The uninterrupted reports of success with dimercaprol in cases of metallic poisoning may encourage the use of higher dosage of gold in the treatment of chronic rheumatism.

I am indebted to many colleagues for help with the preparation of this paper; particularly to Miss M. Roberts, assistant city analyst, Liverpool, for the gold estimations in Case 2. I am grateful to Dr. C. McGibbon, Dr. R. B. Nelson, and Dr. C. D. Alergant, of the dermatological and V.D. departments of this hospital, for allowing me to see their cases, and to Dr. C. O. Stallybrass and Professor R. A. Morton, Liverpool University, for helpful criticism.

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HOSPITAL AND DOMICILIARY CONTROL OF RESPIRATORY TUBERCULOSIS*

BY

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HOSPITAL TREATMENT

The Problem

In certain places visited significant statistical evidence was available of changes in the rates of infection, morbidity, and mortality associated with active anti-tuberculosis programmes. Graphic records of these statistics show a progressive shift of the maximum incidence of infection to the right, or to older age groups. The same is true of active disease and of deaths from tuberculosis. A population which is being infected, which is suffering definite symptoms and succumbing to the disease at a greater age than previously, and in whom this age change is progressive, affords hope for the ultimate elimination of tuberculosis from the community by methods already in use or by factors already operating.

Similar statistical evidence of progress in the United Kingdom during recent years is less reassuring. In some areas, in spite of the general downward trend which is common to many lands, there seems to be a disturbing shift to the left, or to younger age groups, in the mortality figures. Elsewhere a definite increase in the death rate

per 100,000 of population has occurred, and the morbidity in some age groups is on the increase in certain localities.

These figures indicate that an intensification of the present measures for controlling the disease is needed and that elimination will require even greater efforts.

Common Measures Employed Against Tuberculosis

A Pure Milk Supply.—Among measures of public health the necessity for an uninfected milk supply is generally accepted. Myers, in Minneapolis, presenting the features of an exceptionally successful control scheme, is emphatic regarding a great fall in the incidence of tuberculin reactions within the general population which accompanied the development of tubercle-free herds in the State of Minnesota.

Apart from general public health reforms, the main features of the anti-tuberculosis campaigns are alike in Scandinavia, the U.S.A., and the Canadian provinces I was privileged to visit. They are:

1. Segregation in sanatoria or tuberculosis hospitals of all persons known to excrete tubercle bacilli in their sputum.
2. Treatment of all cases of active respiratory tuberculosis to the stage of sputum conversion and stability of the disease.
3. Restoration therapy, or "rehabilitation," designed to keep the treated patients in good health.
4. Case-finding by miniature chest x-ray surveys.
5. Protection of non-immunes in exposed groups with B.C.G. vaccine.
6. Domiciliary supervision.
7. An economic and social evolution outpacing similar reforms for the general population.

The emphasis on these measures is not uniform and the factors bringing one or other into prominence will be discussed.

1. Segregation of Infectious Cases of Tuberculosis

A sanatorium bed ratio of 2.5 per annual death from respiratory tuberculosis is widely accepted as a minimum in Canada and the U.S.A. Mark, in Minneapolis, claims (personal communication) to make full use of the 4.5 beds per annual death which the reduced incidence of the disease now makes possible. A recent claim for 10 beds per annual death has been advanced by Bogen (1949) as the appropriate measure for elimination of the disease. Scandinavian countries favour a ratio of 3 to 1. The more extreme ratios represent individual views unlikely to be the basis of national policy.

Public Health Law 725 in the U.S.A. laid down that the number of beds required to provide adequate hospital services for tuberculous patients should not exceed, for the purpose of grants-in-aid, two and half times the average annual deaths from tuberculosis in any State over the five-year period 1940-4. Canada and the other countries mentioned intend that beds shall be available, without waiting, for every case of tuberculosis requiring admission, and that indefinite segregation for infectious cases shall be provided.

