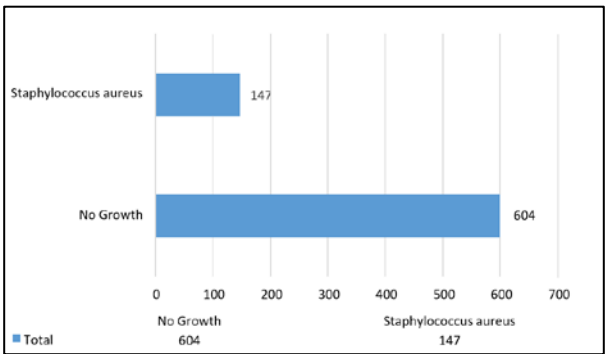


Fig1: Number of positive and negative cases of Staphylococcus Aureus

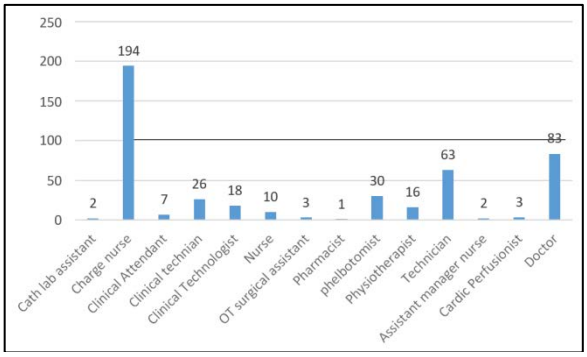


Fig.2a: Profession wise distribution of study participants among clinical staff

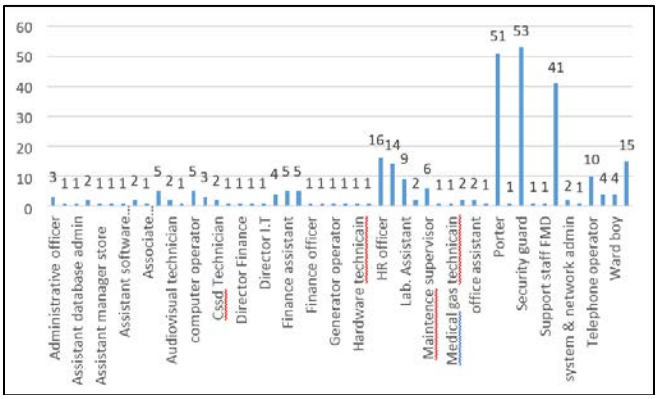


Fig.2b: Profession wise distribution of study participants among non-clinical staff

