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The Bradshaw Lecture

ON

THE DIAGNOSIS AND TREATMENT OF INCIPIENT PULMONARY TUBERCULOSIS.

DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS, LONDON,
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BY

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(Abstract.)

WILLIAM WOOD BRADSHAW, M.D., F.R.C.S., M.R.C.P., in memory of whom this lectureship was established by his widow, was a Member of this College engaged in general practice. It seems appropriate, therefore, that the Bradshaw lecturer should select a subject in which general practitioners are specially interested, and should endeavour to elucidate questions of diagnosis and of treatment in such a manner as shall be helpful to them in their daily work. No subject is more important to the general practitioner than the diagnosis and treatment of incipient pulmonary tuberculosis; no morbid condition more frequently claims his attention; in none is a correct diagnosis and a suitable treatment more necessary for the welfare of the patient and for the reputation of the practitioner. . . .

At this time, when a national effort is being organized, and when large contributions from the national resources are to be furnished in support of this effort, it is highly desirable that the most effective measures and, as far as possible, the least costly should be adopted, so that the greatest possible benefit may be secured, and the funds provided may be most economically administered. This unexpected but most welcome therapeutic opportunity is a call to the medical profession to consider carefully what measures they will recommend. It is ours to direct this campaign. Are we quite clear in our minds as to the precise measures which ought to be employed?

[The lecturer then briefly reviewed the statistical evidence as to the prevalence of tuberculosis, and arrived at the conclusion that about 50,000 deaths from pulmonary tuberculosis occurred every year in the United Kingdom, and 20,000 more from other forms of tuberculosis.]

After pointing out that the pathological, clinical, bacteriological, and experimental work of the last few years had shown that the problem of tuberculosis might be resolved into two separate problems of unequal magnitude arising from the action of two distinct types of the *Bacillus tuberculosis*—the "bovine" and the "human"—he went on to say that the bovine type was found chiefly in tuberculosis of the abdominal organs and of the cervical and bronchial glands, and even in these almost exclusively in early childhood. It appeared, he said, to have very little influence in the production of pulmonary tuberculosis, and as five-sevenths of the total mortality from tuberculosis was due to disease of the lungs, it was quite clear that the complete annihilation of the bovine type of the bacillus would make very little difference to the mortality from phthisis. The crucial point of the struggle against tuberculosis in general was whether it was possible to abolish phthisis. If pulmonary tuberculosis could be annihilated, there would be no spread of infection by means of sputum, and there would be little or no infection of other organs in the patients themselves. For the answer, he said, we

must go far back to the individual case of incipient pulmonary tuberculosis and to the individual medical practitioner who is called upon to diagnose and to treat it. The abolition of pulmonary tuberculosis is possible on two conditions only: first, that every practitioner shall learn how to detect the disease at its first appearance, long before any bacteriological evidence is available; and, secondly, that a method of treatment can be employed by the practitioner, in the patient's own home, which will be simple, harmless, completely effective, and yet inexpensive.]

I. THE DIAGNOSIS OF INCIPIENT PULMONARY TUBERCULOSIS.

At present the great majority of general practitioners do not feel justified in giving a definite diagnosis of incipient pulmonary tuberculosis until the bacillus has been found in the patient's sputum, either by themselves or by some acknowledged bacteriological expert. This is unfortunate, for the disease is often present for weeks or months, and may have spread extensively in the lungs before a positive bacteriological report can be given. A negative bacteriological report may be entirely misleading and, indeed, calamitous in its results, for it may delude the patient and the practitioner into a false sense of security, so that the disease goes on its way unchecked until its manifestations become too plain to be any longer ignored. The fact that no bacilli can be detected in the sputum is no proof whatever that they do not exist in the lungs.

Value of Percussion.

The most recent monographs and articles in the medical journals all, with one consent, in considering the diagnostic evidence of incipient pulmonary tuberculosis, lay stress on auscultation and say very little about percussion. Yet the auscultatory signs may be very slight indeed when the percussion signs are well marked and entirely distinctive. Quite large dull areas may be present in the positions characteristic of a tuberculous infection of the lungs, and yet there may be few or no evidences of local catarrh; there may be nothing abnormal observable by the most careful auscultation, except a defect in the entry of air.