In the U.S.A. there seems to be considerable evidence of an agreement in policy existing between the major interests in tuberculosis control. The National Tuberculosis Association, the Trudeau Society, and the Tuberculosis Control Division of the U.S. Public Health Service are united in a policy of hospital treatment, to which the allocation of Federal funds has given a great stimulus.

State and city authorities are naturally influenced by the prospects of grants-in-aid for sanatorium construction.

*Extracted from a report to the Nuffield Provincial Hospitals Trust, to whom I am indebted for travel facilities during the spring and summer of 1948.

The grave shortage of nurses and other staff is not considered to be a hindrance to the extensive building programme. In the opinion of the controlling bodies other expedients are likely to be ineffective and may sometimes be dangerous.

The purpose in America is to afford shelter until re-education, restorative therapy, and vocational training—commonly grouped under the heading of “rehabilitation”—are either completed or advanced enough for the patients to be referred to the Department of Labour.

Compulsory Measures.—Although most of the States in the U.S.A. have passed laws making the compulsory segregation of infectious cases possible, there are practical difficulties in their operation. The co-operation of patients is not always secured. The irregular discharge rate from sanatoria for the whole of the U.S.A. is variously quoted, as the statistics are incomplete, but a very conservative figure is 33%, with individual institutions exceeding 55%. It appears that a policy of detention does not achieve its object unless it is supported by a vigorous programme of restoration therapy which gains the co-operation of the patients. In individual sanatoria where these essentials for success did exist the self-discharge rate was as low as 5%. It may be noted that, in order to complete the approved State programmes of sanatorium construction for conformity with the statutory formula, some 80,000 additional beds are still required in the U.S.A.

2. Treatment of Active Disease to the Stage of Stability

Effect of Antibiotics on Bed Requirements.—To the established methods of treatment of respiratory tuberculosis, which include rest therapy, collapse therapy, and environmental therapy, the advent of antibiotics capable of influencing the tubercle bacillus in the human body has added antibacterial drug therapy and excision therapy. The use of streptomycin to render a patient suitable for surgical treatment may reduce the period of preparation by many months, and in some cases routine treatment also may be shortened; but there is likely to be a considerable increase in the demand for surgical facilities and for time-consuming bacteriological and biochemical control. The net effect in reducing bed demands is unlikely to be very great.

Duration of Treatment in Sanatoria.—The provision of beds on the basis of 2.5 per annual death makes possible an average stay in hospital of 14 to 18 months. Converted into maximum and minimum figures, it appears that some 15% of patients, for whom a full programme of restoration therapy is justified, may remain for an average of 2.5 to 3 years. A further 10%, the chronic sputum-positive segregation cases, would continue indefinitely as in-patients, perhaps in somewhat modified accommodation, if they were prepared to accept the restrictions of institution life. The low self-discharge rate from United Kingdom sanatoria compared with American figures is probably due to the differences in bed function and the average duration of stay, which in the former case is limited by the pressure of waiting-lists to less than six months.

3. Restoration Therapy

The term “rehabilitation” is criticized in the U.S.A. because it implies the removal of the patients from the sphere of medical care to the hands of lay officials of the Department of Labour.

It is an aspect of treatment which receives very varied attention. In Norway and Denmark, as too often in England, there is little provision. Sweden has shown

considerable initiative both in sanatoria and with sheltered workshops. In certain sanatoria of Canada and the U.S.A. a high standard has been reached.

Much money, equipment, and building space is devoted to restoration therapy in these countries. The logic of this is simple, as some 30% of patients in sanatoria are readmissions who typify the relapsing nature of a disease which is affected by environment. If patients could be kept well after once being restored to apparent stability and working capacity a major source of infection, in the relapsed cases, would be removed from the community and the demand for bed accommodation would be substantially reduced. American opinion is that the disease cannot be controlled without an adequate programme of restoration therapy.

This constitutes the maximum of physical, mental, social, economic, and vocational assistance. The proportion of sanatorium patients who will find their former employment unsuitable varies very considerably in different areas, but may average some 15% of discharges throughout this country.

