

## Staphylococci in a Mental Hospital

By S. S. REZA

### INTRODUCTION

The present study on the acquisition of *Staphylococcus aureus* by patients during their stay in a mental hospital, and the nasal carrier rate in the institutionalized patients, was prompted by the fact that in 1959 and 1960 193 out of a total of 407 deaths in Napsbury Hospital were due to lung infection, and that a bacteriological study of 45 unselected cases at necropsy in 1960 had suggested that the fatal lung infections were predominantly staphylococcal (Table I). The incidence of staphylococcal skin lesions, however, remained low, and only 147 cases of this kind were reported during 1959 and 1960 (4 per cent. per annum of the population) (Table II).

mostly adults, comprise the population of this hospital. These suffer from acute and chronic mental illnesses and are accommodated in 42 wards in 6 buildings, each ward comprising Day Room, Dormitories and Dining Room, besides the Ward Pantry, Nurses' Office and Doctor's Office. The available bed space varies and on some of the wards the beds are only three feet apart. Most of the patients are at liberty to move about in and out of the wards. The total strength of the nursing staff is 500.

Psychiatric treatment is by individual and group psychotherapy with the assistance of tranquillizers. Social activities are organized in and outside the hospital, and there is a large occupational therapy department where a great variety of activities is undertaken. Seven per cent. of the patients work outside the hospital as an initial phase of rehabilitation before their

### DESCRIPTION OF HOSPITAL

About 700 male and 1,200 female patients,

TABLE I

*Summary of Post-mortem Bacteriology of the Lungs in 45 Unselected Cases in 1960*

Cause of Death	No. of Cases	No Growth	<i>Staph. aureus</i>	Others
Respiratory infection . .	24/45	7	15*	Coliform 1 T.B. 1
Other causes . . . .	21/45	14	2 (scanty) (evidently due to contamination)	Coliform 4 <i>Proteus</i> 1

\* 13/15 were resistant to penicillin and of these 3/15 were resistant to penicillin and tetracycline.

TABLE II

*Incidence of Staphylococcal Skin Lesions and the Sensitivity Pattern of the Strains Isolated in 1959 and 1960*

Average Number of In-patients	Number of Staphylococcal Skin Lesions Reported in 2 Years	Sensitivity of <i>Staph. aureus</i> Strains Isolated from Skin Lesions		
		Penicillin Sensitive	Penicillin Resistant	Tetracycline Resistant
1,900	147	90 (61%)	57 (39%)	25 (17%)

The tetracycline resistant strains were also resistant to penicillin.

discharge from hospital. From the point of view of infection conditions are therefore more like those of an hotel than a hospital, and the relatively low incidence of skin infections is probably due to the high standard of personal cleanliness of the patients, the frequent changing of the bed linen, prompt treatment of the skin lesions and provision of isolation for patients in single-bedded rooms in cases of persistent infection.

#### MATERIAL

##### *Series I*

Nasal swabs were taken from 187 patients weekly from admission for six months. The patients in this series came from four wards and included both males and females of all age groups.

##### *Series II*

Nasal swabs were taken from 186 patients who had already been in the hospital several years, weekly for six months. The patients in this series came from three wards and included both males and females mostly above 65 years.

#### METHODS

1. Anterior nares were swabbed with dry swabs at weekly intervals by the technician allocated to the present study. The swabs were plated out within 3 hours of collection on 6 per cent. defibrinated horseblood-agar plates and incubated overnight at 37° C. The plates had been flooded with alcohol and dried in the incubator before inoculation in order to prevent the swarming of *Proteus*.

2. Swabs from consolidated parts of the lung were collected through seared tissue during autopsy and were plated out within 3 hours of collection on plain and alcohol-treated 6 per cent. defibrinated horseblood-agar. The inoculated plates were incubated overnight at 37° C.

3. At least half a dozen colonies suspected of being *Staph. aureus* colonies were tested for coagulase production by the slide method (Cadness-Graves *et al.*, 1943).

4. Single coagulase-positive colonies were subcultured on 6 per cent. defibrinated horseblood-agar plates. Difco sensitivity discs at a concentration of 10 units penicillin, and at a

concentration of 30 mcg. tetracycline were planted. A zone of inhibition of at least 5 mm. around the disc was taken as indication of sensitivity.

