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Effect of mupirocin and intensified hygienic practices in the decolonization of MRSA in nasal carriers - A comparative study

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ABSTRACT

Background: Mupirocin is a powerful topical antibiotic for treating carriers of MRSA. Resistance to this medication has grown as a result of its frequent use in clinical settings and over-the-counter accessibility. Concern is also raised by Staphylococcus aureus having Mupirocin resistance. **Materials and Methods:** It is a cross sectional study conducted in in Department of Microbiology during the period of May 2016 to April 2017. 1200 patients were selected in the study. Out of which, 400 patients were inpatients, 400 patients from community and 400 were from health care workers. **Results:** 64 (16%) were MRSA carriers out of 400 inpatients, 48 (12%) were MRSA carriers out of 400 health care workers and 25 (6.25%) were MRSA carriers out of 400 community samples. 137 (11.4%) were overall MRSA carriers. 33 (51.5%) patients from a total of 64 culture positive MRSA inpatients were sensitive to mupirocin and 31 (48.5%) were mupirocin resistant. 11 (17.2%) showed low level resistance and 20 (31.3%) showed high level resistance among 31 isolates which were resistant. 21 (43.8%) patients from a total of 48 culture positive MRSA health care workers were sensitive to mupirocin and 27 (56.2%) were mupirocin resistant. 6 (12.4%) showed low level resistance and 21 (43.8%) showed high level resistance among 27 isolates which were resistant. 11 (44%) patients from a total of 25 culture positive MRSA community samples were sensitive to mupirocin and 14 (56%) were mupirocin resistant. 4 (16) showed low level resistance and 10 (40) showed high level resistance among 14 isolates which were

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resistant. Five of the individuals who had the 2% Mupirocin treatment test negative for nasal carriage of Staphylococcus aureus in each of the four follow-up swabs. Twelve of the people who used intensified hygiene practises had no nasal carriage of Staphylococcus aureus in any of the four follow-up swabs. **Conclusion:** Instead of utilising Mupirocin ointment, decolonization with adjusted hygiene behaviours including routine hand washing and nose cleaning produced positive effects.

Keywords: Intensified hygienic practices, decolonisation, colonisation

Introduction: Methicillin-resistant Staphylococcus aureus (MRSA) infections account for 40–60% of all nosocomial infections in various hospitals around the world. Multidrug resistance strains of S aureus have been found with increasing frequency worldwide[1]. There has been a documented explosion in MRSA infections in populations that have never used healthcare services. The discovery of novel MRSA strains, also known as community-acquired MRSA (CA- MRSA) strains, has been linked to this rise[2]. MRSA is a severe concern to individuals around the world who are hospitalised as well as to the general public as community acquired infections. S. aureus nasal colonisation is a major factor in the rising incidence of MRSA infections worldwide[3]. Colonized patients were thought to be the main source of S. aureus in hospitals; 10% to 40% of new patients have S. aureus nasal carriage.[4] MRSA colonisation makes it possible for members of the public to unwittingly harbour and spread this deadly bacterium. MRSA colonisation has been noted as a significant contributor to the emergence of infections in both community and hospital settings.[5] MRSA can colonise the anterior nares, neck, web spaces, rectum, axilla, and groyne, among other places. It is widely known that colonisation raises the risk of infection in the hospital setting and that up to 30% of the community may be carriers of the disease. Since the emergence of methicillin resistance, treating infections brought on by Staphylococcus aureus has grown more challenging. The first-line treatment for MRSA has been deemed to be vancomycin. Unfortunately, both vancomycin-intermediate and vancomycin-resistant S. aureus resistant cases have increased in number (VISA and VRSA). S. aureus produces life-threatening infections in hospitalised patients as well as the general public, which has alarmed the medical community. The treatment choices are severely restricted by the fact that MRSA strains are resistant to all lactam antibiotics. Mupirocin is a powerful topical antibiotic for treating carriers of MRSA. Resistance to this medication has grown as a result of its frequent use in clinical settings and over-the-counter accessibility. Concern is also raised by

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Staphylococcus aureus having Mupirocin resistance. Since the beginning of time, ancient health traditions from all over the world have encouraged routine, daily hygienic washing of the body, including the bodily cavities. According to Ayurvedic traditional medical knowledge, nasal discharge is one of the body's daily excretions and needs to be cleansed away. In order to prevent serious infections and their consequences, it is necessary to screen the hospital population as well as the population in the community for nasal MRSA colonisation.

