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CONTROL OF A STAPHYLOCOCCAL EPIDEMIC UNDER ADVERSE CONDITIONS

BY

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Inadequacies of staff, equipment, and premises can easily induce pessimism when one has to attempt the control of staphylococcal epidemics in many of our smaller hospitals. In the circumstances reported here all of these factors were present, and unusual difficulties were added by the nature of the patients—mentally subnormal but mostly active male children between the ages of 6 and 15 years. Our success in bringing an epidemic of cutaneous infections, due to *Staphylococcus pyogenes* (phage types 80 and 3B/3C+), rapidly under control was as unexpected as it was gratifying, and we present this account of our experience as an encouragement to others.

Description of Children's Unit Involved

(The following details were correct during the rise and fall of the epidemic. Some improvements have since been made.)

The unit is part of an upgraded Poor-Law institution of 297 beds, which caters for cases of mental subnormality, chronic sick, and geriatric "Part 3" cases (Kent County Council); and receives on licence chronic cases of mental disorder from a local mental hospital.

The children's unit is a modern brick building, 40 yards (36 m.) from the nearest other hospital block. It was originally built as a nurses' home, but was never used as such. It has two stories, with adequate window lighting; each window opens only to a 4 in. (10 cm.) gap top and bottom.

Ground Floor.—(a) The dining-room, 18 by 16 ft. (5.5 by 5 m.), contains three wooden tables with low padded tubular-metal chairs, and two old wooden tray chairs. (b) The kitchen has one gas stove, no refrigerator, poor washing-up facilities, and no tiles. All food is brought to this kitchen from the main hospital kitchen in metal containers on a wooden trolley. (c) The sister's office, 12 by 12 ft. (3.6 by 3.6 m.), has a desk, two chairs, and drug-and-instrument cupboard. Doctors' consultations and treatments are carried out here as there is no other more suitable room. (d) Potting-room, 13 by 8 ft. (4 by 2.4 m.), has one hand-basin, which is used by doctor and other staff. (e) Sluice-room, 9 by 6 ft. (3 by 2 m.), contains four low W.C.s and one hand-basin. (f) The bathroom has one bath, used for six spastic children. (g) The ground-floor dormitory, 18 by 14 ft. (5.5 by 4.3 m.), has six cot beds spaced 18 in. (4.6 cm.) apart. (h) The play-room, 18 by 14 ft. (5.5 by 4.3 m.), has no furniture. All floors are linoleum-covered.

Upper Floor.—This has (a) four dormitories—three 18 by 14 ft. (5.5 by 4.3 m.); and one 33 by 14 ft. (10 by 4.3 m.) with 26 beds in all; (b) two bathrooms, each with single bath and hand-basin; (c) one lavatory with three low W.C.s; (d) linen and clothes cupboards.

Outside is a cement playground 60 by 40 ft. (18 by 12 m.) surrounded by a high fence and a privet hedge.

The Patients.—All are male children between the ages of 6 and 15 years, all but six being between 7 and 10. The total numbers vary between 27 and 30. All are cases of severe mental subnormality: many are unable to talk or to feed themselves. Some are very destructive and dirty in their habits. At the time of the epidemic 22 were incontinent of urine and faeces; six were bed-ridden.

Staff.—There are a sister (a registered mental nurse), and five mental nursing assistants (including the night nurse). A night superintendent (a registered mental nurse) is on duty also for the whole hospital.

Development of Staphylococcal Sepsis

During 1958 the health of the children was good. During 1959 cutaneous infections gradually increased (see Chart): most of these were boils; a few cases of staphylococcal otitis externa and conjunctivitis occurred also.

The numbers of new independent lesions appearing in each month after April, 1959, were: May, 10; June, 14; July, 24; August, 27; September, 45; October, 49; November, 39 (up to November 15). During November boils appeared on the buttocks and limbs of one nurse and on the face and axilla of another.

Measures For Control

On November 11, 1959, one of us (V. H. B.) was called in consultation to suggest how the situation should be managed. It was obvious that there would be many difficulties in achieving what appeared to be the essential

conditions for gaining control. For example, there was nowhere to send patients who became free from lesions, and it was impossible to isolate them within the unit. Insufficient staff were available for barrier-nursing to be practised. Most of the children were active and ambulant, not easily kept apart, and they frequently removed their dressings. Chipped enamelled chamber-pots were used interchangeably for the children, who

Chart of the Epidemic. A: Measures for control introduced, including naseptin cream for all patients and all staff, and hibitane sponging for all patients. B: Naseptin cream and hibitane sponging restricted to patients with lesions; suspended for other patients and for staff. C: Above procedures again extended to all patients, but not to staff. D: Naseptin cream again restricted to patients with lesions. Hibitane sponging retained for all patients.

sometimes exchanged pots in mid-session. In fact, many features of their day-to-day behaviour ensured that their bacterial flora would be shared between them.