#### RESULTS

Table I shows that in 15 out of 45 unselected post-mortem examinations the cause of death was a staphylococcal respiratory infection. Of these 13 were due to penicillin-resistant organisms, 3 of which were also resistant to tetracycline. Table II shows that 57 (39 per cent.) out of a total of 147 staphylococcal skin lesions were due to penicillin-resistant organisms and 25 (17 per cent.) were also resistant to tetracycline. It should be noted that no change was made in the reporting of the skin infections during the period of the investigation and no attempt was made to swab all the skin lesions which occurred, so that only specimens from the severe or persistent cases reached the laboratory.

Table III shows the nasal carrier state of patients at the time of admission to the hospital and in the following six months. A small increase in the proportion of penicillin-resistant organisms and a definite increase in the proportion of tetracycline-resistant organisms had occurred by the end of the first week. This change persisted throughout the period of investigation.

The carrier rate of penicillin-resistant and tetracycline-resistant *Staph. aureus* among long-stay patients (Table IV) also exceeded that among patients on admission. Seventy per cent. of 373 patients investigated carried a penicillin-resistant strain and 24 per cent. carried a tetracycline-resistant strain at some time during the six months of the investigation.

#### DISCUSSION

The total nasal carrier rate was normal (McDonald, Miller *et al.*, 1960; Miller *et al.*, 1962) at the time of admission of the patients and remained so after hospitalization. A small but significant rise in the proportion of carriers of penicillin-resistant staphylococci, and a quite definite rise in the number of carriers of tetracycline-resistant organisms, was apparent by the end of the first week of

TABLE III

*Nasal Carriage Rate of Staph. aureus in a Total of 187 Patients (Series I) at the Time of Admission and in the Subsequent 26 Weeks. The Patients were Swabbed Weekly*

	On Ad- mission	1st Week	2nd Week	3rd Week	4th Week	5th- 6th Week	7th- 8th Week	9th- 11th Week	12th- 14th Week	15th- 20th Week	21st- 26th Week
No. of nasal swabs examined .. ..	152	83	109	94	86	147	121	133	99	129	88
% carrying <i>Staph. aureus</i> .. ..	45	48	45	47	45	46	50	41	40	40	57
% Penicillin resistant .. ..	16	24	25	25	17	27	29	29	31	23	30
% Tetracycline resistant .. ..	1	6	7	10	5	3	8	6	12	11	8

The tetracycline resistant strains were also resistant to penicillin.

Not all the patients in this series were available for swabbing each week.

TABLE IV

*Nasal Carriage Rate of Staph. aureus in a Total of 186 Institutionalized Patients (Series II) Who were Swabbed Weekly for 26 Weeks*

	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week	9th Week	10th Week	11th Week	12th- 14th Week	15th- 17th Week	18th- 20th Week	21st- 23rd Week	24th- 26th Week
No. of nasal swabs examined .. ..	149	151	144	145	147	138	138	139	127	127	122	185	157	168	163	130
% Carrying <i>Staph. aureus</i> .. ..	50	37	38	45	46	48	49	40	44	46	49	46	52	49	36	54
% Penicillin resistant .. ..	33	18	19	24	35	28	29	31	34	39	34	34	43	34	29	37
% Tetracycline resistant .. ..	3	4	2	6	7	4	4	6	13	9	8	7	12	8	6	4

The tetracycline resistant strains were also resistant to penicillin.

Not all the patients in this series were available for swabbing each week.

hospitalization. The fact that 70 per cent. of all patients investigated were carriers of penicillin-resistant organisms and 24 per cent. were carriers of tetracycline-resistant organisms at some time during the period of study suggests that there was considerable circulation of these strains in the population of the wards.

The incidence of staphylococcal skin lesion was low, but the death rate from staphylococcal pneumonia was high in the aged, bed-ridden patients with poor mental and physical condition. The predominance of penicillin-resistant organisms in staphylococcal respiratory infections suggested that penicillin administered in mega unit doses had removed the sensitive flora, which was then replaced by antibiotic-resistant organisms prevalent in the ward. Although there are obvious differences between conditions in a psychiatric and those in a general hospital, the problem of antibiotic

resistant staphylococci in terminal pneumonia exists in both kinds of hospital. Further study is required to elucidate the relation of the giving of antibiotics to the appearance of resistant organisms in individual patients.

#### SUMMARY

Nasal carrier state, incidence of staphylococcal skin lesions and fatal respiratory infections, were investigated for a period of six months in a sample of the population of a mental hospital. Description of the hospital where the investigation was undertaken is given. Evidence of a small rise in nasal carriers of penicillin-resistant organisms and a definite rise in nasal carriers of tetracycline-resistant organisms without any increase in the total nasal carriers is presented. It is suggested that

there is considerable circulation of the resistant organisms in the population of the ward.

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