ORIGINAL ARTICLE

IMPACT OF ACTIVE SURVEILLANCE SCREENING OF MRSA ON SURGICAL SITE INFECTION RATES- A PROSPECTIVE INTERVENTIONAL STUDY

Tazeen Fatima, Faiza Rezwan, Farheen Ali, Shobha Luxmi, Furqan Ahmed Raheel, Muhammad Nadeem

National Institute of Cardiovascular Diseases, Karachi Pakistan

ABSTRACT

Background: Methicillin-resistant Staphylococcus aureus (MRSA) is one of the most common cause of surgical site infections. Different methods are employed to reduce nosocomial spread including application of Isolation precautions, admission screening cultures and MRSA decolonization [3,4,5,6,7]. Preoperative MRSA screening in patients undergoing cardiac surgeries can reduce the risk of surgical site infections. To evaluate the significance of preoperative MRSA screening on rates of surgical site infections in cardiac surgery patients

Material and Methods: This was a prospective interventional study, conducted at the National Institute of Cardiovascular diseases, Karachi from 1st February 2022- 31st July 2022. Preoperative MRSA screening in patients undergoing cardiac surgeries was performed at the Microbiology Laboratory. Patients identified as colonized were isolated and decolonized with chlorhexidine baths prior to surgeries. Surgical site infections (SSIs) rates were recorded by Infection control nurse through active surveillance for the screening period. SSI rates for a prescreening period of 6 months (August 2021- January 2022) was retrieved through electronic medical records for comparison.

Results: Total 359 patients were screened from 1st February 2022- 31st July 2022, out of which 20 were colonized with MRSA. None of the patients who screened positive for MRSA developed SSI. 11 SSIs with MRSA were reported from August 2021- January 2022 and 4 SSIs were reported from February 2022-July 2022 (p value < 0.05).

Conclusion: It can be concluded that active MRSA screening and subsequent implementation of decolonization policy would decrease the percentage of SSI in cardiac surgery

Keywords: MRSA, Screening, Surgical site infection, Surveillance

BACKGROUND

Staphylococcus aureus is one of the most common cause of nosocomial and health care associated infections. A significant rise in the frequency of methicillin-resistant *Staphylococcus aureus* (MRSA) strains is seen in last few decades which is a huge challenge in management of complicated infections. With a current prevalence of more than 60% reported across the country,[1] MRSA has become the leading cause of nosocomial skin and soft tissue infections.

Surgical site infections (SSIs) are defined as those skin and soft tissue infections, developing at the surgical site within 90 days of a surgical procedure (Cardiac surgery, Coronary artery bypass graft with both chest and donor site incisions, Coronary artery bypass graft with chest incision only, Pacemaker surgery).[2] SSIs is one of the most common nosocomial infection, accounting for 14% to 25% of healthcare associated infections.[3,4] Though most cases can be prevented by following appropriate infection prevention practices but unfortunately despite the implementation of infection prevention bundles, the incidence of SSIs remains 2% to 5% in all kinds of surgeries including cardiac surgeries.[5,6,7,8] Even this figure may be an underestimation and the actual number of infections is higher, probably because most of the patients have been discharged from hospitals when SSI develops and diagnosis is missed due to poor surveillance system. The rates are even higher in underdeveloped and developing countries as compared to developed countries ranging from 2.5% to 41.9%.[9] SSI is a serious complication as it contributes significantly to increased postoperative length of hospital stay, financial burden, long-term disability, and mortality. SSIs are responsible for one third of postsurgical deaths and 8% of all deaths attributed to nosocomial infections[10] According to a meta-analysis, around 19.1% of SSIs are caused by *S.aureus*, and MRSA is the causative agent in 40% of these infections.[11]

Correspondence: Dr. Tazeen Fatima, Senior Registrar, National Institute of Cardiovascular Diseases, Karachi Pakistan.