At a conference between us and the sister-in-charge, the following measures were agreed to as practicable; and we wrote down individually what each of us had to do:

1. The noses of patients and staff would be swabbed weekly (one swab in both nostrils); and the discharges from all lesions would be swabbed also. Identification would be by labelling on the swab. No request forms would be required; and the sister was given permission to send swabs on her own initiative.
2. All the blankets (wool) in the unit, the mattresses, the pillows, and all articles of patients' clothing were initially to be autoclaved at 5 lb./sq. in. (350 g./sq. cm.) for 30 minutes. Subsequently woollen blankets would receive similar treatment whenever they were changed: as the woollen blankets deteriorated with this treatment they would be replaced by others of cellular cotton type which could be given high-temperature laundering.
3. All curtains were to be laundered, and the rooms were to be cleaned one at a time, using antiseptic for the walls and floors.
4. The enamelled chamber-pots were to be replaced by others of plastic material.
5. The baths, hand-basins, lavatory pans and seats, and chamber-pots were to be wiped over after use with "savlon" hospital concentrate 1 in 200.
6. Hibitane 1 in 5,000 was to be used in the bath-water.
7. Hexachlorophene ("cidal") soap was to be used for hand-washing, followed by hand-cream; and for bathing.
8. Antiseptic ointment was to be applied into both nostrils twice daily by all staff and all patients until directed other-

wise. "Neobacrin" was used for about two weeks, after which "naseptin" cream was substituted.

9. The responsible authority was to be requested to provide more staff.

After consultation with Dr. J. Glover, consultant physician to the unit, it was decided to treat the boils by local measures only. The use of systemic antibiotics or sulphonamides was considered and rejected.

Active immunization, using staphylococcus toxoid or autogenous vaccine, was also considered, but we decided to keep this treatment in reserve until the results of our other measures were known. In the event we have had to do no more about it.

The measures agreed upon were all implemented within a few days of our conference. No additional staff were engaged, but a nursing assistant was sent from a near-by ward at intervals daily to assist with the extra duties.

[Proposals 2 and 6, above, were later modified in some particulars without reference to us, so that what actually happened was as follows: All the blankets, pillows, and mattresses (hair-stuffed) were autoclaved at 5 lb./sq. in. (350 g./sq. cm.) for 30 minutes, weekly from November, 1959, to March, 1960. After this the blankets were laundered with a quaternary ammonium compound, and in fact cotton cellular blankets have not been issued to the unit. The mattresses and pillows continued to be autoclaved weekly until September, 1960, then fortnightly until October, 1960, when new ones were supplied with plastic covers, which are wiped over weekly with savlon hospital concentrate 1 in 200. 1 in 5,000 hibitane in the bathwater was found to be too expensive, and it was replaced after a few weeks by the following procedure. Each patient was bathed in fresh clean water, using hexachlorophene soap. He was then sponged all over, including the hair, while standing in the bath, using a flannel soaked in 1 in 5,000 hibitane solution, which was contained in a bowl. A different flannel was used for each patient. Before and after use the flannels were mixed indiscriminately and stored in 1 in 200 savlon hospital concentrate. They were all boiled once daily.]

Results

Bacteriological

Staphylococci from all the boils which were present initially were submitted to Dr. R. O. E. Williams, who kindly determined their phage types. Six proved to be type 3B/3C+, and the other four type 80. All were resistant to penicillin but fully sensitive to streptomycin, chloramphenicol, chlortetracycline, and oxytetracycline.

Nasal swabs were not received until after intranasal antistaphylococcal cream had been applied for a week or more. Subsequently nasal swabs were received from patients at weekly intervals, with few exceptions, but from members of the staff very irregularly. Among the staphylococci from the noses of the staff the following phage types were identified by Dr. Williams: 80; 3B/3C+; 7/4E; 47/53 v.w.; 29/52; 73+.

Considering only weeks in which nasal swabs were received from at least 29 patients, the percentages of swabs yielding *Staph. pvogenes* at various dates were:

28/11/59	..	13/32 (39%)	9/1/60	..	8/29 (28%)
5/12/59	..	9/29 (31%)	16/1/60	..	3/32 (9%)
12/12/59	..	8/29 (28%)	30/1/60	..	3/29 (10%)
19/12/59	..	9/32 (28%)	13/1/60	..	4/29 (14%)
26/12/59	..	9/33 (29%)	20/2/60	..	6/29 (21%)

All swabs were taken by the sister-in-charge.