In incipient pulmonary tuberculosis the earliest signs are local areas of dullness with defective air entry as the only constant auscultatory phenomenon, though some catarrhal sounds may possibly be present in addition. The tuberculous invasion is as a rule very slow and insidious, as if the bacillus found great difficulty in establishing itself. For weeks or months the process may continue with very little general indication. Even cough may be entirely absent, no pyrexia may be detected, and loss of weight, malaise, flushing, or occasional night sweats may be the only symptoms.

Sites of Dull Areas and Method of Percussion.

If any practitioner will acquire the habit of carefully and invariably examining the heart and lungs by accurate percussion before using his stethoscope, he will enormously increase his ability to form a correct diagnosis, and will gain invaluable indications for treatment. But at what part of the thorax may the practitioner hope to detect the earliest indications of an incipient pulmonary tuberculosis? He will naturally turn to the "apex" of the lung, and on consulting some of his authorities will be instructed to percuss above the clavicle to detect a disease which such authorities imagine to commence at the extreme summit of the lung and to advance steadily downwards. The progress of the disease has even been divided into "stages" in accordance with the distance downwards from the summit attained by the morbid process, the affection of the lower lobes being often ignored altogether in such classification. Yet it was pointed out more than twenty years ago, in a valuable paper by Sir James Fowler, that *post-mortem* examination of the precise site of the earliest tuberculous process showed that it did not begin in the summit of the lung, but at a spot about an inch and a half below the summit, from which the morbid process may extend backwards and also downwards. Sir James Fowler showed that a second localization in the outer part of the upper lobe at the same horizontal level is also extremely common, and that a third early focus is very frequently present at about an inch and a half below the summit of the lower lobe on each side.

Can we detect these local areas of incipient pulmonary tuberculosis by accurate percussion? If we are to succeed in this attempt it is essential to adopt a correct method of examination. For the investigation of the front of the chest the patient *must lie on his back on a comfortable couch*, and must be completely at his ease and with his muscles relaxed. It is impossible to obtain an accurate result from percussion of the front of the chest while the patient is standing or sitting erect; the habit of physicians to examine such patients in the erect position has been the cause of the delay in the recognition of the true picture of the localization of an early pulmonary tuberculosis. If the patient is in the recumbent position on a comfortable couch which supplies an adequate resistance, and at the same time allows of complete muscular relaxation, it is quite easy by careful percussion to detect dull areas in the first and second intercostal spaces which correspond to the statements made by Sir James Fowler, if it be remembered that a distance of an inch and a half in the collapsed lung of the *post-mortem* room will correspond to a distance of two inches or more in the air-containing lung during life. Of course, it is important to adopt a proper method of percussion. Let the practitioner practise light percussion on the terminal phalanx of a finger of his left hand firmly pressed on the spot to be percussed (the rest of that hand and forearm being kept away from the patient's chest wall). After a little careful practice of this method he will have no difficulty in determining in a case of incipient pulmonary tuberculosis dull areas in the inner and in the outer part of the first intercostal space on each side. The second and the third interspaces must then be examined in the same way, and the remaining parts of the anterior wall of the chest and also the axillary regions. For the posterior aspect of the thorax the patient should be sitting erect with his back to the practitioner; he should place his hands on the anterior aspect of the opposite shoulders, should bend gently forwards and relax his muscles. Careful percussion should then be practised over the inner and the outer parts of the suprascapular fossa on each side, and also over the posterior end of the spine of the scapula and the surrounding region. In a case of incipient pulmonary tuberculosis a dull area will be found in the inner part of the suprascapular fossa, quite close to the first and second dorsal vertebrae (a region normally resonant), which corresponds anteriorly to the dull area in the inner part of the first intercostal space. Similarly, a dull area (smaller in size) will be found in the outer part of the first intercostal space, and a very definite dull area, as large as or even larger than the area first described, will be found in the upper part of the lower lobe at the extremity of the spine of the scapula.

