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Original Research Article

Observational Research on MRSA Decontamination in Nasal Carriers Using Mupirocin and Improved Hygiene.

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Abstract

Aim: The aim of the present study was to assess the effect of mupirocin and intensified hygienic practices in the decolonization of MRSA in nasal carriers.

Methods: The present study was conducted in the Department of Microbiology, Madhubani Medical College and Hospital, Madhubani, Bihar, India and 300 (100 from Inpatients, 100 from Community, 100 from Health care workers).

Results: Out of 100 Inpatients, 15 (15%) were MRSA carriers. Out of 100 HCWs, 10 (10%) were MRSA carriers. Out of 100 samples from the community, 5 (5%) were MRSA carriers. Overall MRSA carriage was 30 (10%). However, this observation was not statistically significant. Out of 15 cultures, positive MRSA from Inpatients, 6 were sensitive to Mupirocin and 6 were resistant to Mupirocin. Out of 15 cultures, positive MRSA from Health care workers, 4 were sensitive to Mupirocin and 4 were resistant to Mupirocin. Out of 5 cultures, positive MRSA from the Community 2 isolates were sensitive to Mupirocin and 2 were resistant to Mupirocin.

Conclusion: Decolonization with modified hygienic practices like regular hand washing, nasal washing gave good results than using 2% Mupirocin ointment. Regular cleansing of the nostrils appears to not allow the stagnation of secretions, thereby preventing colonization and hence transmission of *Staphylococcus aureus*. Nasal washing in particular and maintaining body hygiene in general is a simple and inexpensive method that reduces MRSA colonization, relieves a variety of nasal conditions and also helps in minimizing antibiotic resistance.

Keywords: Methicillin Resistant *Staphylococcus aureus*; Colonization; Mupirocin; Intensified Hygienic Practices; Decolonization

Introduction

Nasal decolonization of methicillin-susceptible *Staphylococcus aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA) is currently used in some countries for specific patient groups. In the UK it is recommended [1] that carriers of MRSA, who are receiving prophylaxis for an operation, should undergo nasal decolonization with mupirocin. Mupirocin is effective at removing *S. aureus* from the nose over a few weeks, but nasal relapses are common within several months. [2] There are few prospective randomized clinical trials (RCTs) with sufficient patients to achieve statistical significance that have been completed in this field. [3] Taken together, these trials suggest that clearance of S. aureus from the nose is beneficial in some patient groups. [4]

MSSA lives on the skin of humans as a commensal. In developed countries ~30% [5–7] of the general adult population are colonized, although the data range from as low as 15% [8] up to 100%, in specific populations, such as those with MSSA skin infections. [9] Nasal colonization (stable colonization is defined as *S. aureus* in the nose detected from nasal swabs taken several days apart) with strains such as MRSA is much lower, at ~1% of the total population, [10] and is more frequent in certain sub-groups of patients such as frequently hospitalized people, those of advancing age, patients on dialysis, AIDS patients and diabetics. [1,11]

Colonization with MRSA has been shown to increase the risk of infection with MRSA both immediately after colonization [12] and in long-term carriers, of whom 23% develop MRSA infections in the year following the identification of their carriage status. [13] Patients who have had contact with healthcare facilities such as hospitals may be colonized in the nose with healthcare-associated (HA) MRSA. A different set of MRSA strains affects patients who have not had recent contact with healthcare units, and these strains are called community-associated (CA) MRSA. HA-MRSA usually causes diseases such as bacteraemia and

infective endocarditis that tend to be more multiresistant. In contrast CA-MRSA tends to affect younger, healthy people, causing skin and soft tissue infections and other infections such as the serious necrotizing pneumonia. [11] It is currently less multiresistant than HA-MRSA and is usually susceptible to commonly used antibiotics such as tetracyclines, but is more virulent, e.g. it invades tissue more readily, partly as a result of some strains that carry the Panton-Valentine leucocidin toxin gene. [14]

The aim of the present study was to assess the effect of mupirocin and intensified hygienic practices in the decolonization of MRSA in nasal carriers.

Materials and Methods

The present study was conducted in the Department of Microbiology, Madhubani Medical College and Hospital, Madhubani, Bihar, India for three months and 300 (100 from Inpatients, 100 from Community, 100 from Health care workers).