Materials and Methods: It is a cross sectional study conducted in Department of Microbiology during the period of May 2016 to April 2017. 1200 patients were selected in the study. Out of which, 400 patients were inpatients, 400 patients from community and 400 were from health care workers. Inclusion criteria for community were subjects of age above 18 years, both the sexes and all economic groups were selected, those patients who had no previous hospitalization in the past 1 year, those patients who had no exposure to antibiotics in a month prior to the study. Inclusion criteria for inpatients were subjects of age above 18 years, both the sexes and all economic groups were selected, patients with greater than 48 hours of admission to hospital. Inclusion criteria for health care workers were that health care workers of any department were selected. Exclusion criteria was for community was subjects below age of 18, hospitalization in the past 1 year, in a month, prior to study, antibiotics exposure, for inpatients, subjects below age of 18, patients admitted to hospital who have length of stay less than 48 hours, those patients who had sino nasal symptoms like rhinitis, headache, cough, post nasal discharge and for health care workers, those patients who had sino nasal symptoms like rhinitis, headache, cough, post nasal discharge. After receiving informed written agreement from the subjects, 1200 individuals (400 from the community, 400 inpatients, and 400 healthcare personnel) were checked for MRSA. Using sterile cotton swabs, nasal swabs were obtained by rolling the swab within each nostril while applying equal pressure. The collected samples were plated onto Blood, Mannitol Salt, and Nutrient Agar, and then incubated at 37°C for 24-48 hours. Further processing involved the golden yellow colonies in nutritional agar, beta hemolytic colonies in blood agar, and yellow colonies in mannitol salt agar. The Catalase test, Gram's staining test, and Coagulase test (Slide and tube) were all performed on the golden yellow colonies from Nutrient agar along with the corresponding controls. Using 5 g and 200 g Mupirocin discs, 10 g Fusidic acid, and 25 g Cotrimoxazole, it was determined whether MRSA positive isolates were susceptible to Mupirocin in vitro (HI-Media). According to CLSI recommendations, zone diameters were

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interpreted. Mupirocin susceptible isolates were those whose zone of diameter was ≥14 mm for both 5 µg and 200 µg Mupirocin discs, and the corresponding individuals were assumed to be Mupirocin sensitive for intervention with 2% Mupirocin ointment intranasally for 7 days twice daily. Low level resistance was defined as isolates with a zone of diameter of less than 14 mm for a 200 µg Mupirocin disc and less than 14 mm for a 5 µg disc. High degree Mupirocin resistance was defined as isolates with a zone of diameter 14 mm for both 5 µg and 200 µg. Both Low level and High level Mupirocin resistance were taken into account as Mupirocin resistant isolates, and the corresponding subjects were taken into consideration as Mupirocin resistant for intervention with improved sanitary practises. They were advised to step up their daily bathing, hand, foot, and face washing routines, as well as paying extra attention to their nasal cavities and oral cavities. They were also instructed to clean their noses by using a straightforward adaptation of the Jalaneti by Hand technique, which is a traditional method of nasal irrigation. In light of this, they were instructed to add some previously heated and cooled water to their palms. They were then instructed to delicately blow their noses after gently inhaling water. Additionally, the patients were instructed to use their little fingers to gently wash the inside surfaces of the nasal cavities. They were told to carry out the process a couple more times each day as desired. Following the 7-day intervention period, follow-up swabs were collected from both groups (those who were instructed to apply intranasal mupirocin and those who were instructed to intensify sanitary measures) once a week for a total of one month. The result was that each person in each group had four follow-up swabs taken from them. All of the aforementioned follow-up swabs were inoculated onto NA, MSA, and BA, and samples that showed no growth on the principal isolation media were deemed negative for Staphylococcus colonisation and consequently MRSA colonisation. The disc diffusion method (Cefoxitin 30 g) was used to test the Staphylococcal isolates produced for catalase, coagulase, Gram's staining, and methicillin resistance. Data was entered into a Microsoft Excel data sheet, and SPSS 22 version software was used for analysis. Data that was categorical was displayed as frequencies and proportions. As a test of significance for qualitative data, the chi-square test or Fischer's exact test (for 2x2 tables only) were also employed. After taking into account all the guidelines for statistical tests, a P value (Probability that the result is true) of 0.05 was regarded as statistically significant.

