In general, in each group of those who had abnormal faecal chemical fat the faecal radioactivity determination was abnormal in about 75%, while the blood peak radioactivity was abnormal in only about 50%. On the other hand, in nearly each group, of those who had normal faecal chemical fat, nearly 80% had a normal faecal radioactivity, while the blood peak radioactivity was normal in nearly 85%.

Of the two ^{131}I triolein determinations the faecal radioactivity determination was found to be a much better index of the presence of steatorrhoea than the blood peak radioactivity test. When both studies were carried out the index of accuracy was increased.

If a patient has normal blood peak and faecal radioactivity values after the ^{131}I triolein meals, the chances of his being normal are about 85 to 95%, while the chance of his having steatorrhoea (false negative) are about 15 to 25%. On the other hand, if both values are abnormal the chances of his being normal are about 10% (false positive), while the chances of his having steatorrhoea are about 75%.

Administration of the ^{131}I -labelled triolein does not afford an adequate quantitation of steatorrhoea, as does the faecal chemical balance study.

Although the ^{131}I triolein studies are good, simple exploratory tests in the detection of steatorrhoea, particularly if both faecal and blood peak radioactivity are determined, show by our results that ^{131}I triolein is not as sensitive an index of accuracy in the detection of steatorrhoea as is the faecal chemical fat determination. However, if facilities for metabolic balance studies are not available, then because of its simplicity the triolein test (using both blood peak and faecal radioactivity determination) may be used as a diagnostic aid in the detection of steatorrhoea, provided its limitations are fully appreciated.

It is also recommended that, in a given patient, if both blood peak and faecal radioactivity are abnormal, that patient should have faecal chemical balance studies to establish the diagnosis definitely and for the quantitative estimation of steatorrhoea.

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STAPHYLOCOCCAL SEPSIS IN OUT-PATIENTS

RELATION OF PENICILLIN RESISTANCE TO PREVIOUS CONTACT WITH HOSPITALS

BY

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It is in hospital that the majority of antibiotic-resistant bacteria are thought to originate. For *Staphylococcus aureus* there is abundant evidence that patients, and babies born in hospital, may become nasal carriers of penicillin-resistant staphylococci and may take resistant staphylococci home. Additional and rather different support for the view that hospitals are the main source of penicillin-resistant staphylococci has been put forward recently by Galbraith (1960). Working with septic patients in general practice, he was able to relate the presence of penicillin-resistant staphylococci in lesions to previous hospital contacts. Similarly, McDonald *et al.* (1960) in a study of recruits joining the Royal Air Force concluded that the high proportion of penicillin-resistant staphylococci carried by men with a history of recent admission to hospital or contact with a baby born in hospital could be attributed to acquisition of staphylococci from hospital.

From this hospital over the last ten years we have reported the increasing proportion of out-patients infected with penicillin-resistant strains of *Staph. aureus*. In this paper we describe our most recent findings and also the results of a survey undertaken to determine if patients with resistant staphylococci had previously been in direct or indirect contact with hospitals.

Materials and Methods

The patients in the survey comprised 208 unselected out-patients attending the casualty department with acute infections of the skin and subcutaneous tissues between October, 1959, and March, 1960. In addition, there were 214 patients with other non-septic conditions, such as lacerations and contusions, attending the same casualty

department during this period. Patients attending other departments in the hospital were excluded from both groups.

Swabs were taken from the lesions of the septic patients as soon as possible. In 85% they were taken immediately after incision; from the rest they were taken at the first attendance or as soon as the lesion discharged. Abscesses accounted for 57% of the septic lesions and boils for 19%. Nasal swabs were taken at the first attendance of septic and non-septic patients; patients in each group were asked for details of recent personal or family hospital contacts.

Bacteriology.—Swabs were cultivated on horse-blood-agar plates. Staphylococci which coagulated plasma in tube were regarded as *Staph. aureus*. Sensitivities to penicillin and tetracycline were determined for all the staphylococci isolated by the cup-plate method.

Results

Antibiotic Sensitivities of Staphylococci from Septic Patients

Coagulase-positive staphylococci were isolated from the lesions of 170 of the patients with sepsis: 67 (39%) of the strains were resistant to penicillin and 103 (61%) were sensitive. Table I shows how these proportions compare with previous published findings from this hospital.

