

SOME ASPECTS OF THE DIAGNOSIS OF  
PULMONARY TUBERCULOSIS

- by -

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## HISTORICAL SUMMARY

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A disease whose ultimate etiology is unknown and whose pathology is obscure must depend for its diagnosis upon a complex of symptoms, and until a definite pathological basis for these is unequivocally established, its recognition must remain doubtful. The disease "phthisis", "consumption", "decline", is as old as human civilisation; the disease "pulmonary tuberculosis" dates back no further than 1867, the date of publication of an epoch-making book, "Études sur la Tuberculose" by J.A.Villemin, and the epoch-making<sup>1</sup> discovery of the tubercle bacillus by Robert Koch fifteen years later. The pathological and bacteriological researches of these two men gave to the medical world a new conception of the disease, a conception with vast sociological implications, and has added an indispensable weapon to the armoury of the diagnostician.

It would be untrue and unjust to dismiss as of little account the work of earlier men. Great and valuable had become the accumulation of knowledge by the middle of the nineteenth century particularly in symptomatology and in physical diagnosis, and it will be the duty of the writer in the next few pages to give a brief description of the progress made in the art of diagnosis until the beginning of the present century.

Pulmonary Tuberculosis was undoubtedly a common enough disease in classical times from the descriptions given of several of its manifestations in Greek and Roman writings. Such symptoms as cough, lassitude, sweating, haemoptysis, pleurisy, wasting,

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<sup>1</sup> The phrase "epoch-making" is a sadly overstrained one but it may safely be used with reference to the works of such men as Villemin and Koch.

are constantly met with in the Hippocratic writings, and in the works of Galen, but they were described as diseases in themselves and the grouping of these symptoms into one pathological entity was impossible. It was only when the patient was moderately advanced in consumption and had all or most of the above symptoms that he was recognised to be suffering from a specific malady. The concept of wasting dominated the whole clinical picture, Galen, for example, using the words "phthisis", "tabes", "marasmus", more or less indiscriminately for all wasting diseases. Some of the descriptions of wasting, particularly that of Aretaeus, stand unrivalled as the most graphic accounts of this symptom ever written. Needless to say there was much confusion of thought and many cases of empyema, bronchitis, bronchiectasis, and cancer of the thoracic organs must have been diagnosed as consumption. Greek physicians did not account for some of the earlier symptoms of pulmonary tuberculosis, for example, haemoptysis was not regarded as a symptom of phthisis but as a malady which could lead to phthisis. "The spitting of blood is followed by the spitting of pus, consumption follows this and death follows consumption", was a Hippocratic aphorism, a conception that prevailed in medical writings until the middle of the nineteenth century.

The phthinoid type of chest did not escape observation and comment, and the young adult with a thin elongated thorax, flattened in front and behind, the costal margins meeting the sternum at an acute angle, the scapulae standing out like wings, was considered to be peculiarly susceptible to phthisis, and this is an opinion that has held its ground until recent times.

It is doubtful if, in ancient times, a diagnosis could be based on more than the inspection of the patient, although the presence of fluid could be detected by shaking (succussion). Direct percussion and immediate auscultation were probably known to the Greeks but were seldom applied to the detection of diseases in the chest as their implications here were unknown.

From Galen, in the second century, it is necessary to pass through a long period of time, to the seventeenth century, to find any information of value on what was still a very obscure theme. In the "Opera Omnia" of Sylvius, who was Professor of clinical and anatomical medicine in the University of Leyden between 1648 and 1672, there appeared the first recognition of tubercles in diseased lungs, and of the association of the lymphatic system with tuberculosis. He also restricted the word "phthisis" to the emaciation which follows an ulceration of the lungs<sup>1</sup>. Further recognition of the association of tubercles in the lungs with phthisis was made in the work of Willis, "Pharmaceutica Rationalis", which appeared in his "Opera Omnia" published posthumously in 1672.

The book, however, which attempted to deal with the subject on ambitious lines was the "Phthisiologia"<sup>2</sup> of Richard Morton, which was written at the end of the seventeenth century and dedicated to King William the Third. This is a long and difficult book to read as Morton subdivided the disease into a great number of varieties, but his definition of pulmonary tuberculosis

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<sup>1</sup> Flick: Development of Our Knowledge of Tuberculosis, p.77; Philadelphia 1925.

<sup>2</sup> Transl. into English in 1694 by Smith and Walford.

was as follows:- "A consumption of the lungs is an universal wasting of the parts of the body caused by distemper of the lungs, such as a stuffing, swellings, inflammation and exulceration of them, and thereupon it is attended with a cough, difficulty of breathing and other symptoms of the breast, and accompanied with a fever, which, at first, is slow and hectic, afterwards inflammatory and, at last, putrid and intermitting<sup>1</sup>". In this book Morton discussed hereditary predisposition to the disease acquired from the parents, direct infection from close contact, the phthinoid chest, and among predisposing diseases included scrofula or King's Evil, asthma, spitting of blood, inflammation of the lungs, and unresolved pleurisy. In an individual with one or more of these predisposing conditions, a small upset, such as a "cold" could usher in phthisis. In the second chapter of the second book he mentioned seventeen diagnostic signs which need not be recapitulated here as many of them would not be accepted as solely applicable to pulmonary tuberculosis at the present day, but one of them, namely, "sick stomach after a full meal" is of distinct value in diagnosis and will be referred to later in this thesis. He discussed at considerable length the three symptoms of cough, fever, and wasting, and spent much intellectual acumen in differentiating between a "consumptive" cough and a "catarrhal" cough. That amenorrhoea might be associated with phthisis did not escape Morton's observation, - "This is most commonly the original of women's consumptions and I have very seldom seen any woman that was capable of the monthly purgations, either virgin,

