direction is in the long axis of the stomach. They are most numerous on the posterior wall near the greater curvature and towards the proximal end of the stomach. The depth of the depressions between the rugae, and therefore their thickness, vary according to the degree of distension to which the stomach is subjected.

With the patient lying in the left lateral position the stomach is "J"-shaped, and the lesser curve makes almost a straight line until the antrum is reached. Thus the latter can be inspected with the instrument lying practically straight in the stomach. However, if the stomach is looked at from above in this position it is not in one plane, but the pyloric end turns slightly backwards. Moreover, the opening of the pylorus is not situated exactly at the end of the "J," but is placed a little towards its anterior and upper wall. During the examination air has constantly to be blown into the stomach, in order to keep its walls under tension. Excess of air is to be avoided, although there is little danger of damaging the stomach in any way, even if an ulcer be present, because the air can escape so easily, either into the duodenum or through the cardia alongside the gastroscope. It is essential not to distend the stomach too greatly for the patient's comfort, for it might cause him considerable distress, both mentally and physically, should he involuntarily belch up a lot of wind when the examination is in progress. The distension should be sufficient to hold the walls of the stomach away from the end of the gastroscope and to blow away any "bubbles" that may interfere with vision. The duration of the examination itself should not exceed five to six minutes, which is long enough for the average patient, although on many occasions examination has been prolonged for a quarter of an hour or so. The patient complains of no other discomfort than of having some soreness of the throat on the day following the examination.

Indications for Gastroscopy

Gastroscopy is unquestionably a very useful addition to our methods of investigating cases of gastric disorder. Whether it will become a routine method, as cystoscopy has in diseases of the urinary tract, is a matter that will be decided in years to come. It must be remembered that modern gastroscopy is in its infancy, for it is only four years since the Wolf-Schindler instrument, which has made gastroscopy a practical procedure, was invented. It can never replace radiological examination, which must be made first, in order that all contraindications to gastroscopy may be excluded. Its present indications may be summarized thus:

1. Cases in which there is reason to suspect a lesion in the stomach despite negative radiographs—for example, chronic gastritis.
2. Cases in which the *x*-ray examination shows evidence of a lesion affecting the stomach, but does not give sufficient information for a definite diagnosis to be made—for example, persistent spasm, deformity as the result of an extragastric lesion, gastro-jejunitis following gastro-enterostomy.
3. Cases of chronic ulcer of the stomach in which doubt exists as to whether or not the ulcer is malignant.
4. To confirm the *x*-ray diagnosis in rare conditions—for example, simple tumour of the stomach, polyposis ventriculi.

In addition to these absolute indications gastroscopy is of very considerable value in checking the results of medical treatment of chronic gastric ulcer. It provides the most reliable criterion of the healing of an ulcer.

I wish to disclaim any originality in the technique described, which is in the main an imitation of that described by Schindler and practised and taught by Henning at Leipzig.

LATENT ADOLESCENT PULMONARY TUBERCULOSIS

BY

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This investigation is the fifth of a series^{1 2 3 4} from the Brompton Hospital Research Department on the pathogenesis of pulmonary tuberculosis.*

The relatively large number of young adults who are admitted for treatment in our tuberculosis institutions with already extensive disease causes grave concern. It is a common experience that in a considerable proportion of these cases the symptoms of ill-health that lead them to seek medical advice are slight in proportion to the lung lesions present. Further, these symptoms are mainly of comparatively recent appearance.