TABLE I.—Sensitivity to Penicillin of Strains of *Staph. aureus* from Lesions of Septic Out-patients, 1949–60

Reference	No. of Strains	Resistant to Penicillin
Griffiths <i>et al.</i> (1949)	261	6%
" " (1950)	200	16%
Birnstingl <i>et al.</i> (1952)	200	21%
Rees <i>et al.</i> (1955)	218	25%
Burn <i>et al.</i> (1957)	170	39%
Present series		

Five strains were resistant to tetracycline in addition to being resistant to penicillin. They were all sensitive to chloramphenicol and erythromycin. One strain was resistant to tetracycline but sensitive to penicillin.

Penicillin Resistance of Staphylococci from Sepsis in Relation to the Patient's History

Patients were asked if they had attended any hospital in the past 12 months, if their family included any babies born in hospital within the last 12 months, if any other members of the family had been in-patients within the last 12 months, and if they had been given antibiotics by their own doctor in the past three months. The results are set out in Table II. The largest group of patients with a positive contact history was that of 65 who had been out-patients (but not in-patients) during the previous 12 months; penicillin-resistant strains were

TABLE II.—Penicillin Resistance of *Staph. aureus* Isolated from Lesions of Patients with Sepsis in Relation to the Patient's History

	Total	Resistant to Penicillin
All septic patients	170	39%
Patients attending any hospital in last 12 months:		
As an in-patient	13	69%
" out-patient*	65	49%
With family with baby born in hospital in last 12 months	13	62%
With any other member of family as in-patient in last 12 months	24	58%
Having been given antibiotic by own doctor in past 3 months	20	65%
Patients in one or more of above categories	94	52%
" " none of above categories	76	24%

* Excluding those who were also in-patients.

isolated from 33 (49%) of these patients. Even higher rates were recorded among the other small groups with recent contact, and the patients who had been given an antibiotic by their own doctor. Patients who answered "Yes" to any of these questions had 52% of their staphylococci resistant to penicillin, whereas those who answered "No" to all the questions had only 24% of their staphylococci resistant. All the patients with staphylococci resistant to penicillin and tetracycline had a history of personal or family hospital contact.

Of the 170 septic patients no fewer than 65 had had a similar lesion within the previous 12 months. The penicillin-resistance rate of their staphylococci was 40%. For 53 of the patients chemotherapy was begun before the lesion was incised. Their staphylococcal resistance rate was 45%.

Nasal Carriage of *Staph. aureus* by Septic and Non-septic Patients

Table III sets out the proportion of septic and non-septic patients who were found to be carrying *Staph. aureus* in the nose, and the sensitivity of the staphy-

TABLE III.—Nasal Carriage of *Staph. aureus* by Septic and Non-septic Patients

	Total	Nasal Carriers	Staphylococci Resistant to Penicillin
Septic patients	170	71%	42%
Non-septic " "	214	34%	32%

lococci to penicillin. Carriage rates were almost twice as high in the septic as in the non-septic patients, and the resistance rates were increased.

For the patients with sepsis there was some correlation between the nasal and infecting staphylococci. Of the 170 patients, 49 were not nasal carriers at the time of swabbing. Of the remainder, 70 carried penicillin-sensitive staphylococci in the nose, and of these 64 were infected with sensitive staphylococci. Fifty-one patients carried penicillin-resistant staphylococci, and of these patients 44 were infected with resistant staphylococci.

Although the nasal carriage rate was lower among the non-septic patients, the carriage rate was greater for the non-septic patients with hospital contacts, as defined earlier, or a history of antibiotic therapy, than for the patients without such a history. The penicillin-resistance rate for the first group was almost double that of the second group (Table IV).

TABLE IV.—Penicillin Resistance of *Staph. aureus* Isolated from the Noses of Non-septic Patients

	Total	Nasal Carriers	Staphylococci Resistant to Penicillin
Patients with hospital contact or previous history of antibiotic treatment	100	39%	41%
Patients without hospital contact or previous history of antibiotic therapy	114	28%	21%

Septic Patients from Whose Lesions *Staph. aureus* was Not Isolated

There were 38 patients from whose lesions staphylococci were not isolated. In some cases this failure may have been due to technical reasons. That this may not have been responsible for the majority is suggested by the finding that the nasal carriage and the penicillin-resistance rates of this group of patients approximated closely to the rates for the non-septic patients (34% and 31% respectively).

