Acta Dermatovener (Stockholm) 51: 301–304, 1971

ISOLATION-WARD TREATMENT FOR DERMATOSES

II. *Influence on Bacterial Colonization*

Bertil Nyström, Lars Molin and Georg Rajka

From the Department of Dermatology and the Clinical Bacteriological Laboratory, Karolinska Sjukhuset, Stockholm, Sweden

Abstract. Infected and particularly infection-susceptible dermatosis patients were treated in a dermatological isolation unit. In only two of 30 patients was the skin lastingly colonized with hospital strains of *Staphylococcus aureus*—a much lower frequency than that found in dermatosis patients in more conventional ward units (3). Statistically the difference was highly significant. No dominant *Staph. aureus* strain emerged in the unit. Counts of *Staph. aureus* in the room air were less than in the conventional units. Isolation-ward treatment therefore seemed to be largely effective in preventing staphylococcal colonization in patients with dermatoses.

Nyström, Skog, Andersson & Ljunggren in 1970 (3) found heavy bacterial colonization of the skin in patients with dermatoses. This was reduced when local treatment was given in the patients' own rooms instead of in a central treatment room. The occurrence of clinically manifest bacterial infection was not influenced by the decentralization of treatment. Because of the massive bacterial colonization, however, the writers concluded that patients with erythroderma, extensive eczema or bullous dermatoses, i.e. conditions in which bacterial colonization often leads to clinically manifest infection, should be treated in isolation.

A special unit for infected and infection-susceptible patients, with good facilities for isolation, has been built at the dermatological clinic of Karolinska sjukhuset (1). The present study concerns the effect of isolation-room treatment on bacterial colonization in patients with dermatoses. The results are compared with observations by Nyström et al. (3) in more conventional ward units of the same clinic.

MATERIAL AND METHODS

Hospital units. The study covered about 3 months in the spring of 1970. The isolation unit had then been in use for about 6 months. It has been described in detail by Hellerström, Linneroth & Nilzén (1), and the general clinical experiences with it have been described by Molin, Rajka & Tarras-Wahlberg (2).

Sampling and culture technique. Sampling for culture was done at the same intervals and in the same way as described in the earlier report (3). Thus, swabs were taken from the patients within 2 hours of admission, after 3 and 7 days and then once weekly. The techniques of culture and sensitivity testing were the same as before (3), as were the definitions of sensitivity to antibiotics.

Patients. Thirty-nine patients were treated in the unit during the period of the study. In 30 of them bacteriological cultures were made on at least three occasions. The age distribution of the patients is shown in Table I, the length of hospitalization in Table II and the diagnostic grouping in Table III.

Staff. Nose and throat swabs were taken at fortnightly intervals from all staff on duty at these times, including doctors and temporary staff. The total number of persons was 26. In 21 of them swabs were taken on at least three occasions.

Air sampling. The bacterial content in the air of the patients' rooms was measured three times during the study. A slit sampler of type BIAP was used. The flow rate was 400 litres per minute.

RESULTS

The number of cultures showing growth of the most important of the isolated micro-organisms and the number of patients who at some time harboured these pathogens are shown in Table IV. The sensitivity patterns of the *Staph. aureus* isolated from the patients are presented in Table V

Table I. *Age distribution of the patients*

Age in years	No. of patients
⩽9	2
10–19	3
20–29	2
30–39	4
40–49	7
50–59	7
60–69	9
⩾70	5
Total	39

Table II. *Length of hospital stay*

Stay in days	No. of patients
1–7	9
8–14	10
15–21	11
22–28	5
29–35	1
36–42	3

Table III. *Distribution of dermatoses*

Diagnosis	No. of patients
Erythroderma	1
Eczema	8
Varicose ulcers	8
Psoriasis	5
Bullous dermatoses	5
Pyoderma	8
Other dermatoses	4

and the phage types of the *Staph. aureus* isolated from patients, staff and room air in Table VI.

Seventy-two per cent of the staphylococcal strains isolated from the patients were penicillinase producers. No methicillin-resistant strains of *Staph. aureus* were found. Thirty per cent of the staphylococcal strains were resistant to two or more antibiotics. The most usual combinations were penicillin + tetracycline and penicillin + tetracycline + streptomycin (Table V).

Phage types of group I were the most common among the *Staph. aureus* isolated from the patients (15 patients). These phage types were found in only three of the staff and in the air of one room. Phage types of group II were most usual among the staff (seven persons), but were found in only one patient and never in room air. Phage type 6/47/53/54/75+ was that most commonly found in room air (eight rooms). It was found also in 5 of the patients and in three staff members (Table VI).