In examining the subclavicular dull areas more carefully, it will be found that they can usually be traced downwards into the second intercostal space, being in this space smaller but nearer together than in the first space. In a severe case the outer part of the second space may be involved, and (more rarely) the dullness may extend under the anterior fold of the axilla into the axillary region. It should also be observed that though at first the dull area in the inner part of the first space extends quite up to the sternum, as the patient improves resonance begins to appear at the sternal edge and may extend from 1 to 2 cm., so that the focus of morbid action is situated at about a fingerbreadth from the sternum.

There are, therefore, six dull areas to be detected in the upper part of the lungs in a case of incipient pulmonary tuberculosis, two in each upper lobe and one in each lower lobe. Over these dull areas the only auscultatory phenomenon in many cases is a defect in the air entry. Even the deepest possible inspiratory effort on the part of the patient produces very little inspiratory sound at these localities, while in the lower part of the lungs the air entry may be much more distinct. On careful auscultation one may sometimes detect a slight crepitant sound with inspiration or with expiration also; it may or may not vanish after the patient has coughed. Occasionally the inspiration will be slightly "wavy" in rhythm; occasionally the expiration will be slightly prolonged. At this stage of the disease there is rarely any increase in the conduction of voice sounds.

The six dull areas above described may all be present

and even of considerable size, while the supraclavicular region, corresponding to the summit of the lung, may be still very fairly resonant, though the clavicle itself may yield a dull note in the positions corresponding to the dull areas below.

These six areas at the four apices are the most important and the most easily detected part of the morbid signs of an incipient pulmonary tuberculosis. They do not represent the complete picture, far from it, as I shall show presently. But they are sufficient for the diagnosis. They are, I believe, invariably present in all cases of early pulmonary tuberculosis, though in a small minority certain areas about the angle of the scapula (of which I shall speak later) may become unusually definite, especially if any pleurisy develops over them.

Diagnostic Value of Typical Dull Areas.

To prove that these typical dull areas are not produced by any other type of disease is obviously more difficult, and requires a much wider range of careful clinical observation. Yet I believe it to be the fact. The condition which may simulate them most nearly is the tendency to lobular collapse of the apices which is not uncommon in feeble children; but this condition rarely, if ever, attains to the typical symmetrical distribution of the six dull areas of pulmonary tuberculosis. An influenzal or pneumococcal bronchopneumonia does not usually affect the apices in this definite and symmetrical fashion, and the distribution of the dull areas caused by pulmonary infarcts is very different.

Extended observation is, of course, necessary to attain to absolute certainty that these six dull areas are not produced by any other infection, but at all events it is quite clear that they justify a very strong suspicion of a tuberculous infection present or past.

It must be carefully noted that the discovery of these six areas does not necessarily prove that the tuberculous infection which has produced them is active at the time when they are discovered. For, though they diminish in size as the patient improves, they do not entirely disappear. It is probable that these old dull areas caused by former tuberculous infection remain during the rest of the patient's life. They are, no doubt, in large part due to local fibrosis—small pulmonary scars. How long they may yet contain living bacilli, which may under favourable circumstances again start a morbid process, it is impossible to say. Certainly for some months after apparent recovery these areas ought to be very carefully watched, for an increase in the size of any of them may explain doubtful clinical symptoms, and may show the necessity for renewed treatment. But after a time they may certainly become completely quiescent.

It is always wise, on the first discovery of the typical areas at the four apices, to consider carefully whether there are any indications of present activity, such as tenderness, pyrexia, cough, haemoptysis, or local crepitant sounds. Whenever any reasonable ground for suspicion of active disease exists, a week or ten days of rest in bed with continuous antiseptic inhalation should be instituted as a precautionary measure. The result will often show that this treatment has been wise, for the active signs will subside, and the dull areas will become definitely smaller.

Progress of Case indicated by Measurement of Dull Areas.

When the practitioner has detected the existence of the six typical dull areas at the four apices in a case of suspected pulmonary tuberculosis, it is most important that he should carefully measure their diameter, and should keep a record of their size at the time of their first discovery, which can be compared with subsequent measurements made at intervals of three or four weeks. I have a large number of such records, and find them easy to make, and of the greatest service in prognosis and in estimating the progress towards recovery. The size can be determined with very considerable accuracy, though not, of course, with mathematical precision. To measure them in inches or centimetres would give a false idea of the amount of exactness possible under the circumstances, and would alarm the patient by the use of tape measures. But the measure by fingerbreadth is made during the routine process of physical examination and without the patient's knowledge. The fingerbreadth

is a measure which is invariable for the same observer; it is (very literally) always at hand, and it admits of quite sufficient clinical accuracy. After a little practice it is possible to estimate the size of a dull area to one-sixth or even one-eighth of a fingerbreadth, approximately equivalent to one-third and one-quarter of a centimetre.