Inclusion Criteria:

For community:

• Subjects of age above 18years, both the sexes and all economic groups.

• No previous hospitalization in the past 1 year.

• No exposure to antibiotics in a month prior to the study.

For Inpatients:

• Subjects of age above 18 years, both the sexes and all economic groups.

• Patients with >48 hours of hospital admission.

For Health Care Workers

• HCWs irrespective of any Departments

Exclusion Criteria for Community

• Subjects below the age of 18.

• Hospitalization in the past 1 year.

• Exposure to antibiotics in a month prior to- the study.

For Inpatients

• Subjects below the age of 18.

• Patients admitted to the hospital who have a length of stay <48 hours.

• Those who had Sino nasal symptoms like Rhinitis, Headache, Cough, Post nasal discharge.

For HCW

• Those who had Sino nasal symptoms like Rhinitis, Headache, Cough, Post nasal discharge.

Method of collection of data

A total of 300 subjects (100 from the community, 100 inpatients and 100 health care workers) were screened for MRSA after obtaining informed written consent from the subjects. Nasal swabs were obtained by using sterile cotton swabs by rolling the swab inside of each nostril with application of an equal pressure. [15] The collected samples were inoculated onto Nutrient agar, Blood agar and Mannitol salt agar and incubated at 37°c for 24-48 hours. Golden yellow colonies in nutrient agar, Beta hemolytic colonies in Blood agar and yellow colonies in Mannitol salt agar were processed further. Golden yellow colonies from Nutrient agar were subjected to Catalase test, Gram's staining and Coagulase test (Slide and tube) with respective controls. [16] MRSA Positive isolates were tested for in vitro susceptibility for Mupirocin by using 5 µg for and 200µg Mupirocin discs, Fusidic acid (10µg) and Co- trimoxazole (25µg) (HI-Media). Zone diameters were interpreted as per CLSI guidelines. [17] Those isolates whose zone of diameter ≥14 mm for both 5 µg and 200 µg Mupirocin discs were considered as Mupirocin sensitive isolates and the respective subjects were taken as Mupirocin sensitive for intervention with 2% Mupirocin ointment intranasally for 7 days twice daily. Those isolates whose zone of diameter < 14 mm for 5µg and ≥14mm for 200 µg Mupirocin disc were considered low level resistance. Those isolates whose zone of diameter <14mm for both 5µg and 200 µg were considered high level Mupirocin resistance. Both Low level and High level Mupirocin resistance were considered as Mupirocin resistant isolates [18] and the respective subjects were taken as Mupirocin resistant for intervention with intensified hygienic practices. They were advised intensification of routine general hygienic measures such as taking baths every day, washing hands, feet, face and with special reference to nasal cavity and oral cavity, i.e. cleansing of nose by using a simple modification of traditional nasal irrigation, viz: Jalaneti, by Hand technique. [19,20] Accordingly, they were asked to pour some previously boiled and cooled water into their cupped palm. Then they were asked to gently sniff the water up the nose followed by blowing of the nose lightly. Also the subjects were advised to gently wipe the inner sides of the nasal cavities with their little fingers. They were advised to repeat the procedure for a few times every day as per their convenience. After 7 days of intervention, follow up swabs were taken from both the groups (Group who were advised Intranasal Mupirocin application and Group who were advised Intensified hygienic practices) at weekly intervals for the duration of 1 month. Thus four follow up swabs were taken from each individual of each group. All the above mentioned follow up swabs were inoculated onto NA, MSA and BA, samples with no growth on the primary

isolation media were considered as Negative for *Staphylococcus* and thus MRSA colonization. The Staphylococcal isolates grown were tested for Catalase, Coagulase, Gram's staining, Methicillin resistance by disc diffusion method (Cefoxitin30 µg).

Statistical analysis: Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

Results

Table 1: Prevalence of MRSA in the three study groups

Study Groups	N
Inpatients	15
HCW	10
Community	5
Total	30

Out of 100 Inpatients, 15 (15%) were MRSA carriers. Out of 100 HCWs, 10 (10%) were MRSA carriers. Out of 100 samples from the community, 5 (5%) were MRSA carriers. Overall MRSA carriage was 30 (10%). However, this observation was not statistically significant.

