SIGNIFICANCE OF PYREXIA IN CHRONIC
PULMONARY TUBERCULOSIS

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Until quite recently it was held that a patient could not suffer from active pulmonary tuberculosis without his temperature chart showing some abnormality. There was no method by which the physician could obtain accurate information on the progress of the disease in the chest. Physical signs were notoriously unreliable, and one laboratory test after another had to be discarded as useless for this purpose. X-ray technique had, as yet, not improved sufficiently to demonstrate the value of serial films. Therefore the control of the treatment was based on the only instrument of precision available to the physician—the thermometer; and it was assumed that pyrexia was the index of the activity of the disease. Changes in body weight and objective and subjective symptoms were also used as guides, but the temperature chart was given pride of place. The patient was kept in bed or at rest until his temperature had been normal for some time, and then exercise was gradually attempted.

The Temperature Chart

Various elaborate methods of temperature-taking were therefore evolved, in order that the most accurate observations should be recorded and that even the slightest variations in the daily swing should not be missed. The temperature taken in the axilla was quite rightly discarded as not being sufficiently accurate, and even oral temperatures were rejected by many clinicians for the same reason. The method of taking the temperature in the rectum thus came into common use in the treatment of pulmonary tuberculosis. Patients were impressed by this; it became a solemn rite.

The advent of x-ray, and especially the serial x-ray, examination in the study of the disease has fundamentally altered our ideas of the relation between the activity of the disease (as evidenced by the spread) and the patient's temperature. It has become apparent that not only can the disease be active and spread without any disturbance of the temperature curve, but also, conversely, that the patient can be febrile over comparatively long periods without any evidence that the disease in the lung is spreading. Nowadays, the serial x-ray examination is undoubtedly the most accurate single method of determining the progress or retrogression of the disease. The temperature chart, although still of great importance, has been relegated to a subsidiary position, and it has been found that in conjunction with x-ray control it is quite sufficient for all practical purposes for the temperature to be taken in the mouth for five minutes morning and evening. This is to be preferred to the rectal method, which is apt to overemphasize every slight variation, especially when it is remembered that more information can be obtained from consideration of the general course of the chart than by attaching importance to the actual readings.

The purpose of this article is to show that although the temperature chart has been relegated to a position of lower importance than formerly, in the treatment of the disease, owing to the fact that it often fails us as a guide to the activity of the disease, yet its readings are still of the utmost significance, and give us much valuable and definite information, especially when correlated with serial x-ray photographs.

Wingfield's Classification

In 1932, at the Brompton Hospital Sanatorium, Frimley, we adopted the classification suggested by R. C. Wingfield in his article¹ "Chronic Pulmonary Tuberculosis—A New Conception." It became the routine practice to take serial x-ray films of the majority of the patients at monthly intervals. The information derived from these films was correlated with that from the temperature charts and the clinical course of the disease. It was soon observed that, within limits, the various types of lesions, as defined by the new classification, were associated with definite and characteristic variations in the temperature chart.

A full description of the lung lesions to which reference is made may be found in the original article. Briefly, they are:

1. The secondary lesion.—This is a local allergic tissue reaction due to a deposit of bacilli, probably haematogenous. This reaction may disappear rapidly or progress to:
2. The intermediate lesion.—This corresponds roughly to what is known as active fibro-caseous disease.
3. The tertiary lesion.—This is the intermediate lesion healed as far as possible and non-progressive. Intermediate and tertiary lesions may become secondarily infected by bacteria from the respiratory tract.

THE SECONDARY LESION

The disturbance of the temperature chart due to the appearance of a "secondary" lesion is typical, but varies in degree according to the size of the new lesion. The size of this lesion is dependent on (1) the number of tubercle bacilli deposited in the lung; and (2) the allergic state of the lung tissue of the patient. For descriptive purposes this type of lesion may be considered under three headings, according to the area of the lung tissue involved.

1. The small "secondary," involving an area about the size of a two-shilling piece, may produce no rise of temperature and, indeed, no symptoms whatever. The lesion may disappear entirely as revealed by x-ray examination, or leave a definite "intermediate" lesion, without having given any clinical indication of its presence.
2. The medium-sized "secondary," involving a larger area, results in a typical disturbance of temperature, which is very like that of a mild attack of influenza. There may or may not be a slight rise of temperature for a day or two beforehand, and then the chart shows a pyrexia of 100° to 101° F. for a day or two. This gradually settles to normal in a few days, and may remain so for some weeks or even months. It is probably for this reason that so many patients suffering from pulmonary tuberculosis give a history of an attack of influenza as the starting-point of their disease.