In 8 of the 30 patients from whom bacterial cultures were made at least three times (i.e. 27%), *Staph. aureus* was at no time isolated. In 3 of the 30 patients the same *Staph. aureus* strain was isolated on each test occasion. One of these strains was resistant only to penicillin and two were multiresistant. In 19 patients, therefore, the staphylococcal strain changed at least once during their stay in the unit. At the time of discharge, 13 of these 19 patients were free from *Staph. aureus*. In 4 of the remaining 6 the cultures showed the same staphylococcal strain with the same phage type and sensitivity pattern on discharge as on admission. They had thus changed their strains when in the ward but then changed back again to their admission strain. Twenty-one of the 30 patients thus were free from staphylococci when they left the unit and 7 harboured

Table IV. *Pathogenic micro-organisms cultured from the nose/throat and skin of the patients*

Micro-organisms	Nose/throat		Skin		Total patients
	No. of positive cultures	No. of patients	No. of positive cultures	No. of patients	
Staph. aureus	38	17	54	24	28
Haemolytic streptococci, group A	4	2	9	7	8
Haemolytic streptococci, others	0	0	2	2	2
Pneumococci	4	2	0	0	2
Enterococci	0	0	15	7	7
Gram-negative bacteria	24	13	33	13	22
E. coli	13	6	14	5	10
Coliforms	8	5	8	5	9
Pseudomonas	3	2	11	3	3

the same staphylococcal strain as on admission. This implies that 28 of 30 patients were not lastingly colonized with hospital-acquired strains of staphylococci. The corresponding frequency in the earlier investigation was 29 of 110 patients (3).

Of the 21 staff members from whom cultures were made at least three times, 7 at no time showed *Staph. aureus* in the nose or throat. In the earlier study this frequency was 2 of 24 (3).

The mean bacterial count per 1 000 litres of room air was 78, of which 5 were *Staph. aureus*. In the previous study (3) the air in the two wards gave mean bacterial counts of 130 and 238 micro-organisms, of which 105 and 171 were *Staph. aureus*.

DISCUSSION

The patients in this study were not directly comparable with those in the previous report (3). The present groups contained more younger patients and the hospital stay was shorter, presumably because the patients were transferred to an ordinary dermatological ward when they were judged to be no longer in need of isolation.

The indications for admission to the isolation unit were mainly clinically manifest infection or one of the dermatoses which experience has shown to be highly susceptible to infection. Consequently, the conditions for bacterial colonization and dissemination were especially favourable in these patients, and comparison between the frequency of clinically manifest infection in this and in the earlier investigation was not feasible.

Table V. *Antibiotic resistance of Staph. aureus cultured from patients (92 strains)*

Resistant to	MIC	No of resistant strains
Benzylpenicillin only	>2 IU/ml	39 (42 %)
tetracycline only	>4 mcg/ml	2 (2%)
Streptomycin only	>5 mcg/ml	3 (3%)
penicillin + tetracycline		12 (13%)
Other two-antibiotic combinations		3 (3%)
Penicillin + erythromycin + tetracycline		4 (4%)
Penicillin + streptomycin + tetracycline		7 (8%)
Penicillin + erythromycin + tetracycline + streptomycin		2 (2%)
Total no. of strains resistant to more than one antibiotic		28 (30%)
Total no. of strains resistant to benzylpenicillin		66 (72%)

Table VI. *Phage types of Staph. aureus isolated from patients, staff and room air*

Phage group	Patients	Staff	Air
I	15	3	1
II	1	7	0
6/47/53/54/75+	5	3	8
Other combinations	8	0	2
Non-typable	5	4	2

Despite these differences, however, some comparisons are valid. In the earlier study (3), 29 of 110 patients were not lastingly colonized with *Staph. aureus* during their stay in hospital. In the present study the rate was 28 of 30 patients. Statistically the difference is highly significant. It shows that isolation-ward treatment can to a large extent prevent staphylococcal colonization and thereby diminish the risk of spreading hospital infections.

The differences in the phage pattern of the staphylococci which were cultured from patients, staff and room air, and the fact that no single phage type predominated in any of these three groups of cultures, suggest that no dominant *Staph. aureus* strain emerged in the unit.

Concerning the antibiotic-sensitivity pattern of *Staph. aureus*, the only statistically significant difference between the previous and the present study was that relatively more multiresistant micro-organisms were found in the isolation-ward patients.

Remarkably more gram-negative bacteria were found in the present study. However, a closer analysis showed no difference in the number of patients from whose skin these bacteria were isolated as compared with the previous report. The nose and throat cultures thus were responsible for the difference. A possible explanation is that antibiotics had been more widely used in the isolation-ward patients because many of them had clinically manifest infection.

The lower bacterial count in the air of the isolation rooms probably can be ascribed to the smaller number of patients per room than in the earlier investigation (3). But the percentage of *Staph. aureus* in the total bacterial count was

lower in the isolation rooms. The difference was highly significant. This suggests a quantitatively lesser colonization in the isolation unit.

REFERENCES

1. Hellerström, S., Linneroth, A. & Nilzén, Å.: A new ward for infectious skin conditions in the dermatologic clinic of the Karolinska Hospital, Stockholm. Acta Dermatovener (Stockholm) *46:* 365, 1966.
2. Molin, L., Rajka, G. & Tarras-Wahlberg, C.: Isolation-ward treatment for dermatoses. I. Clinical experiences. Acta Dermatovener (Stockholm) *51:* 298, 1971.
3. Nyström, B., Skog, E., Andersson, B. & Ljunggren, Å.: Centralized or decentralized local treatment of dermatoses in dermatology wards: differences in bacterial colonization. Acta Dermatovener (Stockholm). To be published.

Received December 18, 1970

Lars Molin, M.D.
Department of Dermatology
Karolinska sjukhuset
S-104 01 Stockholm 60
Sweden