In short, too many patients do not seek treatment until their disease is well entrenched. This undoubted fact is the reason why our tuberculosis service spends most of its energies, time, and money in endeavouring to patch up hopelessly damaged individuals by preventing the further activity and inroad of the disease. This is attempted either by making use of the natural means of healing promoted by prolonged rest, or inducing some form of mechanical collapse which, though of great life-saving value, must be regarded as a drastic method of treatment—a last resort made necessary by the gravity of the situation. Nor are the results really good. The treated patients can seldom take up again an *absolutely* normal life in the healthy community. Many do so, or appear to do so, for a time, but it is usually at the price of self-denial and restraint on their part and trouble and expense on the part of their friends, relations, or public assistance bodies. Financial circumstances force most of our working-class patients to try to make this desperate attempt, and they do it at great risk: in fact, one might say that they risk their lives to get their living. Over one and all of them hangs the shadow of that sword of Damocles—relapse. The cause of this state of affairs is that pulmonary tuberculosis is, during long periods of its activity, often a symptomless disease. This is well known to most observers, and lately actual statistical proof of it has been published.⁵

Latent Lesions

Another observation has been made by one of us—namely, that in taking detailed histories of recently diagnosed adult cases there is often a suggestion of a definite period of ill-health in adolescence which might, in the light of their present state, be ascribed to active pulmonary tuberculosis, but which had not been recognized as such. As examples may be mentioned pleurisy, atypical pneumonia or bronchitis, anaemia, and nervous breakdown for no known cause.

The combination of these two observations led to the formation of a nebulous hypothesis that perhaps the extensive lesions of adult disease are really in many cases deposited during adolescence with the accompaniment of slight or, at any rate, unexplained constitutional disturbance: that these lesions are carried unrecognized, perhaps extending slowly and without symptoms, until they make their presence known in adult life, either by reason of

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their spread past a definite point or because some environmental cause has allowed of their reactivation.

Lines of the Investigation

The testing of this hypothesis seemed at first sight a simple matter. If it were true, the radiological examination of a sufficiently large unselected sample of the adolescent working-class population in normal health should reveal a proportion of cases with definite lesions. Further, the incidence of these lesion-carriers should closely approximate to the incidence of clinically manifest tuberculosis in the adult working-class population between the ages of 21 and 40.

This method of solution was not found so simple in practice. It was realized that volunteers could not be obtained in sufficient numbers if they were asked to come to any hospital radiological department for examination; therefore the *x*-ray apparatus would have to be taken to the volunteers. This necessitated the use of a portable apparatus, a great but inevitable disadvantage. However, a Watson's "Sunic Junior" apparatus was obtained, and experiments were made with it. It was found that, although the films were perhaps not good enough for delicate diagnostic work, yet they did show quite clearly definite lesions of the type that we were searching for. It was judged, therefore, that the apparatus was adequate for our purpose, for it was obvious that in this investigation we should not concern ourselves with primary foci, nor with slight shadows of doubtful significance, but only with definite lesions of the adult type.

Our next problem was the source of volunteers. With the helpful co-operation of the Surrey County Council, through the good offices of Dr. Ferguson, County Medical Officer of Health, we were allowed to approach the scholars in all the county secondary schools, and from these a very good response was obtained. In this way 1,350 cases of both sexes between the ages of 14 and 18 years were examined. It was felt, however, that these individuals were not a true unselected sample of their class, being indeed rather picked adolescents whose environment was better than that of their less fortunate brothers and sisters who had had to start earning their living at the age of 14.

We therefore approached several employers of adolescent labour and, after many rebuffs, through the kindness of Messrs. Gale and Polden of Aldershot, the John Lewis Partnership, The United Dairies Ltd., Messrs. Rowntree and Co., Messrs. John Heathcote and Co., and the Mary Ward Boys' Club, we were allowed to approach their employees and members, and to examine them during working hours at the factories and shops. In this way 1,031 more cases were obtained, making a total of 2,381 cases of the adolescent, urban, and semi-urban working-class population between the ages of 14 and 21, and we felt that this number was large enough to give us the answer to our question.

Interpretation of Findings

Our difficulties were not yet over. We had made no selection of our material at all. These adolescents were, so far as we knew, in normal health—that is to say, they were on full working or school hours. Radiological examination was our sole test. But when confronted with the *x*-ray film of any individual's lungs without any knowledge of his clinical condition, if any abnormal shadows are seen, it is only possible to say that these shadows have been thrown by lesions and that these lesions may be due to certain various pathological causes; it is not possible to say that they have been thrown by some particular pathological lesion.

