

# STAPHYLOCOCCAL INFECTION IN A MEDICAL WARD

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In recent years many papers have described staphylococcal infection in hospitals. Nearly all these papers have been concerned with surgical wards. We here give an account of a pilot survey of staphylococcal sepsis as seen during the course of one year in a medical ward.

## Materials and Methods

The medical ward observed between October, 1958, and September, 1959, contained 26 beds, 24 in the open ward and 2 in side-rooms. The ward was equipped with cotton curtains between the beds: woollen blankets were in use. No attempt was made to isolate patients with sepsis.

Nasal swabs were taken from patients on admission or as soon after as possible, and thereafter at weekly intervals. A clinical record was made of all forms of sepsis, and specimens of sputum, urine, etc., were examined whenever indicated by the clinical condition. In the course of the year 190 specimens of pathological material were examined (73 sputa, 43 urines, and 74 miscellaneous). All staphylococci isolated were tested for coagulase production and phage-type by the methods described by Anderson and Williams (1956). In this paper only coagulase-positive strains have been considered. They are described as *Staph. aureus* or just staphylococci.

## Results

**Staphylococcal Sepsis.**—During the year 349 patients were admitted: 9 (2.6%) were admitted with sepsis and 13 (3.8%) of the remainder developed staphylococcal sepsis. Of the 22, 9 had a lower respiratory infection, one progressing to an empyema and another to a lung abscess. Nine patients suffered from infection of the skin or subcutaneous tissues, one had sinusitis, one an extensive ulcer in the mouth, and two had staphylococcal enterocolitis. Two patients had a terminal septicaemia and one a staphylococcal urinary infection. Three patients each had two staphylococcal incidents. There was more sepsis amongst the 90 patients with malignant disease or disease of the blood than among the 259 who had neither; 13 (14%) of the former developed staphylococcal sepsis as compared with the 9 (3%) of the latter. It was not easy in every case to assess the significance of the sepsis. Nine of the patients were admitted with existing sepsis, and the patient with sinusitis was admitted because of it. Five of the infected patients with malignant or blood disease died, and in four the infection contributed to the cause of death. Of the remaining patients the infection was regarded as serious in 10 and of moderate or slight severity in the others.

**Sepsis in Relation to Type of *Staph. aureus*.**—Only two patients were infected with the same type of staphylococcus (75/77, resistant to penicillin, tetracycline, and streptomycin). One of these patients had a urinary infection, the other enterocolitis. They were in the ward together. Other tetracycline-resistant staphylococci—types 80, 52/80+, 52/80, 7/47/54/75/77, and 75A—were isolated from lesions, but only of single patients. There was no evidence of spread to produce sepsis in other patients. This was surprising, in view of our previous experience in surgical wards and of the evidence on the change of nasal staphylococci put forward in the next section.

TABLE I.—Nasal Carriage of *Staph. aureus*

Patients never nasal carriers	.. .. .	No. 144
carriers at some time	.. .. .	205
Patients not carriers on admission, becoming carriers	.. .. .	No. 57
Patients admitted as carriers, changing nasal type of staphylococcus	.. .. .	37
Total patients acquiring a new staphylococcus	.. .. .	94 (27%)

**Nasal Carriage of *Staph. aureus*.**—Table I gives the salient observations on the nasal carriage rate. Almost a third of the patients acquired a new staphylococcus in the nose during their stay in hospital. Antibiotics were given to 107 of the 349 patients. There was no evidence that antibiotic treatment increased the chance of a patient acquiring a penicillin-resistant strain.

**Sepsis in Relation to Nasal Carriage of *Staph. aureus*.**—One hundred and forty-four patients were not nasal carriers on admission, and remained free from nasal staphylococci during their stay in the ward. Two of these (1.4%) were septic on admission. The remaining 205 patients were either carriers on admission or became so subsequently. Twenty (10%) were admitted with or developed sepsis. No fewer than nine patients were admitted with sepsis. Table II shows these patients and

TABLE II.—Staphylococcal Sepsis in Patients with Malignant and Blood Diseases, and Other Diseases, Related to the Patients' Nasal Staphylococcus

	No.	Admitted with Sepsis Due to Staphylococcus of		Admitted with No Sepsis, Developed Sepsis in Ward Due to Staphylococcus of		
		Type Present in Nose on Admission	Type Not Found in Nose on Admission	Type Found in Nose on Admission	Type Acquired in Nose in the Ward	Different Type from that in Nose
Malignant or blood disease	90	3	1	5	0	4
Other diseases	259	1	4*	2	0	2
Total	349	4	5	7	0	6

\* Includes two patients never found to be carriers.

the patients developing sepsis while in the ward. The staphylococci from the septic lesions have been compared with those carried by each patient in his nose. Four of the nine patients admitted with sepsis were found to have staphylococci of the same type in the nose and lesion. Of the patients becoming septic in the ward, seven developed sepsis due to the same type of staphylococcus as that isolated from the admission nasal swab, and six became septic with a staphylococcus which differed from any staphylococcus isolated from their nose on admission or during their stay. These staphylococci were presumably acquired in the ward, though their sources could not usually be determined. In no case did a patient develop sepsis due to a staphylococcus acquired first in the nose during the stay in hospital.