[The lecturer then related eight recent (unpublished) cases. The first six were very early cases, in which an *x*-ray examination was made, so that the results of both methods of examination could be compared. The seventh case showed that a slight relapse, due to excess of exercise, gave evidence of increase in size of some of the dull areas, and that rest and continuance of the antiseptic inhalations rapidly brought about subsidence of this extension. The eighth was a much more chronic case, which had made remarkable improvement under the use of continuous antiseptic inhalation. The practitioner would soon find the advantage to be derived from a careful observation of these six areas and would do well at first to confine his attention to them, but there were many other positions on the chest wall where small dull areas might be detected in an early case.]

Other Dull Areas.

On the anterior wall of the chest a small dull area can be discovered by careful percussion in the third intercostal space on each side, above the nipple or somewhat more internally; and further out in the same space there is on each side a dull area below the anterior fold of the axilla. On the right side, internal to and below the nipple (in the region of the middle lobe of the right lung), there is a very definite dull area, with resonance between it and the border of the right auricle (which normally extends a fingerbreadth outwards into the fourth space, and in these cases of early pulmonary tuberculosis sometimes as much as a fingerbreadth and a half). Nothing corresponding to this area can be detected on the left side, for in this position there is the dullness due to the heart. But on both sides there is a small dull area in the anterior part of the axilla at about the level of the fourth space or fifth rib. Posteriorly there is always a dull area at the angle of the scapula on each side, and another a little externally in the posterior axillary region. When the infection in this region extends to the surface of the lung and sets up a local pleurisy, as is not uncommon, these two areas unite into one, especially if any pleural effusion occurs. If the patient improves and the effusion is absorbed, the dullness diminishes and the two separate areas can again be distinguished. But if the pleural effusion increases, it may produce a large area of dullness with defect of air entry, vocal resonance, and vocal fremitus.

If the horizontal line through these two areas be prolonged towards the spine a third area is met with on each side near, but not close to, the spine. These areas also are very constant. At a slightly higher level there is an interesting difference between the two sides, for on the left side a dull area is found at the posterior edge of the scapula, about two fingerbreaths above the angle, while on the right side the position of the corresponding area is not at the scapular edge, but always nearer to the spinal column in about the sixth space. This is a remarkable and invariable difference, which evidently depends on the different anatomical division of the lungs into three lobes on the right side and two on the left. Furthermore, in the upper part of the back on each side three small separate dull areas can often be detected, and below the angle of the scapula there are also several dull areas detectable in positions which are arranged in a kind of regular pattern.

This remarkable grouping of small dull areas may usually be detected by careful percussion in quite early cases of pulmonary tuberculosis. Their relative positions are practically invariable. From their scattered and symmetrical distribution and from the slight differences between the two lungs which I have described, it seems clear that they must correspond to the ultimate distribution of the bronchial tubes in their most direct course. The dullness and lessened air entry are probably caused by multiple local centres of infection giving rise to local collapse, followed by local bronchopneumonia of a very chronic type, and finally fibrosis.

Of these dull areas the largest are always the six at the apices, as previously described. For the apical region

is the least expanded in ordinary respiration, and in a tuberculous infection of the lung (especially if it at all implicates the pleura) there appears to be a reflex inhibition of respiration, just as the diaphragm movements are checked by even a local peritonitis. In an early stage of pulmonary tuberculosis the fluorescent screen will often show a marked limitation of the inspiratory movement of the diaphragm, sometimes unequally on the two sides. There can, I think, be no doubt that a similar reflex inhibition of the other inspiratory muscles is common in pulmonary tuberculosis. Every physician must have observed how difficult it is to induce such patients to take a long deep breath and thoroughly to expand the chest. This failure of expansion in its turn makes the local conditions more favourable for the development of the tubercle bacillus—another instance of a "vicious circle" in disease. Thus the morbid process develops more rapidly in the apical areas, and these areas are the most prone to soften down into irregular cavities.

