ful cases have had subsequent anti-syphilitic treatment. The present results as regards serological tests are seen below.

TABLE II.—*Serological Results in Successful Cases*

	C.S.F.	Blood	Both Blood and C.S.F.
Negative	7	5	2
Positive	7	9	5

In five cases the blood Wassermann test is now negative, but the cerebro-spinal fluid remains positive. In no case has the cerebro-spinal fluid become negative while the blood has remained positive.

CLINICAL RESULTS IN OTHER CASES

In the patients who made an incomplete recovery there was in every case considerable physical improvement and some mental improvement. The patients, for example, were less excitable, became continent and clean in their habits, and were often able to go about in hospital. Tabetic pains were often relieved.

JUVENILE GENERAL PARALYSIS OF THE INSANE

Fourteen cases of juvenile general paralysis of the insane have been treated. It was to be expected that this group would be rather a barren field, but, as the figures show, quite a fair measure of success has been achieved. Some observers consider juvenile general paralysis of the insane as a contraindication to malaria therapy (Johnson and Jefferson*). The clinical picture was usually very definite—a young person who had become dull, stupid, backward, dirty in habits, careless, and unduly “childish.” The clinical recovery in 21.4 per cent. of these patients, with a mortality of 14.3 per cent., justified this method of treatment, as otherwise the prognosis in such cases is progressive dementia and early decease. All juvenile patients improved physically, almost all regained control of their organic reflexes, and returned to clean habits. Drug treatment alone has not produced such gratifying recovery.

TABLE III.—*Serological Results in Juvenile General Paralysis of the Insane*

	Strong Positive	Weak Positive	Negative
Blood	9	0	3
Cerebro-spinal fluid	8	1	3

TABLE IV.—*Serological Results in Whole Series*

	Strong Positive	Weak Positive	Negative
Blood	32	2	10
Cerebro-spinal fluid	29	11	4

MORTALITY

In our series nine patients (18 per cent.) are now dead. Of these deaths three were not directly attributable to malaria. In Case 7 the patient died nineteen months after malaria from dementia and cerebral seizures; in Case 35 the patient committed suicide; in Case 19 the patient improved sufficiently to attend as an out-patient, then went on holiday, and three months later was found dead, the cause being unknown. Malaria, or intercurrent disease occurring during or very soon after the pyrexia, was the cause of death in five cases (10 per cent.). One patient died in hyperpyrexia; this was a very enfeebled case of juvenile general paralysis of the insane that had been inoculated with quartan malaria. Three cases showed an advanced degree of mental enfeeblement and physical debility, so that malaria was considered a grave

risk; these patients developed cardiac failure and bronchopneumonia, and died shortly after terminating the rigors. One patient, aged 55, suffered from severe diabetes, and though he was carried through eight malarial rigors, he died three months later from diabetic coma.

As this series includes several advanced cases of general paralysis of the insane, and several cases of other serious disease, and as all deaths to date are included irrespective of cause, the mortality is not unduly high. When it is recalled that the death rate from untreated general paralysis of the insane is considerable, the treatment by induced malaria is not, in our opinion, an unduly dangerous procedure. This view is supported by results obtained by others, particularly in the clinic of von Jauregg in Vienna. Our observations have so far been in favour of this therapeutic measure, and we hope that by earlier diagnosis of general paralysis of the insane, and by applying this method to cases before marked mental changes are observed, even better results will be obtained. Further observation over a long period is essential before a final estimate of results is possible.

SUMMARY

1. Fifty cases treated (36 adults and 14 juveniles).
2. Successful result in 28 per cent. of cases (30.6 per cent. adults alone, 21.4 per cent. juveniles alone).
3. Mortality due to malaria is small (10 per cent.).
4. Induced benign tertian malaria is easily cured. No malaria relapses in this series.
5. Serological improvement in blood and cerebro-spinal fluid frequently observed.
6. Value of anti-syphilitic treatment following malaria. Both clinical and serological results often show progressive improvement.
7. Necessity for prolonged observation of all cases.

I am greatly indebted for permission to observe and report these cases to Mr. David Lees, and to the honorary physicians of Edinburgh Royal Infirmary, under whose care the patients have been: Colonel E. D. W. Greig, lecturer on tropical diseases, Edinburgh University, has observed nearly all the cases throughout the course of the malaria, and has given great assistance in the treatment, and very valuable help in the preparation of this report. Colonel S. P. James of the Ministry of Health has supplied us on several occasions with strains of malaria for use in this series.

