SHORT COMMUNICATION

Effect of ablution on Methicillin-resistant *Staphylococcus aureus* (MRSA) nasal colonisation in healthcare workers

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Abstract

Healthcare workers (HCWs) with MRSA nasal colonisation pose a serious threat of passing on the infection to patients. A cross sectional study was designed to investigate the effect of ablution on MRSA nasal colonisation and was conducted at the Department of Pathology, King Edward Medical University. A total of 220 nasal swab samples, 110 from ablution performing HCWs and 110 from non-ablution performing HCWs were processed for the identification of *Staphylococcus aureus* and sensitivity testing for Cefoxitin. In the ablution performing group, 11(10%) HCW were harbouring *Staphylococcus aureus* in their nose, while in non-ablution performing group 32 (29%) HCWs had colonisation of *Staphylococcus aureus*. Frequency of MRSA colonised HCWs was 9/11 (82%) in ablution performing group, while in the non-ablution group 16/32 (55%) had MRSA in their nose. Logistic regression analysis demonstrated that the duration of working experience and non-performance of ablution are the potential risk factors.

Keywords: MRSA, Nasal colonisation, Ablution, *Staphylococcus aureus*.

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Introduction

Staphylococcus aureus (*S. aureus*) is one of the major causes of community and health-associated infections. It is increasingly being isolated in skin and soft tissue infections such as furuncles, carbuncles, deep seated abscess as well as severe life-threating systemic infections such as bacteraemia, septicaemia, necrotising pneumonia, osteoarticular infections and infection associated with indwelling devices.[1]

Staphylococcus aureus typically causes asymptomatic skin and mucosal bearing with highest occurrence in anterior nares (vestibulum nasi) in 20-80% of the population.[2] *S. aureus* express many cell surface components (clumping factor B, iron-regulated surface determinant A, etc.) to establish its interaction with epithelial cells of the nose. Colonisation can be transient or persistent depending upon its interaction. It is reported that 10-20% of the population is colonised persistently, 30-50% intermittently and the rest of the proportion never get colonised.[3] *S. aureus* nasal carriers pose a greater risk for infections in hospital setting. Several studies have identified *S. aureus* colonisers as an independent risk factor for surgical site infections.[4] It spreads from the nose to hands and thus contaminate the surgical sites. People with *S. aureus* colonisation are also at a greater risk of developing invasive infections by their own colonising strains as evident by the many molecular studies.[5]

Methicillin-resistant *Staphylococcus aureus* (MRSA) is further worsening the scenario. MRSA is linked with increased morbidity and mortality.[6] It used to be a nosocomial pathogen but it has emerged as a community-acquired pathogen as well. In a meta-analysis study MRSA colonisation exhibited a higher rate of infection than Methicillin-sensitive *Staphylococcus aureus* (MSSA).[7] MRSA contributes more than 50% in nosocomial infections. Similarly, it accounts for more than 60% nosocomial infections in intensive care units.[8]

Elimination of nasal carriage is the most important strategy to curb this menace. For this purpose, a topical ointment Mupirocin is frequently used.[6] Other options include oral antibiotic therapy. However, the intermittent nature of colonisation with frequent use of these strategies pose a risk of emergence of antibiotic resistance.[9] Hand hygiene and frequent washings are effective means to limit the spread of infections.

Muslims all over the world offer prayers five times a day. Ablution (*Wuzu*) is the prerequisite for offering prayers. This ritual consists of 26 washing and cleansing action. One of them is washing of anterior nares by sniffing up water three times consecutively. This washing can have an impact on nasal colonisation. This specific study was designed to investigate the rates of Staphylococcal and MRSA nasal colonisation among healthcare workers and to observe the effect of ablution on transmission rate.

Subjects and Methods

After approval from the institutional review board (letter # 229/RC/KEMU, dated 16/10/2018), this descriptive cross-

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sectional study was conducted at the Department of Pathology, King Edward Medical University, Lahore, from October 2018 to December 2018. Sample size was estimated by using 95% confidence interval, 10% absolute precision with expected percentage as 62% by the following formula: $N=Z2_{1-\alpha/2}$ -p-qd^2.[10]

The study participants were briefed by the principle investigator about the type and purpose of the study. The required data was obtained on the prescribed proforma from willing participants. Both male and female HCWs working in different wards of Mayo hospital Lahore since one year at least, were included in the study. The study population was divided into two groups: ablution performing healthcare workers (HCWs) who perform ablution at least three times a day with predetermined instruction for nasal washing and non-ablution performing healthcare workers. The ablution performing group included 110 Muslim participants, while the non-ablution performing group included 103 Muslim and 7 non-Muslim HCWs. Participants with ongoing respiratory illness were excluded from the study.