Table 2: Mupirocin Susceptibility of MRSA isolates in the three study groups

	Mupirocin Susceptibility			
	Sensitive (%)	MuL	Resistant (%) MuH	Total
Inpatients	6	3	6	15
HCW	4	2	4	10
Community	2	1	2	5
Total	12	6	12	30

Out of 15 cultures, positive MRSA from Inpatients, 6 were sensitive to Mupirocin and 6 were resistant to Mupirocin. Out of 15 cultures, positive MRSA from Health care workers, 4 were sensitive to Mupirocin and 4 were resistant to Mupirocin. Out of 5 cultures, positive MRSA from the Community 2 isolates were sensitive to Mupirocin and 2 were resistant to Mupirocin.

Discussion

Multidrug resistant strains of *S. aureus* have been reported with increasing frequency worldwide, most commonly Methicillin resistant Staphylococcus aureus (MRSA) infections account for 40-60% of all nosocomial infections in many centers across the world. [21] Explosion of number of MRSA infections were reported in populations without prior healthcare contact. This increase has been associated with the recognition of new MRSA strains, often called community acquired MRSA (CA- MRSA) strains. [21] MRSA is a serious threat to hospitalized patients globally and also public as community acquired infections. [22] Nasal colonization with *S. aureus* plays pivotal role in the increasing prevalence of MRSA infections worldwide. [23] Colonized patients were considered as a chief source of *S. aureus* in hospital; approximately 10% to 40% of people on admission have nasal carriage of *S. aureus*. [24]

In a study conducted by Doebbling et al [25] among HCWs, they reviewed data from follow up studies. On the basis of intent to treat analysis, they found that the application of Mupirocin twice a day for 5 days led to a significantly lower rate of positive nasal carriage rates of *Staphylococcus aureus* at 48-72 hrs 22(13%) of 170 Mupirocin recipients vs 157(93%) of 169 placebo recipients. The lower rate of carriage persisted at four week follow up 18% vs 88%. Out of 100 Inpatients, 15 (15%) were MRSA carriers. Out of 100 HCWs, 10 (10%) were MRSA carriers. Out of 100 samples from the community, 5 (5%) were MRSA carriers. Overall MRSA carriage was 30 (10%). However, this observation was not statistically significant. Out of 15 cultures, positive MRSA from Inpatients, 6 were sensitive to Mupirocin and 6 were resistant to Mupirocin. Out of 15 cultures, positive MRSA from Health care workers, 4 were sensitive to Mupirocin and 4 were resistant to Mupirocin. Out of 5 cultures, positive MRSA from the Community 2 isolates were sensitive to Mupirocin and 2 were resistant to Mupirocin.

Bommer et al [26] conducted patient blinded trial comparing Mupirocin (3 times per day for 10 days)

with placebo among 54 patients undergoing long term hemodialysis. They performed nasal cultures for *S. aureus* at days 3, 8, 10, 21, 42, 70 and 140 days after commencement of treatment and they found significantly lower rates of positivity of *Staphylococcus aureus* among Mupirocin recipients than among Placebo recipients on day 10 {8(24% of 33 patients vs 19 (90%) of 21 patients respectively} In a study conducted by Ellis et al [27] in the community (healthy soldiers), eradication rate at the end of the follow up (56 days) was 88% with Mupirocin application and 65% with placebo treatment. However, we reported lower rates of eradication among Mupirocin application group when compared to intensified hygiene practicing group. This finding in our study suggests that simple hygienic measures are effective in preventing long term colonization of *Staphylococcus* and thereby MRSA in the Hospital and Community. Colonization with Staphylococcus in the nose from exogenous sources, which appears to be the primary mother focus, can be correlated with the British Medical Journal 1895 which quotes that the nose is one of the dirtiest organs in the human body. [28]

Conclusion

Decolonization with modified hygienic practices like regular hand washing, nasal washing gave good results than using 2% Mupirocin ointment. Regular cleansing of the nostrils appears to not allow the stagnation of secretions, thereby preventing colonization and hence transmission of *Staphylococcus aureus*. Nasal washing in particular and maintaining body hygiene in general is a simple and inexpensive method that reduces MRSA colonization, relieves a variety of nasal conditions and also helps in minimizing antibiotic resistance.

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