Results:

Table 1: MRSA prevalence in three study groups

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Study Groups	MRSA	Percentage
Inpatients (400)	64	16%
HCW (400)	48	12%
Community (400)	25	6.25%
Total	137	11.4%

Table 1 shows that 64 (16%) were MRSA carriers out of 400 inpatients, 48 (12%) were MRSA carriers out of 400 health care workers and 25 (6.25%) were MRSA carriers out of 400 community samples. 137 (11.4%) were overall MRSA carriers. This observation was not statistically significant. P value was 0.128.

Table 2: Mupirocin susceptibility of MRSA isolates.

Study Group	Mupirocin Susceptibility			Total
	Sensitive %	Resistant %, MuL	Resistant %, MuH	
Inpatients	33 (51.5)	11 (17.2)	20 (31.3)	64
HCW	21 (43.8)	6 (12.4)	21 (43.8)	48
Community	11 (44)	4 (16)	10 (40)	25

Table 2 shows that 33 (51.5%) patients from a total of 64 culture positive MRSA inpatients were sensitive to mupirocin and 31 (48.5%) were mupirocin resistant. 11 (17.2%) showed low level resistance and 20 (31.3%) showed high level resistance among 31 isolates which were resistant. 21 (43.8%) patients from a total of 48 culture positive MRSA health care workers were sensitive to mupirocin and 27 (56.2%) were mupirocin resistant. 6 (12.4%) showed low level resistance and 21 (43.8%) showed high level resistance among 27 isolates which were resistant. 11 (44%) patients from a total of 25 culture positive MRSA community samples were sensitive to mupirocin and 14 (56%) were mupirocin resistant. 4 (16) showed low level resistance and 10 (40) showed high level resistance among 14 isolates which were resistant.

Inpatients:

Out of 33 patients who followed 2% mupirocin intranasal application, 11 were staphylococcus aureus culture positive, 22 patients showed no growth of staphylococcus aureus in the follow up. Of 11 staphylococcus aureus isolated, 4 (12%) were MRSA and 7 (21%) were MSSA.

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HCW's:

Out of 21 patients who followed 2% mupirocin intranasal application, 6 patients were culture positive for S.aureus nasal carriage, out of 6 patients isolated, 2 (10%) were MRSA and 4 (19%) were MSSA. 15 showed no S. aureus growth on follow up.

Community:

Out of 11 patients who followed 2% mupirocin intranasal application, 4 patients were culture positive for S.aureus nasal carriage, out of 4 patients isolated, 1 (9%) were MRSA and 3 (27%) were MSSA. 7 showed no S. aureus growth on follow up.