The procedure of ablution starts with hand washing with running tap water by rubbing and rinsing right hand with left on both sides and in between the fingers and vice versa for three times. Nasal washing step of ablution is performed by taking running tap water in right hand and inhaling 2-4 ml of it for 3-5 seconds followed by snorting and then repeating the step two times.

A total of 220 nasal swab samples (110 from each group) were collected from HCWs. Nasal swab was collected from both nostrils of the study participants by using moist cotton swab with physiological saline. Before collecting the specimen, the outer surface of the anterior nares was disinfected with 70% alcohol swab. The specimen was sent to the laboratory within one hour of collection.

The collected specimens were processed in the Microbiology department for microscopy and culture. The positive cultures were taken and processed for the identification of *Staphylococcus aureus* i.e. confirmation by colony morphology, gram staining, catalase, DNAase, coagulase test and results were recorded. Isolated *Staphylococcus aureus* were screened for methicillin resistance by applying Cefoxitin (FOX) disc according to CLSI guidelines 2018.[11]

The gathered data were stratified into ablution performers and non-ablution performers, male and female, according to wards (medical, surgical and pathology) and into years of working experience in hospital settings. The data was cross tabulated by SPSS-23 for chi-square analysis to compare the statistical significance among different distributions. Binary and multinomial logistic regression analysis was performed to check potential risk factors for harbouring Staphylococcus in the nose of the participants.

Results

According to demographic data, females were the dominant participants 140 (64%) and majority of the participants — 91 (41%) — were from the surgical ward. A total of 117 (53%) participants had more than five years of working experience.

In the ablution performing group, 11 (10%) HCWs were harbouring the *Staphylococcus aureus* in their nose while in non-ablution performing group 32 (29%) HCWs were colonised with *Staphylococcus aureus* representing the 43 (20%) colonisation rate among both the groups. The frequency of MRSA in *S. aureus* colonised HCWs was 9/11 (82%) in the ablution performing group, while in the non-ablution group 16/32 (55%) had MRSA in their nose (Table-1).

Females from the non-ablution performing group were harbouring increased number 10 (63%) of MRSA in their nose as compared to females from ablution performing group; however, the difference is not statistically significant (p=0.819). HCWs in Surgical wards and with less than one year of work experience had higher number of MRSA nasal colonisation in non-ablution performing group 11 (69%) and 12 (75%) respectively (Table-2). Binary and multivariate logistic regression analysis demonstrated that duration of

Table-1: Frequency of S. aureus and MRSA nasal carriers isolated form nasal swabs of ablution performer and non-ablution performer in HCW.

Culture results	Ablution- performers N (%)	Non-ablution performers N (%)	Total	p. value
Positive for S. aureus	11 (10%)	32 (29%)	43 (20)%	0.001
Negative for S. aureus	99 (90%)	78 (70%)	177 (80%)	
Total	110	110		
MRSA	9 (82%)	16 (55%)		0.03
MSSA	2 (18%)	13 (44%)		
Total	11	29		

Table-2: Frequency of MRSA isolated from different groups of participants among ablution-performer and non-ablution performer HCW.

		Ablution Status			
		Ablution performers		Non-Ablution performers	
		MRSA	p value	MRSA	p value
		n (%)		n (%)	
		09 (100)		16 (100)	
Gender	Male	05 (56%)	0.237	06 (37%)	0.819
	Female	04 (44%)		10 (63%)	
Ward	Medical	04 (44%)	0.373	04 (25%)	0.014
	Surgical	05 (56%)		11 (69%)	
	Pathology	00 (0%)		01 (6%)	
Experience	≤1 year	03 (33%)	0.519	12 (75%)	0.013
	2-4 years	02 (22%)		01 (6%)	
	≥5 years	04 (44%)		03 (19%)	

Table-3: Binary and multinomial logistic regression analysis of potential risk factor for *S. aureus* nasal carriage among total participants.

