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Carriage of *Staphylococcus aureus* in the elderly

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Summary: The point prevalence and incidence of *Staphylococcus aureus* (methicillin-sensitive and -resistant) carriage by inpatients on acute elderly care wards was estimated. The relationship to body site and to previous admissions to hospital or other institutions was determined. Fifty-five patients were included in the point prevalence study and 136 in the incidence study, which was performed over a two-month period. One in three patients carried *S. aureus* and 1 in 20 was infected. The incidence rate for MRSA was 2.9%. No endemic strain was found. Nostrils were significantly associated with carriage, and skin break isolates were significant in the point prevalence survey. Screening these sites alone would be most cost effective.

Keywords: *Staphylococcus aureus*; MRSA; elderly inpatients.

Introduction

Staphylococcus aureus continues to be a major cause of infection in hospitals.¹ Strains of methicillin-resistant *S. aureus* (MRSA) were first reported in 1961² and their emergence has hampered the eradication of staphylococcal cross infection. Numerous epidemics of nosocomial infection, associated with considerable morbidity and mortality, have been reported worldwide.³ Although MRSA are generally no more virulent than methicillin-sensitive *S. aureus* (MSSA),⁴ the treatment options for colonization or infection are limited. Treatment of hospital-acquired infection has severe personal impact on the patient and considerable cost implications for the hospital.⁵ The appearance of MRSA is associated with increased rates of hospital-acquired *S. aureus* infection overall.⁶ This study was, therefore, undertaken to:

(1) examine the overall carriage and infection rates of *S. aureus*, including MRSA in patients on acute elderly care wards; (2) evaluate whether such carriage relates to body site in order to adopt a rational approach to future screening; and (3) investigate whether carriage and infection rates were influenced by previous admissions to hospital or other institutions, as has been found elsewhere.⁷

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Patients and methods

Point prevalence survey

Inpatients on four acute elderly care wards were screened for *S. aureus* over four consecutive days in February 1994 (one ward per day). The sites sampled were nostrils, throat, axillae, perineum, indwelling urinary catheter site (if present) and skin breaks (if present). A questionnaire (see Appendix) to establish the hospital admission and residential history of the patient and risk factors for staphylococcal colonization was completed at the time of sampling.

Incidence survey

Consecutive admissions to the same wards during February and March 1994 were screened, within 24 h of admission, using the same protocol. Patients who were admitted after the weekend screen had been taken were screened on Monday morning.

Laboratory procedures

Swabs from one patient were inoculated together into 10% salt Robertson's cooked-meat broth (Central Public Health Laboratory) and incubated at 37°C aerobically for 48 h. Subculture was made onto mannitol salt agar (Unipath), incubated at 37°C aerobically and examined at 24 and 48 h. If positive, the patient was rescreened and these swabs processed separately. Identification of staphylococci was by Staphylase reagent (Unipath), DNase testing (Oxoid) and tube coagulase. Methicillin testing was performed on diagnostic sensitivity testing agar (Oxoid) at 30°C overnight, using 25 µg strips (Mast Diagnostics). Phage-typing was performed by the Staphylococcal Reference Laboratory (Central Public Health Laboratory).

Results

The demographics of the patient populations, in the two surveys, are summarized in Table I.

The point prevalence survey ($N=55$) yielded 15 (29%) isolates of MSSA and no MRSA. Three (5.5%) patients were clinically infected, one with cellulitis and two with infected varicose ulcers. Nine (60%) patients were available for rescreening. Ten strains were typable and nine were single isolates. No clusters were identified.

The incidence survey ($N=136$) yielded 48 (35%) isolates of MSSA and four (2.9%) isolates of MRSA. Five (3.7%) were infected with MSSA (three with cellulitis, one with infected eczema and one with infected broken skin following a fall). No patient was infected with MRSA. Thirty (59%) patients were available for rescreening. Table II records the phage-types by ward.