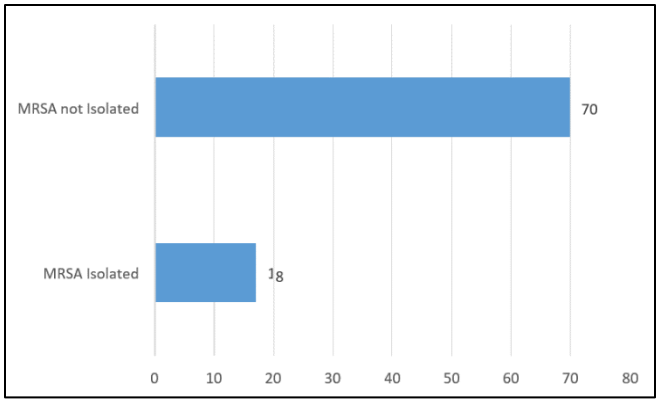


Fig.3a: Distribution of cases in ICU

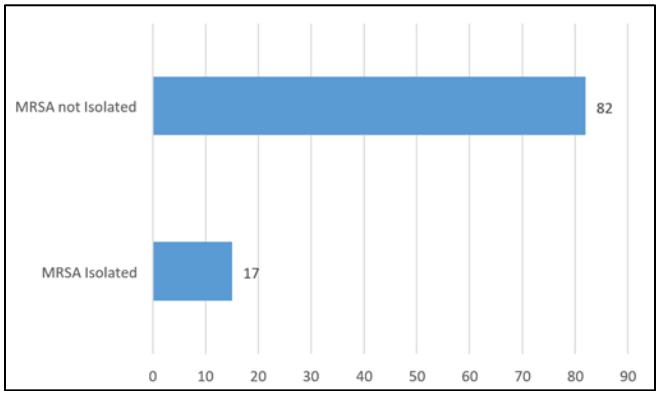
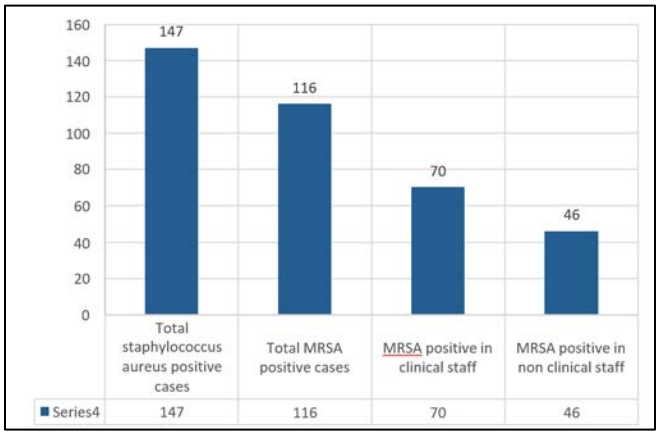


Fig.3b: Distribution of cases in Operation Theatre



P value: 0.001

Fig. 4: MRSA Positive Cases in Clinical and Non Clinical Staff

Discussion

Being one of the major causes of nosocomial infections MRSA is considered a dangerous and resistant pathogen known to cause death in immune-compromised and other hospitalized patients.[9] Therefore close observation of MRSA should be undertaken in a systematic way and routine

evaluation should be done in healthcare staff to minimize any chance of transmission oforganism to the patients by those healthcare workers who are in close contact with them.[10] Workdone on MRSA screening in different regions of the world shows variable data in terms of positivity. In a search of the literature from January, 1980, to March, 2006, the average MRSA carriage rate among screened health-care workers was 4.6%.[11] In another grand study held in Europe and USA where 31 studies were included in a review. The carriage rate within the individual studies ranged from 0.2% to 15%.[12] Similarly a study in Oman about MRSA colonization among healthcare workers showed that screened healthcare workers had a prevalence rate of nasal colonization with MRSA of 7.5%.[13] A study from a major hospital in India identified 32.2% prevalence rate with MRSA.[14] Another systematic review from Iran shows an overall prevalence of 43 % throughout the country in different hospitals including healthworkers.[15] Similarly, a study from one of the hospitals in Nepal shows MRSA positivity rate of 21 % [16] and another study from a hospital in Lahore, Pakistan stated prevalence of 9.3% MRSA positivity and 14.7% for MSSA positive cases.[17] In contrast to all this valuable data our study findings show *Staphylococcus aureus* in 19.5% cases, out of them 15.4% show MRSA positivity in healthcare workers screening program for MRSA identification. MRSA positivity found in clinical staff was 60.9% and 38.8% in non-clinical staff. Pearson chi square test was applied which showed significant p value of 0.001 in relation to MRSA positivity in clinical staff. The variability is in findings of various data suggests that these studies were conducted during different situations in that specific time frame. In literature the observers themselves have pointed out that the studies in endemic settings and those during outbreaks were quite heterogeneous, so expecting proportional results does not appear appropriate.[18] Also this variability can be attributed to risk factors like poor hand hygiene, poor hygiene practices, non- compliance with infection control measures and staff working in other settings with endemic MRSA.[19, 20]

According to several studies, the screening of healthcare workers for MRSA remains controversial because it is time-consuming and costly. The positive results of MRSA might have considerable emotional and psychological impacts on the staff.[21] However, the United Kingdom guidelines for the control and prevention of MRSA in healthcare settings suggests screening of patients in high risk areas and staff screening is suggested in case if there is an 'outbreak' or if there is transmission among the patients despite protective measures have been taken.[22]

Prevention of MRSA transmission is very important thus screening for MRSA is recommended in every new patient admission protocol and in every new employee pre-appointment medical examination. Targeted screening is recommended in routine for those healthcare workers who are working in critical areas or in close contact with the patients to limit the potential for MRSA dissemination. Those healthcare workers who are found colonized should be given a short break and if possible change of duty site or unit is recommended where they are not in direct contact with the patients. All measures adopted for MRSA transmission prevention are not adequate if proper hygiene practices and compliance with infection control measures is not achieved.

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B. Active Participation in Active Methodology
C. Interpretation/ Analysis and Discussion

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