Email: taz.fatima88@gmail.com

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According to the Centre of disease control and prevention (CDC) application of contact precautions is the primary infection control procedure for reducing the nosocomial spread of MRSA.[12] Some healthcare institutes perform admission screening cultures for MRSA[13, 14, 15, 16] which is followed by contact isolation of the colonized patients and MRSA decolonization by different regimens including chlorhexidine baths, 2% intranasal mupirocin and washing with povidone-iodine soap and systemic antibiotics like oral regimens of rifampicin and doxycycline and trimethoprim-sulfamethoxazole.[17,18,19] Preoperative MRSA screening in patients undergoing cardiac surgeries and interventions can be helpful to promptly identify colonized patients, isolate and decolonize before surgery, which can later reduce the risk of surgical site infections with MRSA. Vancomycin is frequently used as a part of preoperative surgical prophylaxis in cardiac surgery especially with prosthetic material and in patients with known colonization.[6] Vancomycin is preferable when frequency of MRSA infections and colonization is high, as it can also lower the rates for SSIs.[25]

MRSA screening and subsequent decolonization of patients is an effective yet debated method considering additional interventional costs to hospitals and patients and delays in surgical schedules. Only few studies have assessed the impact of preoperative MRSA screening on rates of surgical site infections in a cardiac care hospital.[26]

Based on this background we conducted a study to determine the prevalence of MRSA in SSIs and also to evaluate the impact of preoperative MRSA screening and decolonization on rates of surgical site infections in a cardiac care hospital.

MATERIAL AND METHODS

A prospective interventional study was conducted at the National Institute of Cardiovascular diseases, a 600-bed tertiary cardiac care hospital in Karachi from 1st February 2022- 31st July 2022. All patients admitted for invasive surgeries were included in the study by Simple consecutive sampling. Patients were screened for MRSA by nasal and axillary swabs, taken on admission or in case more than 72 hours had lapsed after admission screening and surgery wasn't performed, a second nasal swab was collected 24 hours before surgery to establish nosocomial acquisition. MRSA culture and identification was performed at the Microbiology Laboratory. Patients identified to be colonized were immediately isolated in single room along with contact precautions application and chlorhexidine baths provision. Surgical site infection (SSI) rates were recorded by dedicated Infection control nurses prospectively for the screening period from February 2022-July 2022. A comparative prescreening period from August 2021- January 2022 was defined and SSIs rates was retrieved for this period from the hospital medical records.

Screening swabs were taken from both anterior nares and axilla. Identification and sensitivity testing was performed as following:

Both swabs were inoculated in enrichment broth for two hours and later broth was sub cultured onto blood agar plate, incubated at 35°C for 24-48 hours and examined for 48 hours. Suspected colonies were identified by standard procedures (Gram staining, catalase test, tube and slide coagulase test, DNAse test and fermentation of mannitol). Once identified as Staphylococcus aureus, resistance to oxacillin was determined via the cefoxitin disk diffusion method (zone of inhibition was ≤21 mm) (BD, Oxoid, UK) according to Clinical and Laboratory Standards Institute (CLSI) recommendations.

RESULTS

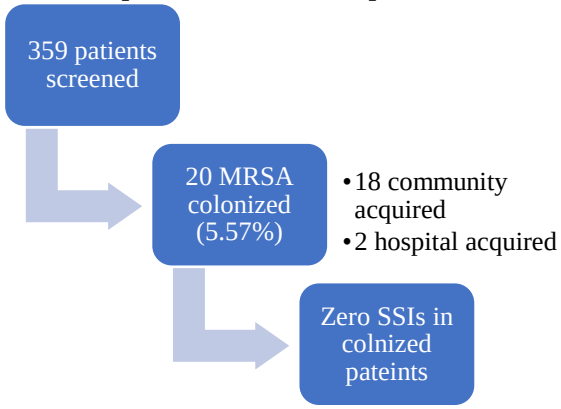
Preoperative MRSA screening was performed for total 359 patients from February- July 2022, admitted for different kinds of cardiac surgeries including Coronary artery bypass surgery (CABG), Intra-aortic balloon pump (IABP), Mitral valve replacement (MVR), Atrial septal defect (ASD) repair, Modified bental procedure, Transcatheter aortic valve replacement (TVR) Aortic valve replacement (AVR), Aortic grafting, Patent ductus arteriosus (PDA) closure, Ruptured sinus of valsalva aneurysm (RSOV) repair etc.