Diagnostic Value of X Rays.

[The lecturer then discussed the value of the *x* rays in diagnosis, and pointed out that this method of examination might reveal changes about the root of the lungs, opaque areas and radiating lines due in all probability to chronic morbid changes in root glands, and to peribronchial and perivascular fibrous thickening. These chronic changes might possibly in any case be very old, absolutely quiescent, and might form no part of the really active morbid process.

Very great care was required in the interpretation of the radiographic picture. It showed much which was probably of little present importance, it showed less distinctly the earliest indications of active mischief, which might be more distinctly detected by careful percussion, and it confused the localization. A practitioner who did not feel able to rely on his own percussion would do well to obtain an *x*-ray picture, taken and interpreted by an expert. But a practitioner who had learnt to trust his own percussion did not need radiography to enable him to arrive at a sound conclusion. Dr. Lees continued.]

Pathological Process.

It is clear from the percussion results already stated in this lecture, and from the *x*-ray findings which confirm them, that an incipient pulmonary tuberculosis consists in the carriage of tubercle bacilli, almost certainly by inhalation, to the finest bronchial tubes and alveoli in areas scattered freely over the lungs, followed by morbid changes which advance more rapidly in the upper part of both upper and lower lobes. From these infected areas the morbid process advances along the lymphatic sheaths of the bronchial tubes and of the blood vessels till it reaches the glands—pulmonary, bronchial, and tracheal. It seems to be possible in young children for the bacilli to make their way to these glands without any apparent implication of the pulmonary tissue. Probably this is due to the greater freedom and activity of the lymphatic circulation in early childhood.

An examination of the *post-mortem* records of the Hospital for Sick Children, Great Ormond Street, shows that in the majority of children dying from tuberculosis the chief seat of the infection is in the bronchial and tracheal glands and in the lungs. This infection is often extremely virulent, the glands being greatly enlarged, caseous, and often breaking down; frequently they involve the pulmonary tissue by contiguity or by rupture into a bronchus. (The lower lobe of the right lung is specially prone to suffer in this way.) An acute miliary tuberculosis of the lungs is a frequent result. When the process is more chronic an implication of the apices of the lungs, resembling that found in adults, may occur, and even in very young subjects cavities are not rare. In this group of cases the implication of the cervical glands is usually much less marked, while the mesenteric glands are often normal. In a smaller number of cases the implication of the bronchial and tracheal glands and of the lungs may be very slight or even absent, while the cervical glands, and still more frequently the mesenteric glands, are caseous. But even these may be but little affected while the peritoneum is crowded with tubercles, as if the bacilli made their way through the intestinal wall, leaving little or no trace of their passage, just as happens in the lungs.

The first group of cases are almost certainly due to inhalation of bacilli of the "human type," while in the second group the infection appears to enter by the alimentary canal. Probably these are often due to the "bovine" bacillus.

In adults the local chronic tuberculous changes in the lungs are much more commonly observed than in children, and the implication of the glands is much less marked and much less virulent. Also the spread of tuberculosis along the lymphatic sheaths of the blood vessels until the cerebral meninges are attacked is much less common in adults than in children. But both in children and in adults the disease begins, not at the root of the lung, but in the finest bronchial tubes and in the alveoli, in scattered areas which show a characteristic localization.

To sum up this discussion, I would claim that the first of my two questions may now be answered in the affirmative. It is possible for any general practitioner of medicine, by the adoption of a correct method of examination and the exercise of a little care and patience, accurately to diagnose the existence of an incipient pulmonary tuberculosis long before any bacteriological evidence can be obtained. It is not necessary for him to wait for a positive bacteriological report, and he will be foolish indeed if he allows a negative report to shake a diagnosis which is founded on an accurate physical examination. The possibility of a correct diagnosis is, in more senses than one, in his own hands.