No definite relationship was seen between the number and duration of the lesions in any particular patient and the total number of nasal swabs from him which yielded *Staph. pyogenes*. Moreover, lesions were frequently present when the nasal swab was negative, and vice versa. In fact, we obtained no useful information from the nasal swabs after we had made the preliminary survey of the types of staphylococci involved in the outbreak.

Clinical

The subsequent course of the epidemic is shown by the following numbers of lesions which appeared in successive months:

1959 {	November 1 to 15	39	} 41	1960 {	January	5
	" 15 to 30	2			February	5
	December ..	8				

Later Events

By February, 1960, conditions had so much improved that on February 29 various measures were relaxed. It was arranged that the use of intranasal naseptin cream, sponging in 1 in 5,000 hibitane solution after bathing, and nasal swabbing should be continued only in respect of patients with lesions. Members of the staff and patients without lesions were to be excluded from these measures.

There followed an immediate increase in the number of new lesions, which totalled 24 during March. We therefore reintroduced naseptin cream and sponging with hibitane for all the patients. During April nine new lesions occurred, during May 10, and during June only 3. In June, naseptin cream was again restricted to patients who had lesions, being applied while the lesions were present and for a few days afterwards. A gradual increase of new lesions was then seen, reaching a peak in August, after which the numbers fell spontaneously without any further action on our part. (This peak may have been wholly or in part a seasonal phenomenon associated with the warmer weather.)

The numbers of new lesions in successive months from June, 1960, to the time of writing were: June, 3; July, 8; August, 25; September, 18; October, 9; November, 9; December, 5; January (1961), 2; February, 5; March, 6.

Discussion

It is perhaps of some general interest that the epidemic was checked immediately without any form of segregation of the patients or staff, or of their belongings, and without isolation or barrier-nursing techniques. We cannot assess the relative values of the different measures we used, but our experience in March, 1960, led us to believe that the use of intranasal naseptin cream and sponging with hibitane 1 in 5,000 solution were playing an important part in holding the position at that time. We have seen no case of sensitization nor any other adverse effect from the use of these substances. It is regrettable that small numbers of new lesions continue to appear, but most of them are now papules or furuncles which heal in a few days, and only three boils have been seen during the first quarter of 1961. When one considers the nature of the unit these facts are not too disappointing.

Summary

An epidemic of cutaneous staphylococcal infections due to phage types 3B/3C+ and 80 occurring in a unit housing 30 mentally subnormal children was brought

rapidly under control without any form of segregation, isolation, or barrier-nursing. The methods used are recorded.

We should like to pay a sincere tribute to the work of the nursing staff, particularly the sister-in-charge, Miss Mary Huston, who applied our suggestions with enthusiasm under conditions that could hardly have been less promising.

THE TRIPLE-X SYNDROME

CLINICAL, PATHOLOGICAL, AND CHROMOSOMAL STUDIES IN THREE MENTALLY RETARDED CASES

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During the course of a survey of nuclear sex in a mental deficiency hospital, five patients with double sex-chromatin masses in their buccal mucosal cells were found (Ferguson-Smith, Handmaker, and Hill, in preparation). Two of these were phenotypic males with the clinical features of Klinefelter's syndrome, who were shown to have a chromosome number of 48 with an XXXY sex-chromosome constitution (Ferguson-Smith, Johnston, and Handmaker, 1960). The other three, who form the basis of this report, were females with 47 chromosomes.

Methods

The chromosome counts were performed on both bone-marrow and peripheral blood cells. The former technique is given elsewhere (Ferguson-Smith, Johnston, and Weinberg, 1960). The latter is based on a method originally described by Osgood and Brooke (1955) and modified by a number of workers. Thirty millilitres of the patient's blood are drawn into a heparinized syringe and placed in 10-ml. amounts in three sterile tubes, to each of which 0.25 ml. bacto-phytohaemagglutinin (Difco) is added; these are put in ice-water for one hour. After centrifuging for 10 minutes at 300–400 r.p.m. the opalescent plasma containing leucocytes is added in 3-ml. amounts to 2-oz. sterile prescription bottles containing 5 ml. of culture medium (NCTC 199 Difco). These are incubated for 66–80 hours. The cultures are treated in succession for the last two hours of incubation, with deacetylmethylcolchicine ("colcemid") to a final concentration of 1 µg./ml. After centrifugation at

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