Discussion: Eliminating MRSA carriage is a critical clinical challenge since it has been shown to lower the risk of infection in patients who have MRSA colonies and stop MRSA from spreading to uncolonized individuals. The effectiveness of MRSA decontamination therapy is still debatable. However, depending on the treatment used and the inclusion criteria, the success rate reported in prospective studies ranged from as low as 25% to as high as 95%. In our study, we split the participants into two groups after examining their susceptibility to Mupirocin using disc diffusion. Individuals who responded favourably to Mupirocin were placed in the Mupirocin Application Group and advised to apply 2% Mupirocin intranasally, whereas individuals who did not respond favourably to Mupirocin were placed in the Intensified Hygiene Group and advised to intensify their hygienic practises. For four weeks, follow-up swabs from both groups were collected at weekly intervals. The Staphylococcus aureus colonies, if any, were processed from these swabs and tested for sensitivity to cefoxitin (30 g). Five of the individuals who had the 2% Mupirocin treatment test negative for nasal carriage of Staphylococcus aureus in each of the four follow-up swabs. Twelve of the people who used intensified hygiene practises had no nasal carriage of Staphylococcus aureus in any of the four follow-up swabs. In contrast to the group that used 2% Mupirocin, the group that practised intensified hygiene practises had a lower rate of Staphylococcus aureus nasal carriage. Numerous placebo-controlled studies testing nasal mupirocin for the elimination of S. aureus carriage in healthcare personnel, patients, and the community have been carried out. Doebbling et al.[6] examined data from follow-up studies in a study they conducted among HCWs. They discovered that the administration of Mupirocin twice daily for five days resulted in a considerably decreased rate of positive nasal carriage rates of Staphylococcus aureus at 48–72 hours, 22 (13% of 170 Mupirocin recipients vs. 157(93%) of 169 placebo recipients. At a four-week follow-up, the reduced percentage of carriage maintained (18% vs 88%). 68 HCWs were randomised to receive either Mupirocin

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or a placebo in a study by Fernandez et al.[7] that was similar to that reported by Doebbling et al.12. The culture positivity rates for Staphylococcus aureus were 13% and 91% immediately after treatment and 67% and 94% at 6 months after treatment, respectively. 54 patients receiving long-term hemodialysis participated in a patient-blinded trial that compared Mupirocin (3 times per day for 10 days) with a placebo. After starting treatment, they performed nasal cultures for Staphylococcus aureus at days 3, 8, 10, 21, 42, 70, and 140. On day 10 (8; 24% of 33 patients vs. 19 (90%) of 21 patients, respectively), they found significantly lower rates of positivity for Staphylococcus aureus among Mupirocin recipients than among Placebo recipients in Bommer et al[8] study. The eradication rate with Mupirocin application was 88% at the conclusion of the follow-up (56 days) and 65% with placebo treatment in a trial by Ellis et al.[9] in the community (healthy soldiers). When compared to the group that practised enhanced cleanliness, we found that the Mupirocin application group had lower rates of eradication. This result from our study implies that basic hygiene practises are efficient in preventing long-term staphylococcus colonisation and, consequently, MRSA in the hospital and community. The British Medical Journal reported in 1895 that the nose is one of the dirtiest organs in the human body, which is consistent with the exogenous Staphylococcus colonisation in the nose that appears to be the primary maternal focus. Since the beginning of time, numerous ancient health traditions from around the globe have promoted periodic, regular hygienic cleansing of the body.[10] The 12 daily excretions of the human body, or "Kha malas," include the nasal discharge, which according to traditional Ayurvedic medical knowledge must be cleansed in order to be removed. In our study, the cupped hand approach, which uses boiled and cooled water, is also a straightforward modification of the now well-liked "Jal Neti" nasal irrigation technique, which is used for numerous Sino nasal issues. [11,12]

Conclusion:

Instead of utilising 2% Mupirocin ointment, decolonization with adjusted hygiene practises including routine hand washing and nose cleaning produced positive effects. Regular nose cleaning appears to reduce secretion stagnation, preventing Staphylococcus aureus colonisation and subsequent transmission. A quick, low-cost strategy for reducing MRSA colonisation, treating various nasal problems, and reducing antibiotic resistance is nose washing in particular and maintaining body hygiene in general.

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