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THE FUNCTION OF THE ISOLATION HOSPITAL IN MODERN PRACTICE*

BY

E. H. R. HARRIES, M.D., D.P.H.

MEDICAL SUPERINTENDENT, CITY HOSPITALS FOR INFECTIOUS DISEASES;
UNIVERSITY CLINICAL LECTURER ON FEVERS, BIRMINGHAM

Isolation hospitals are designed to isolate, until no longer potential sources of danger, those suffering from certain of the acute specific infectious diseases, with a view to the control of those diseases in the community. Since most of those so isolated are also physically ill, treatment of the illness occasioned by the infection is a necessary corollary.

The primary functions, then, of the infectious diseases hospital are the isolation and treatment of the infectious sick. The fact that in this country most of those sick from

* Read in opening a discussion in the Section of Public Health (including Tuberculosis and Occupational Diseases) at the Annual Meeting of the British Medical Association, Eastbourne, 1931.

at least some of the acute specific infections are isolated and treated in special institutions should impose two other functions upon, at any rate, the larger of those institutions—namely, teaching and research. To what extent and with what success does the isolation hospital carry out its primary functions of isolation and treatment, and what may be termed, perhaps, its secondary functions of teaching and research?

THE ISOLATION HOSPITAL

To relate the story of the development of the present-day isolation hospital from the old pest house would be to relate a large part of the history of public health in the nineteenth century. Indeed, the Public Health Service arose out of the necessity of dealing in an organized manner with the then formidable endemic and epidemic acute infectious diseases which took such a considerable toll of lives.

At least from the days of Murchison, the 'sixties of last century, isolation hospitals have been considered an essential part of the equipment of sanitary authorities. Murchison's classical treatise on the continued fevers of Great Britain contains in its last chapter a discussion "on the relative merits of isolating fever patients and of distributing them in the wards of a general hospital." Murchison advocated the isolation of cases of fever in the separate wards of a fever hospital. Except for the modifications made possible by the various types of barrier-nursing, this is in general the practice to-day. With few exceptions, local authorities make provision for the reception of cases of smallpox in a separate institution and for such cases of the other acute specific infections as it is considered desirable by the medical officer of health to isolate in a fever hospital.

The degree of success attained by isolation as a means of control varies with the particular disease and with the particular local circumstances. There is general agreement about two things: the great value of isolating the first cases of an *epidemic* disease and the very small value of the same measure as a means of controlling *endemic* infectious disease. The recent advances in the knowledge of immunity and of epidemiology based in part upon those advances have shown why the hopes which were at one time held in regard to endemic infections were inevitably doomed to disappointment.

Stallybrass, in his admirable work on "The Principles of Epidemiology," recently published, writes as follows:

"The great success of isolation against smallpox, typhus and, to a lesser extent, typhoid led the epidemiologists of the nineteenth century to a hope that they would be able to 'stamp out' scarlet fever and diphtheria in a like manner; in this they were deceived. The finding of numerous 'missed cases' of smallpox and typhus encouraged them to hope that by the search for such cases in scarlet fever and diphtheria they would still be successful in the 'stamping out' policy. . . . The numbers of temporary and chronic carriers (in these two diseases) render it improbable that complete success will ever attend a policy based entirely upon isolation and disinfection. . . . In typhus, typhoid and smallpox the success of isolation was associated with other means of attack upon the means of transmission in the two former and by immunization in the last. It was at first hoped that isolation would prevent measles and whooping cough. . . . Owing to the high infectiousness of these two diseases during the prodromal or catarrhal stage they give rise to numerous secondary cases before the nature of the primary case is brought to light."

Need for Immunization

As is the case with smallpox, which in its present form threatens endemicity through the neglect of vaccination, there is only one rational method of controlling these

endemic diseases—the active immunization upon a sufficient scale of the susceptibles; in this country, a counsel of perfection. A measure of achievement and of success is slowly being attained in the case of diphtheria, a disease which the public fears. In the case of scarlet fever the means exist, but the necessity for their employment upon any large scale can hardly be said to exist while the disease retains its present mild characteristics. Against measles no method of active immunization is so far available, and upon any sufficient scale, proved as they are, neither temporary passive immunization nor attenuation of the attack by the use of human serum is practicable. The supply of human serum is always likely to fall lamentably short of the demand. Whooping cough, probably at present the most damaging of all the acute specific infections of childhood, not excepting measles, at least merits trial upon an adequate scale of prophylactic vaccines used with such success by Madsen in Denmark.