At the same time we both have a wide experience of the *x*-ray appearance of the lungs in health and in disease, and we are well acquainted with the *x*-ray appearances of tuberculous lungs, and are both agreed that tuberculosis is by far the commonest cause of distinct and lasting *x*-ray changes in the lung field. In examining this series, then, we have taken as "positives" those films in which there were *unmistakably abnormal shadows, indicating very definite pathological changes in the lung parenchyma, having the appearance which was compatible with, and usually associated with, tuberculous lesions of the adult type.* We definitely stress the words "adult type," for these were the lesions we were searching for; all evidence of primary foci of infection (the Ghon focus), with the corresponding calcified tracheo-bronchial glands, though numerous, was ignored.

We frankly admit that this is a weak link in our investigation from the scientific point of view, but time, money, and other practical factors made further examination of these adolescents impossible. Although we know that the abnormalities in almost any chest film of a tuberculous case could be explained as being due to other pathological causes, yet we feel that our colleagues will agree that, as we kept very strictly to our standard set forth above, and discarded as negative those films in which we believed that the abnormalities might more easily be ascribed to causes other than tuberculosis, our results may be taken as approximately correct.

Results

In the 2,381 films there were fifteen (0.65 per cent.) positives. In addition, there were eighteen abnormal films, and ten of these showed shadows probably due to tuberculous lesions. We therefore found a definite incidence of 0.65 per cent., and a possible incidence of 1.08 per cent.

Similar investigations based on the *x*-ray evidence of unsuspected pulmonary tuberculosis in groups of young adults have been undertaken by workers in other countries. In the United States latent lesions of an adult type among university students were found in 3.9 per cent. of cases by H. Hetherington, F. McPhedran, and others,⁶ in 1.8 per cent. by W. B. Soper and J. Wilson,⁷ and in 1.5 per cent. by R. H. Steihm.⁸ Among school children between the ages of 15 and 19 years, positive reactors to intradermal tuberculin tests (83 per cent. of the children) showed 1.6 per cent. with radiological evidence of an adult type of lesion.⁹ Of young applicants for employment in a firm in New York 1 per cent. were found to have evidence of definite tuberculous lesions when radiographed.¹⁰

In Germany and Spain the figures show 2 per cent. of university students at Munich (Kattentidt),¹¹ and 4 to 5 per cent. of students in Barcelona (Sayé).¹² In China, among the professional classes, G. Hall and C. Chang found definite *x*-ray evidence of pulmonary tuberculosis with no clinical evidence of the disease in as many as 17.9 per cent. of young adults.¹³ Apart from the experience in China, which is obviously not reflected in Western nations, these observers have found a much higher incidence of latent lesions than we have. We feel we are justified, therefore, in considering that our figures do not over-estimate the situation.

Deductions

How do these results affect the hypothesis? Because of the inherent weakness of the method of investigation which we have mentioned, the results cannot be allowed either to give a clear answer to our question or to turn the hypothesis into an accredited theory, but, if fairly

and carefully examined, they do put the hypothesis on a much firmer footing, very much firmer if weight be given to the figures from other countries. The actual incidence of clinical pulmonary tuberculosis in our working-class population is unknown. Dr. Lissant Cox has calculated it to be about 0.4 per cent.,¹⁴ Dr. Drolet of New York puts the figure at 0.75 per cent. for all adult males and 0.5 per cent. for young adult females.¹⁵ These figures are guesswork, but at present are all we have as a guide to direct our calculations.

For ease of calculation, and to test our hypothesis more severely, let us take these estimated figures as minimal and assume that the incidence is even higher. Now the lesions of these cases of adult clinical tuberculosis must be either recently deposited or else exacerbations of older lesions. Our investigation shows that between 0.5 and 1 per cent. of the adolescent working-class population carry tuberculous lesions demonstrable by x rays, and in all probability they contain living tubercle bacilli.

What happens to these lesions and to their hosts? Are we to suppose that the lesions remain latent for ever or disappear? Our experience of their behaviour in diagnosed cases of clinical disease does not support such a contention. We know that such lesions are always liable to spread and to intensify; they usually do so, even though they remain stationary and symptomless for long periods at a time.