Neither survey found a significant relationship between MSSA or MRSA

Table I. Patient population in point prevalence and incidence surveys on acute elderly care wards

| Patient population | Point prevalence | | Incidence | |
|-------------------------------|------------------|-------|-----------|-------|
| | N=55 | % | N=136 | % |
| Male:female | 23:32 | 42:58 | 60:76 | 44:56 |
| Age range (median) | 62-96 | (79) | 66-99 | (81) |
| Emergency admissions | 50 | 91 | 133 | 97.8 |
| Admitted from: | | | | |
| Own home | 43 | 78 | 108 | 80 |
| Residential/warden aided | 6 | 11 | 16 | 11.9 |
| Other ward CMH* | 6 | 11 | 9 | 6.7 |
| Other hospital | 0 | 0 | 2 | 1.5 |
| Past admissions: | | | | |
| CMH* previous month | 9 | 16.4 | 19 | 14.1 |
| CMH* preceding year | 23 | 42 | 41 | 29.9 |
| Other institution last year | 5 | 9.1 | 22 | 16.2 |
| Surgery in last year | 8 | 14.5 | 14 | 10.3 |
| Infective diagnosis | 10 | 18 | 35 | 23.6 |
| Catheterized before admission | 1 | 1.8 | 4 | 3 |
| Catheterized at swabbing | 9 | 16.4 | 13 | 9.6 |
| Skin breaks: | 24 | 43.6 | 61 | 44.9 |
| Intra vascular device site | 8 | 14.5 | 42 | 31.1 |
| Chronic ulcer | 10 | 18.2 | 15 | 5.3 |
| Cellulitis | 3 | 5.5 | 7 | 5.3 |
| Other skin breaks | 8 | 14.5 | 12 | 8.8 |

* CMH denotes Central Middlesex Hospital.

carriage and place of residence, previous admission to hospital or other institution, surgery or urinary catheterization.

Nasal carriage of MSSA was significant in both surveys $N=7/9$ (78%), $P=0.01$ and $N=15/30$ (50%), $P=0.018$, respectively. The incidence of nasal and skin break carriage of MRSA was significant $N=4/4$ (100%), $P=0.03$. Skin breaks yielded MSSA isolates significantly in the point prevalence survey $N=4/9$ (44%), $P=0.0003$.

Discussion

The unavailability of patients for a second screen after a positive isolate (40%) was high. Our findings should be considered as a pilot study: the design has been satisfactorily tested and could be applied in any setting. The point prevalence and incidence populations were broadly similar. The former were more likely to have been admitted from another ward in our hospital and to have a urinary catheter *in situ*.

Although the numbers in our surveys were small, the significant findings were identified by Fisher's exact test (for small sample sizes), and do suggest that screening nostrils and skin breaks alone is most cost effective. On initial screen this would reduce the number of swabs used by at least four (price 8p per swab). On follow up, when swabs are processed separately, a

Table II. *Phage types of Staphylococcus aureus on four acute elderly care wards in the point prevalence survey. P values are included if more than one case has occurred on only one ward*

| Phage type | Ward 1 | Ward 2 | Ward 3 | Ward 4 |
|-------------|------------------------------|--------------------------------|------------------------------|-----------|
| Not typable | 6 incl 2 MRSA $P=0.29$ | 2 | 4 incl 1 MRSA $P=0.72$ | 2 |
| Strain A | | 4 incl 1 MRSA $P=0.0009$ | | |
| Strain B | 2 | 2 | 2 | |
| Strain C | 1 | | 2 | |
| Strain D | 1 | | | |
| Strain E | | 1 | | 2 |
| Strain F | | | 1 | |
| Strain G | | | 1 | |
| Strain H | | 1 | | |
| Strain I | | | | 1 |
| Strain J | 2 $P=0.086$ | | | |
| Strain K | 1 | | 1 | 1 |
| Strain L | | | | 1 |
| Strain M | | | | 2 |
| | | | | $P=0.086$ |
| Strain N | | | | 1 |

MRSA, methicillin-resistant *Staphylococcus aureus*.

decision must be made as to whether to screen nostrils and skin breaks only, (using one broth for enrichment per swab, and half a plate for isolation per broth), or whether to then perform a full screen, which would use at least four extra broths (price 54p per broth) and two extra plates per patient (price 27p per plate). Previous work has indicated that over 80% of colonized patients are detected by nares culture alone,⁸ which, taken in conjunction with our study, suggests that full screens are unnecessary except in specific cases when the index of suspicion is high but nose and skin break screening is negative. Targeting patients with urinary catheters is not worthwhile. Although we did not look at length of stay specifically, screening medium to long-stay patients with skin breaks (as represented by the point prevalence study) may be useful.^{2,9}

Eighteen distinct phage types of *S. aureus* were identified across the two studies, and 18 (31.6%) isolates were not typable. Of the four Strain A isolates on one ward, three were MSSA and one was MRSA. All of these patients had skin breaks. Two were admitted from one other ward in our hospital and two from the Day Hospital. Their dates of admission spanned one month. Three of the patients with MRSA were admitted from home and one from another ward. One had been in our hospital previously, and one in another hospital. Three had skin breaks. Two patients were on one ward and their dates of admission were a month apart.