Although the failure of isolation of the endemic infections as a communal measure has to be admitted, it is hardly in question that in special circumstances and in individual instances the removal and isolation of a known source of infection is a necessary procedure. Nobody would propose that a case of enteric fever, scarlet fever or diphtheria occurring above a milk shop should remain to be nursed at home. A case of scarlet fever or diphtheria occurring in a residential children's institution must almost inevitably be removed to hospital. Needless to add, this step should be followed by the appropriate measures available for the discovery of other potential sources of infection and for the detection and protection of the remaining susceptible inmates. There are many environmental circumstances which make institutional isolation necessary. Added to them are the social and economic difficulties so often created by the occurrence of a case of infectious disease in the home.

Isolation of the Suspected Case

Its limitations admitted, the isolation hospital, from the point of view of preventive medicine alone, justifies its existence as part of the equipment of the sanitary authority and is likely to do so indefinitely. But this is not to agree that the available accommodation of the isolation hospital is always used to the best possible advantage. Numbers of patients are admitted without sufficient justification from the standpoint of either preventive or curative medicine.

The isolation hospital is unique among hospitals for the reception of acute diseases in that it admits to its wards a large proportion of cases sent directly by the general practitioner. There is no intervening casualty or out-patient department. A receiving room there may be, but this is in the nature of a distributing centre for the wards. Cases examined in the receiving room, even if the notified diagnosis be patently incorrect, are always admitted to one or other of the isolation wards for observation.

Unless it were possible for each notified case to be seen at home in consultation with the practitioner it is difficult to see how the present method is to be avoided. That the practitioner acts for the best in difficult circumstances and in good faith is not for a moment questioned. Nevertheless, there does result the needless isolation of large numbers of adults and children, and, at times, undue pressure upon the available accommodation. This is especially the case in diphtheria. In 1929, there were admitted to the Birmingham City Hospitals, 2,099 cases with a diagnosis of diphtheria; 706 (33 per cent.) presented no evidence of clinical diphtheria upon admission to hospital. In 1930, 2,162 cases were similarly admitted, of which 744 (34.4 per cent.) showed no evidence of clinical diphtheria. Fully 50 per cent. of these revised cases had been sent

in purely as a result of a report upon a swabbing. A considerable proportion of them proved to be Schick-negative or immune to diphtheria on admission. In the great majority the swabbing when repeated was negative or the organisms present were shown to be avirulent. Investigation of these cases—with the Schick test and with virulence tests—occupies on the average ten days, at the end of which period the patients are discharged. Meanwhile valuable beds are occupied, and the patients, especially the adults, suffer considerable social and economic inconvenience. The value of the swab in the diagnosis of diphtheria is over-estimated to the same extent as the value of a timely dose of antitoxin *on suspicion* is underestimated.

It is also peculiar to isolation hospitals that, unless a separate convalescent hospital is available, these institutions have to retain their convalescents, not only on the grounds of physical unfitness, but because of the presumed danger of infection in convalescence. That this danger has been greatly overrated in the past is shown by the fact that although the period of detention of cases of scarlet fever is being steadily reduced there is no rise in the return case rate, but rather the contrary; and that those hospitals which discharge their diphtheria cases without the ritual of swabbing similarly cannot be charged with increasing the proportion of return cases.

TREATMENT

Some infections, however good the environment and the means of isolation, it is hardly possible to treat with the maximum chances of success elsewhere than in an institution. In the case of other infections like rubella and chickenpox, poorness of circumstances and even lack of treatment altogether cannot be said to make much difference to the ultimate result. Morbidity in these conditions is trifling and mortality nil. It is hardly in dispute that any case of clinical diphtheria, as distinct from a transient carrier state, unless of the very mildest, is better treated in hospital if there is not ample provision of skilled nursing in the home. Scarlet fever provides matter for controversy. In spite of a very high isolation rate the disease is as prevalent as ever. Is it necessary to remove to hospital for the purpose of treatment the high proportion of notified cases which at present, in some places at least, is so removed? Could not many of these cases be as well treated at home, especially now that the disease is so mild and that a specific antitoxic therapy is available which is capable of simplifying the management of the case considerably? Could not many of the beds now occupied by cases of scarlet fever be better utilized for the reception of other infections of more serious import?