### Survey of all Medical Wards

We were surprised that we had not found more instances of staphylococci spreading from patient to patient and causing sepsis. We had, however, only a few septic patients, and the absence of spreading infection might have been a matter of chance. To test this proposition a survey was made of 243 male and female patients in the 10 medical wards of this hospital between February 17 and 23, 1960. Pathological specimens were collected where indicated, and 83 specimens (37 sputa, 22 urines, and 24 miscellaneous) were examined.

Only eight patients were found to be suffering from staphylococcal sepsis. In four wards there was no sepsis, in each of four there was one patient septic, and two wards each had two septic patients. Table III lists the

TABLE III.—*Staphylococcal Sepsis in 243 Patients in Ten Medical Wards*

Patient's Primary Diagnosis	Source of Staphylococcus	Phage Type of Staphylococcus	Antibiotic Sensitivity of Staphylococcus	
			Sensitive	Resistant
Krohn's disease (pneumonia)*	Sputum	52A+	P.T.	
Cerebral tumour*	Carbuncle	80	C.E.	P.T.
Leukaemia	Boil	80	C.E.	P.T.
	Ulcer	52+	P.T.	
Dermatitis†	Infected dermatitis	80	T.	P.
Rheumatoid arthritis†	Sinus on hip	47/53/75/77	C.E.	P.T.
Urticaria	Infected urticaria	52A	T.	P.
Rheumatoid arthritis	Abscess on buttock	Not typable	P.T.	

\* Patients in same ward. † Patients in same ward.  
P. = penicillin. T. = tetracycline. C. = chloramphenicol. E. = erythromycin.

septic patients, and the phage type of the staphylococcus involved. In the two wards each with two patients septic, all the four staphylococci were of different phage type.

### Discussion

We were somewhat surprised to find that in a ward with so many patients suffering from blood and other diseases thought to predispose to staphylococcal infection only 6% developed staphylococcal lesions. Moreover, 9 of the 22 septic patients already had the sepsis when they were admitted, and only two patients were infected with any one type of staphylococcus. Apart from this there was no evidence of infection spreading from one patient to another and causing disease in them. This observation recalls the suggestion of Rogers and Bennett (1958) that though staphylococcal infection was not uncommon in medical wards epidemic infection is rare. It is of course possible that, had our observations been continued, we might have found more examples of case-to-case infection, but our rapid survey of the other medical wards of the hospital did not suggest that this is a very common phenomenon. Only 8 of the 243 patients had staphylococcal disease at the time of the survey, and there was no evidence of a common type in any of the wards.

It would therefore appear that spreading staphylococcal infection was not a feature of the ward we observed for a year or within the short period of our survey for the other medical wards. This might reflect the absence of any strains of *Staph. aureus* with epidemic properties, but several of the strains that we isolated have been associated with spreading infection in surgical wards. Perhaps the lack of open wounds and possibly

of patients with post-operative chest conditions in medical wards impose a different behaviour on the staphylococcus so that the spread of the organisms with resultant sepsis is rarer.

Our observations in surgical wards suggested that patients who carry staphylococci in their noses are more likely to suffer post-operative wound sepsis than those who do not, and that in fact the nasal strain is not uncommonly the source of the wound infection (Williams *et al.*, 1959). The association between the nose and the lesion strain is confirmed in the medical ward that we have studied, but there was no evidence at all that the staphylococci which were spreading among the patients' noses in the ward were in fact later producing disease. It was striking that seven of the patients developed staphylococcal sepsis while in the ward with a staphylococcus that had been present in their nose at the time of admission.

### Summary

A pilot survey has been made of staphylococcal sepsis in a medical ward during the course of one year. Of 349 patients, 9 were admitted with sepsis and 13 of the remainder developed it. Only two patients were infected with any one type of staphylococcus. Apart from this, there was no evidence of infection spreading from one patient to another and causing disease.

In a rapid survey of 243 patients in all the medical wards of the hospital, only eight had staphylococcal sepsis at the time and there was no evidence of a common type in any of the wards.

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"[Jacques Loeb's] phenomenal memory . . . coupled with a very active, enquiring mind with a high degree of originality was undoubtedly responsible in a large measure for his success. Beyond this he had that rare gift of scientific intuition, recognizing where progress was significant and feasible and where further study was futile. . . . He was an omnivorous reader in science generally. Literature as such had little interest or appeal for him. In fact, it is from his extensive reading that he developed many of his new, simple and useful techniques in solving problems. . . . In this writer's extensive acquaintance with the leading physicists of the atomic era he knows of no one, with the possible exception of J. J. Thomson, who spent a greater proportion of his waking hours thinking of his work. . . . Finally there is one more characteristic of scientific work that was vital to his success. This was the exacting and intelligent but meticulous care he used in repeating and checking all his observations before publication. The writer knows of few physicists with the possible exception of Rutherford who made as sure of the accuracy of experimental data published as did Jacques Loeb." (Dr. L. B. Loeb's recollections of his father, Jacques Loeb: *Rockefeller Institute Quarterly*, Autumn, 1959.)