Among the 359 screened patients, only 20 were colonized with MRSA (5.57%). 18 of the patients had MRSA colonization on admission which can be attributed to community acquisition, and only 2 had MRSA identified after 72 hours of admission which can be recognized as nosocomial acquisition. However. No SSIs were recorded in any of these colonized patients within 90 days of surgery.

During these 6 months, 4 MRSA SSIs were recorded but none of these patients had evidence of colonization

on initial screening. A 6-month prescreening period was identified from August 2021- January 2022 for comparison of SSI rates, and 11 SSIs were reported during that period. Using Fischer exact the difference between the SSI rates in these two periods was found to be significant (p value < 0.05) Figure-I.

Figure-I: Breakup of MRSA colonised patients.



DISCUSSION

MRSA is a notorious and highly adaptable bacterial pathogen with high virulence and antibiotic resistance. It is considered to be the commonest cause of nosocomial infections, especially SSIs. Poor infection prevention measures, excessive use of unwarranted broad -spectrum antibiotics producing selection pressure, and cross-transmission through healthcare workers' hands, facilitates its spread. Hence, early identification and preemptive decolonization might decrease infections as MRSA carriers are main pathogen reservoirs.[21,22]

The dramatic increase in incidence of MRSA strains is associated with adverse clinical and monetary effects. There is an excessive use of anti-MRSA agents such as vancomycin as empirical as well as targeted therapy, even in the absence of proven MRSA infections due to high MRSA burden in community and hospitals.[23] A study quoted an experience of vancomycin overuse, over a three-year period in a Boston hospital, according to which 2910 patients received at least one dose of vancomycin during their hospital admission, while only 195 (6.7%) had actual MRSA infection[24]. Vancomycin on one hand is associated with important adverse effects like acute kidney injury, red man syndrome, and on the other contributes to rising antimicrobial resistance especially increasing rates of vancomycin resistant enterococci. In addition to these, the burden of drug level monitoring cost and the drug cost itself is humongous.

Preoperative MRSA screening is safe and cost-effective adjuvant approach to control the postoperative rates of MRSA infections. Early detection of MRSA colonization, decolonization, cohorting or isolation, can prevent cross-transmission between patients and also to healthcare workers. Even though the cost effectiveness of screening has been debated, positive colonization status of a patient can help decide empiric MRSA therapy[23,24] in cases of presumed *Staphylococcus aureus* bacteremia or reserve therapy in case of negative colonization status. Vancomycin is a frequently used drug as a part of preoperative surgical prophylaxis especially in cardiac surgery with prosthetic material, in patients with known MRSA colonization and in areas with high prevalence of MRSA infections.[25] However, preoperative MRSA screening can help identify the true burden and prevalence, which can help devise surgical prophylaxis guidelines and revisit the compulsion of including vancomycin in surgical prophylaxis.

CONCLUSION

This study showed a substantial decrease in MRSA SSIs after the commencement of screening protocol and it can be concluded that active MRSA screening and subsequent implementation of decolonization policy would decrease the percentage of SSI in cardiac surgery.

LIMITATIONS

One of the limitations of this study is the absence of post-decolonization screening results, which could have helped evaluate the efficacy of decolonization protocol. Another limitation is the smaller sample size and duration of study. Larger prospective studies are required to confirm these results.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest

AUTHOR CONTRIBUTION

Tazeen Fatima: Conception, design, execution, analysis and drafting

Faiza Rezwan: Manuscript approval

Farheen Ali, Shobha Luxmi: Design, manuscript approval

Furqan Ahmed Raheel, Muhammad Nadeem: Supervision, manuscript approval

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