Strictly from the point of view of the possibility of treatment, many would agree that this is so, but there are two other factors which have to be taken into consideration. First, the public, in many towns at least, expects a case of scarlet fever to be removed to hospital; it always has been so removed. Secondly, the necessity of attendance upon cases of scarlet fever must frequently prove an embarrassment to the practitioner who has a large midwifery practice. Hence, however feasible theoretical reasons may be, practical factors may combine to make attainment a matter of great difficulty. It is largely a question of re-educating a public which at one time was forcibly impressed with the necessity of the hospitalization of scarlet fever, then a severe disease. In a contrary sense the same holds good for measles and whooping cough. Here, the public needs to be impressed with the gravity of these diseases, and with the fact that for the adequate treatment of many cases removal to hospital is essential.

Modern Methods

In the old days treatment of the fevers was wholly expectant. The introduction of diphtheria antitoxin in 1895 was the first nail in the coffin of the expectant treatment of the acute specific infections. Treatment, in addition to becoming more rational, has in many cases become more complex, and necessitates a specially trained medical and nursing staff and a hospital adequately equipped for its task. Team work is as essential in a fever hospital as in any other. To take one example. Recent work has shown that the treatment of severe toxic diphtheria, if the best results are to be obtained, necessitates not only an adequate dose of antitoxin, absolute rest, and skilled nursing, but repeated estimations of the blood sugar. The administration of dextrose and insulin is based upon these estimations; and, in order accurately to gauge the condition of the muscular and conductive tissues of the heart, serial electrocardiograms are necessary. For this work the co-operation of three medical officers is required. By these measures the case mortality of the worst examples of toxic diphtheria, when compared with an adequate series of controls, has shown in the Birmingham City Hospital a reduction of nearly 13 per cent.

The modern treatment of some at least of the acute specific infections necessitates an equipment and a technique as complete as that required in the treatment of diseases other than the fevers. The hospital entrusted with the care of the infectious sick should attain, and in many cases does attain, to a standard no whit inferior in any respect to that of a good general hospital. Where this standard is unattainable by reason of smallness of size or meagreness of staffing, the solution lies, of course, either in the abolition of very small hospitals and the erection of large centralized hospitals served by motor transport, or in the provision for the reception of infectious cases in a block of the local general hospital. Both these measures are in fact in process of adoption.

TEACHING

The admission as a general procedure of cases of infectious disease to blocks attached to general and children's hospitals, although a common arrangement on the Continent and in America, is unusual in this country. In large cities, at least, the high hospitalization rate of cases of infectious disease would make such an arrangement, except as a partial measure, impracticable.

As a result of the advice originally tendered by Murchison, practically all general and children's hospitals possess isolation blocks, but these are in the nature of emergency accommodation. Most of these institutions continue to admit the enteric group of infections and the acute infectious diseases of the nervous system. These diseases are commonly treated in the ordinary medical wards. It is on the whole correct to say that the vast majority of cases of the common fevers, if treated in hospital at all, are treated in isolation hospitals. The consequence is that these institutions have a virtual monopoly of the material necessary for the clinical teaching of fevers. Unless adequate use is made of this material it is bad for medicine, preventive and curative. With one exception, the historic London Fever Hospital, which remains, as it began, a voluntary institution with an honorary as well as a resident staff, the fever hospitals in this country are controlled by public health authorities and staffed by medical officers in the service of those authorities. The large institutions have a medical superintendent and several assistant medical officers; the smaller have resident medical officers who may also have other public health duties; the smallest may be in charge of the local medical officer of health and may have no resident medical officer at all.

During the last few years several of the large fever hospitals have appointed stipendiary specialist visiting staffs—for example, otologists. Some also have appointed consulting general surgeons and physicians for occasional operative or consultative work. Generally speaking, the whole of the clinical material is under the care of resident medical officers. After a longer or shorter stay most of these medical officers pass on either to some other branch of the public health service or to general practice. Their numbers are, relative to the whole profession, infinitesimal. Except for this small number of practitioners with special post-graduate hospital experience of fevers, such clinical knowledge of the common fevers, which form such an important part of preventive and curative medicine, as the recently qualified practitioner obtains, he obtains almost wholly as the result of a breathless series of visits, quite inadequate in number, to the wards of a fever hospital. These visits are sandwiched in with some difficulty between half a dozen special subjects in the final year.