If the term “restoration therapy” is adhered to in the United Kingdom, and it does correctly define an aspect of medical care, a liberal provision of beds for long-term accommodation will be necessary. In training these patients the education authorities may play a prominent part. The formation of “evening institutes” for class instruction in sanatoria is within their province.

There is need for expansion of sanatorium facilities for such prevocational training.

In Scandinavia and in Canada, where bed accommodation for tuberculosis is available on a more liberal scale than in Great Britain or the U.S.A., the nursing and domestic staff problems also appear to be less acute; but the implications of a full programme of restoration therapy have not received the same amount of attention in the former countries. This is probably owing to the varying degree of industrialization and of rural pursuits in each.

The Cost.—The Veterans' Association in the U.S.A., which is persuaded of the need for keeping patients well as a sound economic proposition, is proceeding with a comprehensive programme of restoration therapy for its ex-Service men at a cost which is stated by Bagley (1948) to be from \$0.85 to \$1 per patient bed per day in their sanatoria.

EXTERNAL CONTROL MEASURES AFFECTING HOSPITAL BED DEMANDS

The following measures of prevention and aftercare have a direct bearing on the control of tuberculosis. Though regarded in the National Health Service Act as the function of regional hospital boards, their effective use requires the close co-operation of local health authorities, especially in matters of publicity and case-finding.

4. Mass X-ray Surveys

In the countries visited progress has been made in national surveys, and there is agreement that preventive measures should include the detection of all sources of infection. In the past some reliance has been placed upon tuberculin skin tests as a first step in detecting infection in the population, but this is now replaced by miniature radiography of the chest. Mass x-ray surveys are regarded by the Tuberculosis Control Division of the U.S. Public Health Service in Washington, D.C., as a springboard for all other measures of controlling the disease. In Scandinavia and in Canada there are many areas in which

20% to 25% of the population over 15 years of age are being x-rayed annually. In the United States the Tuberculosis Control Division is sponsoring mass radiography surveys of the larger cities to supplement the local activities of existing services of state, city, and other local agencies.

A pilot survey begun in Washington in January, 1948, was planned to x-ray 80% of the people over 15 years of age within six months. When visited in April, 1948, the work was in full swing and the objective seemed to be within reach.

It is proposed to continue similar surveys in all the cities of the U.S.A. with a population exceeding 200,000, and it is hoped that these will be completed within five years.

The Tuberculosis Control Division considers that such case-finding activities, though they may make temporary demands on bed accommodation, will not do so for any long period. Rather, because of early detection, cases require less time in hospital.

In Canada the use of fixed chest clinic units, of portable sets for industrial or other aggregations of population, and of mobile plant is common. The Province of Ontario provides a typical example. In 1947 a total of 232,571 miniature films were taken. The survey included 159 communities and 12 groups such as university and prison populations, treaty Indians, and Civil Servants. A total of 947 cases of pulmonary tuberculosis were detected, or 0.37% of those examined. Of these, 194 were known to have progressive disease and 168 active cases were not previously suspect.

Some question regarding the cost of finding the individual active case by this means is not out of place. The cost, if calculated in that way, is high, and the 54% of inactive lesions found in the Ontario survey suggests that a proportion of the newly found active disease might undergo spontaneous healing. No single feature was more impressive than the educational value of this publicized search for tuberculosis. Familiarity with the tuberculosis services encouraged a co-operative attitude in the ordinary man and woman. In Saskatchewan, for example, local people casually met in public transport talked quite readily of their routine visit to the x-ray unit and the check-up on their chests as a matter of course.

Examination of Selected Groups.—Emphasis is placed on the relatively high return of active cases from selected groups such as patients of a general hospital. A well-organized miniature unit of the Royal Victoria Hospital, Montreal, succeeds in x-raying approximately 100% of its out-patients. Those attending over long periods are re-examined every six months. Here the abnormalities of all kinds found in chest x-ray examinations approximate 2%. Similar arrangements are almost commonplace in the U.S.A. Immigrants to Canada are required to have a miniature film taken before they leave the United Kingdom, and others are similarly examined on arrival in certain provinces. In Denmark a successful attempt is made, with the co-operation of the employers, to x-ray all seamen, including fishermen, once yearly. They may not go to sea without a current certificate to the effect that radiography of the chest has excluded evidence of active tuberculosis.