Risk Factor	Odds Ratio (95% CI)	Total Participants N=220		p. value
Gender	0.845 (0.426--1.676)	Males	80	0.630
		Females	140	
Ward	0.866 (0.549--1.366)	Medical	73	0.536
		Surgical	91	
		Pathology	56	
Experience	0.636 (0.430--0.942)	≤1 year	65	0.024
		2-4 years	38	
		≥5 years	117	
Ablution status	3.692 (1.750--7.790)	Performers	110	0.001
		Non-Performers	110	

experience and non-performance of ablution are the potential risk factors (Table-3).

Discussion

Staphylococcus aureus is the main coloniser of the nose. If HCWs would have nasal colonisation of *Staphylococcus aureus*, then the patients whom they are dealing with would also be at greater risk of acquiring *Staphylococcus aureus* infections.[12] This study was carried out to determine the overall *S. aureus* nasal colonisation rate and to see the effect of ablution on nasal carriage among HCWs. It has demonstrated 20% overall *S. aureus* nasal carriage rate. Our results correlate well with a study conducted in India which reported 21% *S. aureus* colonisation among paramedical staff.[13] However, our results contradict the study conducted in Khyber Medical University, Peshawar, which has reported 48% *S. aureus* colonisation rate among HCWs.[14] The percentage vary according to different geographical locations, such as Nepal showing 15%, while Saudi Arabia and Nigeria showing 40% and 15% nasal colonisation rates.[15,16]

In this study 58% (25/43) of isolated *S. aureus* exhibited resistance to Methicillin. A study conducted at Allama Iqbal Medical College, Lahore, also reported 67% prevalence of MRSA among HCWs.[17] A similar study conducted in Sheikh Zayed Medical College, Rahim Yar Khan, Pakistan also reported 66.7% MRSA. Such results are not surprising at all because, numerous reports are available on high prevalence of MRSA among isolated *S. aureus*.[18]

The current study compared the MRSA nasal colonisation among regular ablution performers and non-ablution performers. This study exhibited that MRSA colonisation was significantly higher in non-ablution performing group (p-value 0.03). Binomial regression analysis showed non-performance of ablution as an independent risk factor for acquisition of MRSA nasal carriage (OR 3.692 and p value 0.001). These results correlate well with another study conducted in Egypt.[19] It is an established fact that frequent washing reduces the bacterial load, so this phenomena also works well in the form of ablution where multiple washings reduce the number of bacteria if present or inhibit new colonisation.[20]

Multinomial regression analysis showed that working experience in hospital setting is another risk factor. Surprisingly, HCWs with less than one years experience in non-ablution performing group were more colonised with MRSA than HCWs with two years and more than five years work experience and the difference is statistically significant (p= 0.001). This may be due to the fact that naïve personnel may show less colonisation resistance than experienced ones. This clearly shows that new entrants who do not perform ablution are at a greater risk of acquiring MRSA in their nostrils.

In this study MRSA colonisation was not statistically higher between genders of both the groups. This finding contradicts the previous findings where male gender was shown more prone to MRSA colonisation as compared to

females.[21] However, these findings are consistent with another study where females were harbouring higher number of MRSA in their nostrils but the difference was not statistically significant.[22] HCWs working in surgical wards showed higher MRSA colonisation in ablution performers as well as in non-ablution performers. However, the difference between the two groups is not statistically significant. So it can be inferred from the data that gender and ward does not have effect on acquisition of MRSA. According to the best of our knowledge no previous study has included years of experience in hospital settings and wards as variable to see the effect of ablution, so our findings stands alone in this scenario.

This study has two worth mentioning limitations. First, it is a cross sectional study so it cannot differentiate between persistent and transient carriers. Secondly, an intervention based strategy in which carriers should perform ablution regularly followed by screening for MRSA to observe the actual role of ablution can be adopted in future.

Conclusion

This study has demonstrated the high prevalence of Staphylococcal and MRSA nasal colonisation. Regular nasal washing or ablution performance is a simple, easy, effective and inexpensive way to reduce the risk. It is further concluded that new entrants are at greater risk of acquiring MRSA in their nose.

Recommendations

HCWs should wash their nose frequently to prevent nasal colonisation by *Staphylococcus aureus*. Newly enrolled HCWs are at greater risk of harbouring so they should remain vigilant about washing their nose frequently.

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Conflict of Interest: None to declare.

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