CHARTS 1 AND 2.—Pyrexia due to "secondary" lesions of medium size.

3. The large "secondary," perhaps even involving the whole of a lobe, has an onset similar to the above, but more marked. The temperature rises higher, and for a few days the chart may resemble that of an attack of lobar pneumonia. The temperature, however, does not settle by crisis, but returns to normal gradually by lysis, generally within fourteen days from the onset. The absence of the crisis and the presence of tubercle bacilli in the sputum lead to a correct diagnosis.

CHARTS 3 AND 4.—Pyrexia due to large "secondary" lesions.

THE INTERMEDIATE LESION

It was observed with great astonishment that as a general rule an "intermediate" lesion which is spreading, as disclosed by *x*-ray examination, and therefore active, gives no indication of this activity on the temperature chart for at any rate the first few weeks—that is, until it is well entrenched. Many examples of this type of lesion were studied by frequent serial *x*-ray films from the time they appeared as the faintest shadow until there was obvious, dense, spreading disease. Very frequently during the whole of this period not only was there complete absence of pyrexia, but the patient appeared, both subjectively and objectively, to be in good health. It would appear that it is not until this type of lesion erodes a patent bronchus, thus infecting itself with the bacteria

exercise, his physician should, by comparing successive *x*-ray films, satisfy himself that the lesions are static.

When fever does appear in cases with spreading "intermediate" lesions, lesions which are probably secondarily infected, the chart is the common one seen in any chest hospital or sanatorium. The temperature rises gradually, being a little higher each morning and evening than the day before, with, eventually, a fairly constant daily swing. The temperature is thus of an intermittent type, generally below 98.4° in the morning and round about 100° at night, in a case of moderate activity. The height to which the temperature rises and the degree of the daily swing are some indication of the activity of the disease, and all stages between the chart described above and the hectic swinging fever (sometimes inverse in character) of rapidly advancing disease may be observed. The temperature characteristic of these lesions tends to settle with rest in bed, the rate at which it does so depending upon the activity of the disease, together with the resistance of the patient. Providing there has been no interference by any form of collapse therapy, the temperature caused by this type of lesion settles gradually by lysis in favourable cases.

During the period that a patient is pyrexial as a result of a spreading "intermediate" lesion infected with pyogenic organisms, it is still possible for a new "secondary" lesion to appear in his lungs. Should this occur there is a definite and characteristic alteration in the chart. The typical fever of the "secondary" lesion is imposed on that of the spreading "intermediate" lesion, and there is a sudden increase in the height and the swing of the fever, which gradually subsides until after a week or so the temperature is again back at the former level.

CHART 6.—Increase of pyrexia due to the appearance of a "secondary" lesion in a patient already carrying a spreading "intermediate" lesion.

CHART 5.—Chart of a spreading "intermediate" lesion. Successive *x*-ray films taken on the dates indicated showed progressive spread of disease. Note the delay in temperature disturbance.

of the respiratory tract, that fever and the symptoms commonly associated with chronic pulmonary tuberculosis appear. It has thus been realized that a normal temperature chart cannot be trusted as evidence of non-activity of the disease, and it cannot be too strongly emphasized that absence of fever does not always mean absence of activity or spread. The only assurance of non-activity is the existence of a series of comparable *x*-ray films, showing no spread of the lesions. It is therefore essential that before a patient is allowed to enter on the final stage of his treatment, with decrease of rest and increase of

THE TERTIARY LESION

Theoretically, a patient with lesions in the "tertiary" or static state should be free from fever. In practice this is found to be so, providing the disease has not been gross. But in a case in which there has been a long period of illness, with prolonged pyrexia and much destruction of lung tissue followed by gross fibrosis, various abnormalities in the temperature chart may be seen. Although their disease is known to be static and they themselves are in good health, many patients with disease of this type run a constant mild pyrexia, which is apparently of no signifi-

cance. This is probably due to (1) secondary infection, by bacteria from the respiratory tract, of the various small cavities which remain in the interstices of the masses of fibrous tissue; and (2) alteration in the temperature control which has taken place as a result of prolonged pyrexia and toxæmia.