Discussion

The proportion of staphylococci resistant to penicillin responsible for sepsis in out-patients attending this hospital is still increasing. The increase presumably reflects the continued use of penicillin in hospital and general practice, and while this continues there is little reason to expect that the proportion of resistant staphylococci will fall. For infections of the skin and subcutaneous tissues this may not be of great importance, as there is evidence that these conditions perhaps respond to treatment with penicillin, even if caused by penicillin-resistant staphylococci (Burn *et al.*, 1957). More serious infections, however, do not react in this way. A penicillin-resistance rate of 39% implies that penicillin should not be used for the treatment of dangerous staphylococcal infections initially until the results of sensitivity tests are known.

Within hospital, patients who are nasal carriers of staphylococci seem to be more prone to sepsis than those who are not carriers, and the staphylococci responsible can frequently be isolated from the patient's nose before the onset of sepsis (Williams *et al.*, 1959). In our patients, 71% of those with sepsis were nasal carriers as compared with 34% of those without sepsis. That the nasal and septic staphylococci may in most cases have been the same was perhaps suggested by the observation that only 13 (8%) of the patients had a sensitive organism in the nose and a resistant one in the lesion, or *vice versa*. These figures suggest that, outside hospital, sepsis occurs more often in carriers than in non-carriers; but to establish this hypothesis would need a survey of a different kind.

As our survey was conducted on somewhat different lines from those of Galbraith (1960) and McDonald *et al.* (1960), a direct comparison cannot be made. Our results agree in that for staphylococci isolated from patients with sepsis and for staphylococci carried by patients without sepsis the penicillin-resistance rates were considerably higher for the staphylococci belonging to patients with direct or indirect hospital contacts.

Rycroft and Williams (1960) described the high carriage rates of penicillin-resistant staphylococci in children under 6 months who had been born in hospital, an increase which continued at a lower level up to 4 years. They concluded that their results drew attention once more to the part that hospital infection may play in seeding the population with antibiotic-resistant staphylococci. We believe that our results do the same.

Summary

One hundred and seventy strains of *Staph. aureus* have been isolated from out-patients with sepsis. Of these, 39% were found to be resistant to penicillin, the highest figure yet recorded at this hospital and nearly double that reported in 1955.

Patients with a history of hospital contacts or treatment with an antibiotic were more often infected with or carried staphylococci resistant to penicillin than those with no such history. It is suggested that this is a further illustration of the part played by hospital infections in seeding the population with antibiotic-resistant staphylococci.

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CLINICAL EVALUATION OF METRONIDAZOLE

A NEW SYSTEMIC TRICHOMONACIDE

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Infestation with *Trichomonas vaginalis* causes much distress to many women of all ages. The incidence of the condition in the population as a whole is difficult if not impossible to determine. In this country, in recent years, *T. vaginalis* was found in 5.3% of 562 women attending a birth-control clinic (Whittington, 1951), in 12.8% of 400 women attending a gynaecological department, and in 21.3% of 400 women attending a venereal disease clinic (Whittington, 1957). These figures represent the incidence in highly selected groups of patients and do not take into account the women who are treated by their own practitioners and those who, for reasons of modesty or fear, prefer to suffer in silence rather than seek advice. Apart from the often considerable physical discomfort, much psychological upset occurs in many cases because of the offensive nature of the discharge and the marital disharmony consequent on vaginismus and dyspareunia.

It now seems clear that *T. vaginalis* is a pathogen and not a harmless inhabitant of the genital tract, though it may be seen occasionally in the absence of clinical signs of infection. Recently, since improved laboratory methods of demonstrating the organism have made diagnosis easier, the protozoon has been shown to be present in the male genito-urinary tract with increasing frequency. Whittington (1957), using cultural techniques, showed the organism to be present in 15.3% of 325 men with non-gonococcal urethritis, and in 8 (33%) of 24 symptomless male consorts of women with chronic trichomonal vaginitis. In a group of 30 husbands of women with chronic trichomonal vaginitis we found that 18 (60%) harboured the organism, most commonly in the prostate (Watt and Jennison, 1960). Male trichomoniasis is in many cases completely silent and may represent a carrier state.

Treatment of human trichomoniasis has until now been very unsatisfactory and at best could often be only palliative. Local pessaries of various kinds in the female produced symptomatic relief in a proportion of cases, but the incidence of recurrence was always high and the incidence of chemical vaginitis by no means negligible. Treatment of the male, especially if a prostatic focus