5. Protection of Non-immunes by B.C.G. Vaccination

Experimental Studies in U.S.A.—In May, 1948, the American Trudeau Society's Committee on Chemotherapy recommended its use on non-reactors in exposed and susceptible sections of the population. In the following

month Barrett, of the Field Studies Department of the Tuberculosis Control Division, reported investigations on school-children, the effect of vaccinating positive reactors, and the use of freeze-dried vaccine. At a meeting of representatives of public health authorities convened by the Tuberculosis Control Division, Barrett expressed his personal opinion that, if during their course of training 25% of student nurses, tuberculin-negative on entrance, become tuberculin-positive, B.C.G. vaccination is necessary as a protective agent in that hospital.

In the view of Canadians and Scandinavians the protective value of B.C.G. vaccination for selected groups in the community is fully established.

In the U.S.A. a more critical attitude is in evidence with regard to B.C.G. Myers is opposed to its use in the State of Minnesota, where the natural infection rate is so greatly reduced that he regards the tuberculin skin test as an essential weapon in detection which B.C.G. vaccine would nullify.

Considerable publicity is given to Myers's criticism of B.C.G., but in conversation he readily agreed that the vaccine has a definite place in an anti-tuberculosis campaign, except where the infection rate has been successfully reduced by other means.

Scope of Vaccination.—Only in Norway is vaccination for all non-reactors required by law, but in Scandinavia generally the answer to any question regarding means for reducing the bed demands for tuberculosis is "B.C.G. vaccination." Though Canadian vaccination has been on a voluntary basis and in selected groups, it is employed with a thoroughness characteristic of all branches of anti-tuberculosis work in the Dominion.

6. Domiciliary Supervision

Domiciliary supervision as at present practised follows a remarkably uniform pattern in the United Kingdom and in the countries visited. With some notable exceptions there is generally little effective effort on the part of medical staff of health authorities to obtain first-hand information regarding the economic and housing conditions of families in which tuberculosis occurs. Their numbers are limited and they necessarily rely on trained health visitors, either working in tuberculosis alone or with general duties, to assess and report on the home circumstances. Patients attend clinics for supervision and treatment before and after periods in sanatoria. The assistance of social-welfare workers is utilized for the amelioration of social and economic stresses. The patients' own physicians are informed to a variable extent of the course of treatment. The contact cases are sought by health visitors and encouraged to submit themselves for observation at clinics.

Control measures which have effected a significant reduction in the incidence of human tuberculosis share the common factors of generous hospital bed accommodation and case-finding facilities, though the emphasis on other control measures may vary.

If such provision is accepted as necessary, it seems that the essentials for control are not available in the United Kingdom. The claims of tuberculosis in this country for sanatorium accommodation will be considered as part of the overall demand for hospital beds. Numerically the waiting-list of patients suffering from tuberculosis is a small part of the total requiring admission to hospitals for all forms of illness; but the average length of treatment is necessarily much greater.

To provide accommodation equivalent to 2.5 per annual death from respiratory tuberculosis in this country a

further 30,000 sanatorium beds, with staff accommodation and the necessary personnel, also 30,000, would be required.

Though hospital building may be delayed there is not the same objection to early recruitment of staff and a serious attempt to add their number to those already employed in home supervision and treatment. The possibilities of this would be affected by varying degrees of urbanization and industrialization, but wherever feasible the personnel and facilities for home treatment of selected cases might be considered by regional hospital boards and local health authorities in conjunction.

Such a change in emphasis on home treatment has had serious consideration for many types of long-term illness in the pioneer work of the Montefiore Hospital, in New York City, which began in January, 1947. A striking feature of this successful project has been its relative economy, the cost per day to the hospital being only 25% of in-patient treatment.