Inadequacy of Instruction

Even upon the score of making the most economical use of the available beds by a reduction in the percentage of cases unnecessarily admitted, it is essential that the young practitioner should receive more adequate instruction in the diagnosis of fevers than is at present possible. By some means, the wealth of clinical material in the large fever hospitals should be made available for thorough undergraduate and post-graduate study. The isolation hospital should not be separated from the general stream of medicine. It is bad for medicine and for its practitioners, whether within or without the walls of the institution. In provincial university cities, the medical superintendent of the fever hospital also holds, as a rule, a clinical lectureship on fevers in the university, and it is he who gives such clinical instruction in the wards as present circumstances permit. Why should not the medical student clerk in the wards of the fever hospital, if only for a brief period? Why also should not the young general physician attached to a children's or general hospital be also attached for a term to the staff of a fever hospital and take part in its work and teaching? Administrative difficulties there might be, but difficulties exist to be overcome. There is little doubt that with sufficient breadth of view on both sides smooth working could be secured. Of the advantages to medicine, if these suggestions became accomplished facts, there is no doubt whatever. The end justifies the means.

RESEARCH

The fact that the isolation hospital has a virtual monopoly of clinical material imposes upon it not only the duty of dissemination in the most effective manner of the knowledge already gained of fevers, but also the duty of advancing knowledge. The study of the fevers of temperate climates is passing, as did the study of tropical fevers under the stimulus of Manson, from the stage of clinical description and empirical treatment to that of the scientific investigation of cause and mechanism, with the resultant provision of rational preventive and therapeutic measures. The war provided a powerful lever no doubt, but the work of Schick, published, as a matter of fact, in the year preceding the outbreak of war, was the first series of notable advances in immunology.

Paucity of Research in England

What have been the contributions of the fever hospitals of this country to all the recent advances which have been made? To original research, the contributions have been small indeed. The contributions of the fever hospitals to the advancement of knowledge of the diseases

with which they are particularly concerned have been in the nature of repetitive work. The repetition, however necessary and however meticulously and laboriously carried out, of work originated by others with means provided by others is not research; it is merely a checking of the research of others. Here and there an exceptionally able and industrious medical officer has under great difficulties achieved a piece of original investigation. But for the rest, the work, again, it is true, carried out under great difficulties and sandwiched between routine duties, has been repetitive. Save that provided by the occasional thesis, usually stillborn, there is no stimulus to research in the fever hospital, no official recognition of such a thing being possible, and, with few exceptions, no sufficient equipment available. A perusal of the Continental and American literature of the acute infections is from our point of view depressing. The output of original investigation, scientific and clinical, of foreign institutions to which infectious diseases are admitted is continuous, and much of it of the highest standard. Owing to the high hospitalization rate of fevers in this country, the clinical material is relatively more abundant here than elsewhere.

Possible Lines of Research

The contributions which the fever hospital might make to the advance of knowledge are not only direct but collateral. Children form the majority of its patients—children, too, who except for the acute infection from which they are for the time being suffering are essentially healthy. The reaction of the hitherto healthy organism to infection can be studied in the child unaffected by other pathological factors which so frequently exist in the adult.

There is little doubt about the importance of the contribution which the fever hospital might make, for example, to the study of the earliest phases of rheumatism. Among the cases sent in with a diagnosis of diphtheria, many are suffering, not from an infection with diphtheria bacillus, but from tonsillitis due to other organisms. This initial tonsillitis is followed, not infrequently, by rheumatic manifestations—possibly the first manifestations in a young child. The fever hospital is practically the only institution in which cases of tonsillitis come under observation as in-patients.

Need of Organized Research

If the views put forward above are accepted, definite provision of personnel and equipment must be made for organized research, preferably in close association with the university and medical school in order that there may not be unnecessary overlapping. Among the existing young medical officers in the fever hospitals' service are to be found those who possess the necessary bent and mental make-up for research. They only need encouragement and opportunity to produce good work. They cannot give of their best if they are swamped with routine duties. Such medical officers, duly approved by some independent board or committee, should be set free to do a definite piece of original investigation in the hospital to which they are attached. To their number might with advantage be added, from time to time, investigators from outside—able young men and women who might be attached for a definite term to carry out a definite piece of work. Alternatively, those who apply for existing research fellowships might consider the field, so far practically untitled, which the hospitals for infectious diseases present.

These institutions cannot be said so far to play the part they should and could play in advancing preventive and curative medicine. The personnel and the material exist; ways and means have largely to be created.