II. THE TREATMENT OF INCIPIENT PULMONARY TUBERCULOSIS.

It is quite certain that sanatoriums have been extremely useful, and that by their help many patients have been restored to health. Yet it must also be sorrowfully confessed that many patients who have lived in a sanatorium for six months, at a very considerable cost, are still not completely cured, and that numerous instances of subsequent relapse occur, so that in the minds of many practitioners there is a growing scepticism as to the curative value of sanatoriums. And when we consider the matter carefully we see that, though the treatment by absolute rest, abundance of fresh air, and abundance of nutriment places the patient under the most favourable circumstances for fighting his battle with the invading bacilli, it does not include any organized attack on the bacilli themselves. It is the consciousness of this that has led many to desire to make trial of tuberculin. But is there no simpler and less dangerous method of direct attack? Is it quite certain that ordinary antiseptic drugs are of no value in the treatment of pulmonary tuberculosis? On the contrary, it is quite certain that some cases have markedly improved under the use of large doses of creosote. Of late the value of injections of a preparation of which iodine appears to be the active agent, has been prominently advocated in France. And a letter in the BRITISH MEDICAL JOURNAL from a practitioner who had been using tuberculin and whose supply was exhausted related that he had substituted injections of carbolic acid and had obtained better results. But creosote by the mouth is apt to cause much disturbance of the organs of digestion, while hypodermic injections are apt to be painful, and require the most scrupulous precautions against sepsis.

Treatment by Continuous Inhalation of Antiseptic Vapours.

Why not administer these antiseptic drugs by a method of inhalation? If a patient inhales a combination of antiseptic vapours persistently, day and night (except when actually taking food), by the principle of diffusion of gases the antiseptics must make their way into the pulmonary alveoli, if the inhaler be worn for a sufficient length of time. This is surely indisputable. And if antiseptic drugs like creosote, carbolic acid, and iodine are dissolved in alcohol, ether, and chloroform, there must be a gradual absorption of these anaesthetic agents into the blood, for this is an ACE mixture, and we know that if used in greater strength it would prove the absorption by producing general anaesthesia. The slow absorption of these agents in a very dilute condition must carry with them into the blood the antiseptics dissolved in them. How these may be transformed in the blood it is for physiological chemistry to determine, but it seems likely that

some antiseptic influences will thus be carried by the blood stream to the tuberculous foci, which will then be attacked both from without the lungs and from within.

Certain other properties of this combination of drugs deserve attention. First with regard to the alcohol, we have learnt from the remarkable observations of Professor Collingwood and Dr. W. H. Willcox how much the stimulating and tonic effect of oxygen given by inhalation is increased by passing the oxygen through absolute alcohol. Dr. Willcox has calculated the amount of alcohol absorbed, and finds it to be very small; yet it exercises a most remarkable influence, as has subsequently been proved by administering oxygen bubbled through alcohol in cases of cardiac failure. The effect of the continuous inhalation of an antiseptic mixture in which alcohol is the solvent must therefore be a tonic and stimulating influence constantly at work. Another constituent of the mixture—ether—will act similarly, and perhaps more strongly. Lastly, chloroform has a local sedative influence, and strongly tends to diminish cough. I therefore recommend, and have constantly employed, the following formula for a solution to be used for continuous antiseptic inhalation:

R. Creosoti	...	...	...	...	3ii
Acidi carbolic	...	...	...	...	3ii
Tinct. iodi	...	...	...	...	3i
Sp. aetheris	...	...	...	...	3i
Sp. chlorof.	...	...	...	...	3ii

Menthol and formalin appear to me too irritating, and unsuitable for continuous inhalation.

The results of treatment which claims to be "scientific" must be tested not simply by the assertion of the patient that he is "better" (have we not all heard of the *spes phthisica*?), but by diminution of pyrexia, of cough, and of sputum, by increase in weight, and by careful observation and record of the physical signs.

[The lecturer then presented in a table (not here reproduced) the results obtained in 70 cases treated with the formula above stated, which had been already published in the medical journals.* The most recent of the cases had ceased treatment a week ago. The condition of each case in October, 1912, with very few exceptions, had been ascertained by letters directed to the patient or to the medical man who sent him. The answers had been pleasant reading, for they had shown the most satisfactory results in nearly all cases, and they had been full of gratitude. Out of the 70 cases there were:

Complete recoveries	...	...	...	48
Probably complete recoveries	...	...	...	3
Cases incompletely cured	...	...	...	10
Final result not known	...	...	...	2
Died	...	...	...	7
Total	...	...	...	70

Of the 10 incompletely cured, 9 had improved remarkably; 1 had deteriorated. Of the 7 deaths, 1 was due to apoplexy after recovery from the lung disease, 1 was hopeless when first seen, 2 abandoned treatment, 1 died from haemoptysis, 1 from abdominal tuberculosis, and 1 from tuberculous meningitis.