CHART 7.—Mild pyrexia with gross "tertiary" lesions.

Even though the disease is static, these non-progressive and inactive lesions often contain cavities. These cavities may be quite dry and give no symptoms whatever, or else they may be chronically infected from the respiratory tract with pyogenic bacteria, which may give rise to a mild pyrexia. In some patients very characteristic exacerbations of this secondary infection take place from time to time. The patient feels a little out of sorts for a day with some increase of cough and sputum (or sometimes with a sudden lessening of sputum), and his temperature may be slightly raised the same evening. The following day the temperature rises sharply to between 101° and 103°, and then settles rapidly to normal within five days. These attacks generally recur with some regularity, an interval of two weeks to three months elapsing between. The sudden rise of temperature is always accompanied by increased cough and sputum—both of which symptoms rapidly subside to their former level as soon as the temperature has settled. These attacks may be the only disability from which the patient suffers on account of his disease, but they are a serious handicap, and it is most important that they should be treated, both for psychological and for economic reasons. A streptococcus, not

CHARTS 8 AND 9.—Examples of "secondary infection" attacks.

necessarily haemolytic, can often be cultured from the sputum collected at the height of the attack. An auto-genous vaccine prepared from this is frequently efficacious in controlling the frequency and severity of these bouts of fever, and even in preventing them entirely, though it is to be noted that the sputum still shows the presence of the offending micro-organism.

The last type of chart to be discussed in connexion with the tertiary lesion is that produced by "late cavitation."² This occurs in a patient who has had fairly gross disease followed by massive fibrosis. He has probably enjoyed good health and been symptomless for many years. Then, usually when approaching middle age, he contracts a head cold or some other intercurrent infection of his respiratory tract. After a few days of mild pyrexia the chart shows a sudden steep rise associated with a marked swing, and the patient proceeds to expectorate a large amount of purulent material, perhaps containing some caseous lumps or calcified nodules. The temperature then falls rapidly, in some cases to normal; in others a constant mild pyrexia remains. In neither case does the patient get back to his former state of good health. Some cough and sputum remain, and his capacity for exertion is much diminished. The x-ray film shows that there has been no spread of disease. Any changes that may be seen are those of cavitation in the old fibrosed lesion. This cavitation is probably caused by the secondary infection of the caseous material which has remained quite silent for years in the interstices of the mass of fibrous tissue.

CHART 10.—Pyrexia due to "late cavitation" of a "tertiary" lesion.

Conclusions

1. It has been found that the various types of lesion in chronic pulmonary tuberculosis (as defined by Wingfield's classification) give rise, within limits, to characteristic changes in the temperature chart.
2. Spread (that is, activity) of the disease may occur in the absence of pyrexia. We can only assure ourselves that the disease is not spreading by examining a series of comparable x-ray films, taken at intervals, in conjunction with other clinical data.
3. Many cases of quiescent pulmonary tuberculosis suffer from frequent bouts of pyrexia, or may even exhibit a constant mild pyrexia, without there being any evidence of spread of the disease.
4. In view of the above, it is possible that pyrexia in chronic pulmonary tuberculosis is often caused by infection of the tuberculous lesions by the organisms of the respiratory tract.
5. Serial x-ray films are the most reliable guide to the spread or retrogression of the actual tuberculous lesions, but the temperature chart, especially when considered in conjunction with these films, gives us essential and valuable information.

REFERENCES

- ¹ Wingfield, R. C.: *British Medical Journal*, February 4th, 1933.
- ² *Idem*: *Brit. Journ. Tuberc.*, January, 1933.

Professional Note No. 69, issued from the Air Ministry by the Meteorological Office is entitled "The Frequency of Days with Specified Duration of Sunshine." The authors, E. G. Bilham and Lilian F. Lewis, discuss the incidence of sunshine in regard to the percentage frequency of days with (a) no sunshine, (b) more than three hours, (c) more than six hours, (d) more than nine hours, (e) more than half the possible duration. Data in the first four categories are given for eighteen stations, and in the fifth category for six selected stations. The pamphlet may be obtained from H.M. Stationery Office, price 3d., postage extra.