Other interests have been stimulated to plan on similar lines, and the progress of pilot schemes in the cities of New York, Newark, N.J., Richmond, Va., San Francisco, and Montreal deserves close attention, not only with regard to the care of long-term illness in general but because of the lessons they may provide for the home treatment of tuberculosis.

7. An Economic and Social Evolution

Evidence is available of the adverse effect of defective nutrition on the tuberculosis death rate. An upward trend of the tuberculosis mortality figures of certain age groups during recent years has been noted in the industrial north of Great Britain, though the factors operating are not clearly discernible.

Rehousing of families to provide a separate bedroom for the affected member and to avoid overcrowding of the remainder is a common feature of public health authorities' work both at home and abroad.

Economic security, as well as adequate nourishment, is a recognized element in programmes of control; but the amount of assistance and the desirable level of security relative to that of the average wage-earner are not scientifically estimated.

In the home workshops and the sheltered industries of Stockholm, the Altro factory of New York City, and the successful schemes of the United Kingdom there are pointers of which the implications are recognized in the Disabled Persons (Employment) Act, 1944.

Summary

There are certain measures common to programmes for the control of respiratory tuberculosis, of which case-finding facilities and adequate bed accommodation are prominent features in successful schemes.

The other main features of anti-tuberculosis campaigns are described.

The present specific measures for the control of tuberculosis in the United Kingdom are not sufficient to accelerate the natural downward trend of mortality rates.

There are deficiencies in the numbers of hospital beds and staff and also in case-finding facilities.

Respiratory tuberculosis, though it has strong priority claims on institution accommodation and personnel, will receive only a percentage allocation of beds in the foreseeable future.

There is some evidence of the practicability and the economy of home treatment, under certain circumstances, of long-term illness from which respiratory tuberculosis need not be excluded, provided staff and equipment are made available for the purpose.

It is important to assure by adequate measures of rehabilitation that successfully treated cases stay well.

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CORAL ULCER

BY

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The seven cases described in this paper occurred among officers and ratings of H.M.S. *Challenger* during a survey of the eastern seaboard of Qatar Peninsula, in the Persian Gulf, during the months of January and February, 1949.

The name "coral ulcer" is given for want of a better one. Little can be found in the literature on the subject, though the condition is well known among the fishermen and pearl divers of the western seaboard of the Persian Gulf and occurs among the fishermen of Ceylon also. Wyville Thomson, in his *Scientific Reports on the "Challenger" Expedition, 1872-1876*, reports the condition briefly, but says little except to advise the wearing of stout boots on coral reefs. Paradise (1924), a member of the 1924 Great Barrier Reef expedition, gives a good description of the condition and discusses treatment. Byrne (1924) reports the condition in Japanese pearl divers and in bêche-de-mer lugger crews working out of Thursday Island, as well as in himself and ratings of the Royal Australian Navy. Levin and Behrman (1941) report a case in the West Indies and discuss treatment with x rays. Bonnevie (1948) describes "Dogger Bank itch," which is caused by a coralline similar in some ways to the tropical corals.

Clinical Features

The patient first complains of lacerations of the feet, legs, or hands after contact with living coral reefs. In some cases the lacerations may pass unnoticed or be so minute as to escape attention, or may even be absent.

Some 12 to 24 hours later he begins to complain of pain in the injured area. This is fairly severe, especially on walking. In a few hours a spreading area of cellulitis appears around the wound. The laceration gapes and discharges a thin grey serous pus. The course is slow and painful, and deep ulcer formation is inevitable. It is accompanied by cellulitis, lymphangitis, enlargement of the local lymphatic glands, and (rarely) fever and malaise. The ulcer is as a rule disabling and the pain quite out of proportion to the physical signs. The patient is often unable to walk for weeks or months after the injury, especially if it is on a weight-bearing area. The course is punctuated by sudden relapses, when the condition flares up again without warning.