In 19 of the cases in this series a bacteriological examination of the sputum was made. The results were as follows:

	Cases.	Recovered.	Chronic.	Died.
No tubercle bacilli present	8	8	—	—
Tubercle bacilli found in 10: Small or moderate number	6	4	2	—
Many	4	3	—	1
Totals	18	15	2	1

The rapid gain in weight was worthy of notice. The gain in the first three weeks of treatment in 33 cases showed an average of 3.8 lb., the total gain in weight in 59 cases an average of 12.4 lb. In every one of the 70 cases both lungs were found to be affected, but in

* Cases 1 to 30 in the BRITISH MEDICAL JOURNAL, December 11th and 18th, 1909; Cases 31 to 50 in the *Lancet*, November 19th, 1910; Cases 51 to 70 in the BRITISH MEDICAL JOURNAL, April 6th, 1912.

almost all one lung was more affected than the other, though the difference was usually slight. In 2 cases only were the right and left lungs about equally affected. In 44 cases the right lung was more affected than the left; in 24 cases the left lung was more affected than the right. Thus in this list of 70 cases the right lung was chiefly attacked nearly twice as often as the left.

The lecturer said that the idea of administering antiseptic drugs by the air passages in cases of phthisis suggested itself to physicians thirty years ago. He referred to the use of the method by the late Sir William Roberts and the late Dr. Coghill and to the simple inhaler of perforated zinc designed by Dr. Burney Yeo in 1881.* Dr. Wilson Fox in 1885 had recommended the use of antiseptic inhalations, Dr. Beverley Robinson of New York had followed the recommendations of Dr. Yeo and had published evidence of the value of the method in phthisis and especially in laryngeal tuberculosis. Dr. Muthu had also used solutions of menthol and formaldehyde, employing them for six or eight hours daily. Dr. Garry of Cairo had also published good results, and the late Dr. Huggard of Davos had, ten or twelve years ago, used inhalations day and night continuously with success.

The lecturer then continued as follows:]

Method of Inhalation Treatment.

For the last seven years I have treated all my cases of pulmonary tuberculosis (except some seen in consultation at a very advanced stage) by the method of continuous antiseptic inhalation, by means of a Yeo's inhaler, and the antiseptic solution of which the formula is stated above. In adopting this plan of treatment it seemed to me that certain conditions were necessary if the greatest possible amount of benefit was to be obtained.

1. The inhalation must be continuous, the inhaler being worn all day and all night, except at meal-times.

2. At the beginning of the treatment a period of rest in bed is essential. The importance of this in the treatment of tuberculosis is well understood in sanatoriums. In addition the compulsory rest directs the patient's attention to the necessity for careful and thorough use of the method.

3. Digestive disturbances, anorexia, and diarrhoea or constipation must be treated by appropriate drugs.

4. The patient must be supplied with a sufficiency of easily digested food. Malted milk dissolved in (scalded) milk given at the end of each of the four meals has proved invaluable for this purpose.

5. Careful disinfection of the mouth with equal parts of Sanitas fluid and water four times daily, after the milk, has been always ordered. As soon as the patient has begun to make definite progress carious teeth should be stopped or removed. Antiseptic sprays may be used for unhealthy conditions of the fauces, and a spray of cocaine, eucalyptus, and parolein to relieve any nasal obstruction.

6. Smoking must be absolutely forbidden.

These are the principles on which the 70 published cases were all treated.

I advise, therefore, that whenever a practitioner has reason to suspect that a patient is infected with incipient pulmonary tuberculosis, and has by careful percussion detected the presence of the six characteristic dull areas at the four apices, he should carefully note the size of these areas, the morbid sounds present, and the patient's weight; and at once order a period of rest in bed for seven, ten, or fourteen days, according to the extent of the dull areas and the acuteness of the symptoms. Two Yeo's inhalers (each costing only 6d. or 1s.) should be procured, so that they may be used on alternate days and may be properly cleansed by immersion in boiling water and careful drying.

