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Nasal carriage of *Staphylococcus aureus* treated with topical mupirocin (pseudomonic acid) in a children's hospital

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Summary: 2% mupirocin ointment applied intra-nasally for 5 days was assessed for elimination of nasal carriage of *Staphylococcus aureus* in 31 staff members in a children's hospital. Three volunteers failed to complete the trial because of side effects, i.e. buccal reddening and swelling, and unpleasant taste. During treatment staphylococcal nasal carriage was not found in any case; of the 24 post-treatment nasal swabs taken 4 days after treatment 22 were still negative. Re-colonization with *S. aureus* of different phage types occurred in the remaining two cases.

Key words: Nasal staphylococcal carriage; topical mupirocin; pseudomonic acid.

Introduction

Fuller *et al.* (1971) first recorded the antibacterial activity of a group of substances produced by fermentation of a strain of *Pseudomonas fluorescens*. Subsequently, the name pseudomonic acid A was ascribed to the major metabolite, which accounted for most of the antibacterial activity observed. Mupirocin has been accepted as the approved name for pseudomonic acid A. Its chemical structure and mode of action has been shown to be different from any known class of antibiotics (Chain & Mellows, 1977; Hughes & Mellows 1978 *a*,*b*; Alexander *et al.*, 1985).

Mupirocin has a narrow spectrum of activity, confined mainly to gram-positive bacteria, including *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Streptococcus pyogenes*. There is moderate activity against

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some gram-negative organisms, such as *Haemophilus influenzae* and *Neisseria gonorrhoeae*, but it is relatively inactive against enterobacteria and enterococci (Sutherland *et al.*, 1985). Casewell & Hill (1985, 1986) demonstrated the good *in-vitro* activity of mupirocin against *S. aureus*, including methicillin-resistant strains and suggested mupirocin as the topical agent of choice to eliminate nasal carriage. Bactericidal concentrations of mupirocin are achieved by topical administration of a 2% formulation in an ointment. This study was carried out to assess the efficacy of mupirocin in the elimination of nasal carriage of *S. aureus* in healthy volunteers.

Materials and methods

One hundred and eighty-six medical and nursing staff working in clinical areas of a children's hospital were screened for nasal and pharyngeal carriage of *S. aureus*. The organism was isolated from 63 (33·9%), and 31 of these staff (nine males and 22 females), who were still positive after a repeat nasal swab at 1 week, were enrolled in the study. Informed consent was obtained from each subject.

The topical treatment consisted of pseudomonic acid A 2% w/w as calcium salt in an ointment base of soft paraffin containing anhydrous lanolin (Beecham Pharmaceuticals, Worthing, England). Volunteers were given verbal and written instructions. The ointment was applied in match-head size amounts to each nostril by fingertips. After application it was distributed by squeezing the nose between finger and thumb. The ointment was given four times a day for 5 days.

The persistence of staphylococcal carriage prior to treatment was confirmed by examination of a third nasal and pharyngeal swab. On the third day of treatment another swab was taken. Follow-up nasal swabs were collected 1 and 4 days after each course.

All nasal swabs were collected in a standard way by firmly rotating plain cotton-wool swabs, soaked in sterilized physiologic saline, around the periphery of the anterior nares. All specimens were inoculated on blood-agar and on mannitol salt agar plates (Columbia–Blutagar, Mannit-Kochsalz-Phenolrot-Agar, Heipha, Heidelberg, FRG) and incubated at 37°C for 24 and 48 h. Colonies were identified as *S. aureus* if they showed typical morphology on blood agar, fermentation of mannitol salt agar, were gram-positive cocci in clusters and gave a positive reaction of the coagulase-slide or coagulase-tube test. Growth of *S. aureus* was read semi-quantitatively, i.e. a scanty, moderate, or heavy growth.

Phage typing of *S. aureus* was carried out by Dr. W. Lenz (National Reference Center for Staphylococcal Typing, Institute for Medical Microbiology, Bonn, Federal Republic of Germany).

Results

Before treatment, all the 31 nasal swabs and 10 (32·3%) of pharyngeal swabs were positive for *S. aureus*. Three volunteers failed to complete the trial; one noticed buccal reddening and swelling and wished to stop and two found the ointment unpleasant to use. During treatment staphylococcal carriage could not be demonstrated in any volunteer; two swab results could not be obtained. Follow-up swabs 1 day after treatment failed to yield *S. aureus* with one exception or again in two cases swab results were not available. Of the 24 post-treatment swabs taken 4 days after the course was completed, 22 (91·7%) were still negative for *S. aureus*, whereas recolonization of the anterior nares with *S. aureus* of different phage types was found in two volunteers.

Discussion

In the present study, mupirocin has been shown promptly to eliminate nasal carriage of *S. aureus*. As suggested in previous studies (Dacre, Emmerson & Jenner, 1983; Casewell & Hill, 1986), this topical agent has an important role in the elimination of nasal staphylococci. During a small outbreak of gentamicin—and methicillin-resistant *S. aureus* on a urology ward, mupirocin was found to be effective in eradicating the multiresistant micro-organism in 15 nasal carriers (Dacre, *et al.*, 1983). However, the formulation in polyethylene glycol was associated with side effects such as localized stinging, soreness, dry skin and itching around the nose, noticed by six of the subjects.

In Casewell & Hill's study (1986) of 32 healthy volunteers, no significant side-effects were observed with a white soft paraffin base formulation. In their study *S. aureus* could not be detected, even in low numbers, in nose swabs from any of the volunteers within 2 days of starting mupirocin, and even after 5 weeks only six showed recolonization. Ultimately, 14 individuals resumed staphylococcal carriage, in most cases with different phage types.

Similarly encouraging results were found in our study. Elimination of *S. aureus* from the anterior nares could be found on day 3 of therapy in all subjects from whom swabs were available. One week after starting the treatment recolonization was noted in only two subjects. Unfortunately, further follow-up could not be carried out. However, the prompt eradication of nasal carriage by mupirocin within 3 days of treatment was impressive, and gave further evidence that it may be useful in controlling staphylococcal outbreaks in hospitals.

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