These working-class adolescents are often subjected to great and prolonged physiological strain. During that period when the normal animal is using all its energies for proper development into the adult state they have to work, work hard, and often work continuously, in conditions of bad atmospheric pollution and debarred from the normal amount of sunlight. Their natural desire for the recreations and frivolities of youth tempts them to steal for these many of the few remaining hours out of the twenty-four that should be given to rest. Many of them experience definite privation, lack of proper food, and anxiety.

These are well-known aetiological factors in the pathogenesis of pulmonary tuberculosis, encouraging and precipitating the activity of latent lesions. It is inevitable, therefore, that a very definite proportion of these adolescents with their latent lesions will sooner or later exhibit clinical disease, and we must note that the incidence of these latent lesions among adolescents approximates closely to the estimated incidence of clinical disease among adults. It is impossible to say what proportion of the adult cases of clinical disease are due to recently deposited disease or to the spread of latent lesions, but since in the age group from which they have emerged we know that there was at least an equal incidence of lesion-carriers who will probably develop clinical disease we shall not be unfair if we say that a very definite proportion of these adult clinical cases must be the end-result of latent adolescent disease.

So far our investigations support our hypothesis. They give it sufficient standing to permit of a logical corollary, which is its application to the problem of prevention of tuberculosis. It is recognized that the incidence of infection by the tubercle bacillus in adults and adolescents in civilized communities is very high, irrespective of actual known contact, and that also the incidence of clinical tuberculosis is very low relative to this high incidence of infection; obviously, therefore, it is unprofitable and unnecessary to attack the problem of the prevention of tuberculosis for the whole community along the lines of prevention of infection.

It is universally agreed that the task of preventing activity or relapse in a case with slight lesions and no constitutional disturbance is a trivial one compared with

that of arresting activity and maintaining that arrest when lesions are dense and extensive, and when general resistance has once broken down. Therefore, if the problem were attacked, for the present at any rate, along the lines of detecting if possible that small proportion of the inevitably infected adolescent population who are going to suffer later from clinical disease, the saving of life, personal distress, and public funds that should result must be indisputable.

Practical Implications

The significance and implications of this are tremendous. If these adolescent carriers can be detected it is comparatively easy to handle them so that they shall never develop clinical disease, or so that the development in them of clinical disease shall be postponed until much later in life—every year of postponement making such development less likely. This, if successfully attempted, would imply the reduction of the much-deplored young adult mortality by whatever proportion these adolescent lesion-carriers contribute to the adult clinical cases. It must also reduce the amount spent on the institutional treatment of the working-class population between 21 and 40 years by the same amount.

Why should this not be done? Because we cannot see, should we ignore? The mentally defective, the blind, the orthopaedically crippled, those with cardiac disease, and epileptic adolescents are dealt with, protected, and treated at great expense because their lesions or their incapacity are obvious and can be seen, though it is to be noted that the cause of their incapacity, however great, is not necessarily fatal. How much more important, then, is it to endeavour to protect or treat the tuberculous adolescent who, although he may be momentarily free from incapacity, and although the lesion is not visible to the naked eye, yet is just as surely doomed to a permanent, partial, or complete incapacity, and almost certainly to death!

We may well be asked if we really suggest the introduction of such expensive and far-reaching reforms as our conclusions, based on such slender evidence, imply. To this we would reply that the steadily declining death rate from tuberculosis may be regarded with a certain amount of satisfaction, but the young adult death rate, which is not declining, cannot be so regarded. A declining death rate for all ages, including those over 50 years, is of little communal importance compared with a sustained death rate between the ages of 20 and 35 which is a communal menace. Since this menace is not yielding to our well-meant but apparently misdirected efforts—efforts which are based on the conception of the pathogenesis of pulmonary tuberculosis of thirty years ago—conservatism can have no excuse. The implications of more recent thought and fresh evidence, tenuous though it may be, should be followed, and should warrant a renewed attack on this menace from a fresh angle.

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