The solution of which the formula has been already mentioned should be supplied, and the patient instructed to pour six to eight drops on the felt of the inhaler every hour during the daytime and once or twice during the night if he happens to wake. Nearly all patients soon become accustomed to wearing the inhaler at night. The object should be to keep the piece of felt constantly saturated with the solution, but so that none of it wets the framework of the inhaler itself. The base of the inhaler should

be carefully wiped before it is applied, and a little vaseline or lanolin cold cream smeared over the nostrils and upper lip at first.

By simple precautions like these, with the use of an inhaler of proper size, any irritation of the skin of the nose or lips may be avoided. The possibility of such irritation is the only disadvantage of the method, and it may be avoided if careful instructions are given at first. The inhaler must be worn persistently and removed only at meal times. After the first day or two the patient, while in bed, may read, write, do hand work, or play simple games. Dyspepsia and anorexia may be treated with sodium bicarbonate, nux vomica, and a vegetable bitter given a quarter of an hour before meals three times daily. The patient should be encouraged to eat freely of plain nutritious food, and at the end of each of his four meals he should drink slowly a half-pint of fresh milk which has been raised to the boiling point and allowed to cool, and to which two teaspoonfuls (gradually increased to a tablespoonful) of malted milk has afterwards been added. The bedroom windows should, of course, be kept open, but the patient must be kept warm in bed and protected from draught. After his meals he should always rinse his mouth with equal parts of Sanitas fluid and water. Smoking must be absolutely forbidden. When the necessary period of rest in bed is at an end the patient may be allowed to sit up in his room still wearing the inhaler persistently. Two or three days later he may be allowed to lay it aside for an hour in the morning and take a short walk out of doors. But when he returns he must at once replace his inhaler. At the end of three weeks the practitioner should again weigh his patient and again carefully record the size of his dull areas. Almost invariably a considerable gain in weight, often from 3 lb. to 5 lb., will be discovered, and the size of the dull areas will be found to be definitely smaller. Cough will be much diminished—in many early cases it ceases altogether; sputum will be less and more easily expectorated; and the temperature chart will be more satisfactory. The patient generally feels so much better that he is quite willing to continue the treatment. He should now be instructed to practise simple breathing exercises three times daily in order to obtain a better expansion of the lungs. The inhalation treatment should be continued persistently (except for an hour in the morning) during the next four weeks, at the end of which time the weight should again be taken, and the size of the dull areas carefully ascertained and recorded. If the progress of the case has been satisfactory during the first seven weeks it may now be possible to reduce slightly the number of hours of inhalation, but such reduction should be very gradual. The danger at this period is that the patient, feeling himself better, should grow careless. If he does, there is a considerable chance of a relapse, which will necessitate a return to bed for a fortnight with continuous inhalation. Experience shows that the patients who are most conscientious and persevering in carrying out the treatment improve most rapidly and are least liable to relapse. A very early case may, perhaps, be able to return to ordinary life after three or four months of treatment, but one in which cavitation has occurred will need six months or longer. After apparent recovery the patient will do wisely to use his inhaler for one or two hours daily, and also at night, for a further period of six months. Whenever he is conscious of having "caught cold," he should remain in bed for a day or two days, and practise continuous inhalation all the time.

This treatment by antiseptic inhalation can be carried out in the patient's own home if the hygienic and sanitary conditions are satisfactory. It is not usually necessary to send the patient to a sanatorium, so that there is a great saving in expense, and the practitioner does not lose charge of him. But where the home conditions are unsatisfactory it will be wise to send him to a sanatorium at which he will be permitted to carry out the treatment by inhalation. No idea of change of climate or foreign travel or sea voyage should be entertained until he has been through a course of inhalation treatment, and even then he must take his inhaler with him and use it freely.

I now venture to claim that my second question, as well as the first, may be answered in the affirmative. It is possible to provide the practitioner with a simple, inexpensive, and very effective form of treatment which can be used in the patient's own home.

* It had been found advisable to increase the size a little for cases with prominent noses. This model is known as Yeo's inhaler (M), the original type as Yeo's inhaler (F); both are made by Squire and Son.