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<sup>1</sup> The three symptoms in this definition, - cough, wasting and fever, are still occasionally referred to as "Morton's triad".

married woman or widow, who ever fell into a consumption without an obstruction of these purgations coming upon it either in the beginning or at least in the progress of the distemper, ..... Many times it is the occasion of the consumption<sup>1</sup>. It is probable that most of these patients were well advanced in the disease by the time it was diagnosed, but that amenorrhoea may occur in young women as an early manifestation of pulmonary tuberculosis is unquestionable, and further reference will be made to this later.

When one considers that this book rested almost entirely on Morton's own powers of observation and that he had no modern resource for diagnosis, the book, in spite of needless repetition, must be looked upon as a remarkable work.

The year 1761 constituted an important land-mark in the history of the diagnosis of diseases of the chest, for it witnessed the appearance of a modest pamphlet in Latin, describing a new discovery for detecting the signs of diseases in the chest cavity by means of percussion. The author, Auenbrugger, had devoted seven years study to this new art before publishing his thesis which consisted of fourteen observations. The art of percussion, as known to Auenbrugger, consisted in what would be known today as "direct" percussion; for example, in the second observation he advised that "the chest must be struck slowly and softly with adjoining evenly extended finger-tips", and that it should be done over the shirt or with a linen glove covering the hand to avoid the disturbing sound which

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<sup>1</sup> Morton: Phthisiologia, Smith & Walford's trans. 1694.

comes from striking the bare skin. In this work, Auenbrugger discussed, (1) the sounds obtained on percussion of a healthy normal chest, (2) variations in percussion resonance in different diseases of the chest cavity, and (3), correlated, as best as he could, his clinical observations with the results of post-mortem study. Broadly speaking, he believed that the amount and extent of percussion resonance varied in accordance with the severity of the disease (Obs.5).

The book was translated thirty years later into French by Corvisart who declared in his introduction that the work and its author were so little known that he could safely have claimed the authorship for himself.

In spite of the fact that a useful method for detecting abnormalities in the chest had now been provided, the art of percussion remained in obscurity for at least another half century after the publication of Auenbrugger's pamphlet. Its difficulty was apparent; its implications were not clearly understood. Empyema, for example, a disease that still remained in the category of phthisis, was seldom diagnosed during life, most cases being found at autopsy.

A considerable amount of activity was directed throughout the remaining years of the eighteenth century to the morbid anatomy of pulmonary tuberculosis, work associated with the names of William Stark, Thomas Reid, Antoine Portal, and Matthew Baillie. The Glasgow and London Medical Schools contributed a large share of this work and much of it was inspired by the influence of the brothers John and William Hunter. The symptomatology of the disease, however, remained in a very confused state, and the art of diagnosis made little or no advance.



The difficulties of diagnosing pulmonary phthisis were clearly recognised by Portal<sup>1</sup> who maintained that the entire clinical picture had to be considered, and that "very few (indeed if any) can characterise it sufficiently well to recognise it with certainty". Perusal of the books written at this period gives one a confused impression of a conglomeration of symptoms many of which are quite unrelated to pulmonary tuberculosis as the disease is understood today; and as diagnosis rested almost entirely upon the observation of symptoms, the slightest approach to accuracy was impossible.

G.L.Bayle published his book "Recherches sur la Phthisis Pulmonaire" in the year 1810, a year that marked another milestone in the progress of tuberculosis research. In this book he embodied the results of 900 autopsies on patients who had died from phthisis, many of whom he had studied clinically. He recognised that the disease is advanced by the time it is diagnosed and that it may be present in the individual before he shows any appreciable symptoms whatever, that such symptoms as cough, dyspnoea, emaciation, purulent expectoration and hectic fever, are the result of advanced breaking-down of lung tissue and that the disease is present before these symptoms are manifest. His work included some pathological conditions that would not be associated with pulmonary tuberculosis today, such as anthracosis, bronchiectasis, gangrene of the lung, and cancer, but he eliminated other diseases, and in the words of Flick, "reduced the number of kinds of phthisis from the twenty of Sauvage, the sixteen of Morton, and the fourteen of Portal, to six ..... He eliminated all the

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Portal, le Baron Antoine: Observations sur la nature et le traitement de la phthisie pulmonaire, 2 vols. Paris, 1809.

inflammatory conditions from the category of causes".<sup>1</sup> Bayle and Corvisart were zealous advocates of the art of percussion.

Nine years after the publication of Bayle's work, i.e. in 1819, there appeared a book in two volumes that may without danger of exaggeration be described as one of the greatest contributions to the study of clinical medicine that the world has yet seen, - "De L'Auscultation Médiante", by René Théophile Hyacinthe Laënnec, a work that has left its influence on the course of clinical medicine and pathology until the present time. In this work Laënnec gave exceedingly accurate descriptions of diseases of the heart and lungs as diagnosed by auscultation and percussion and correlated them with pathological findings. His descriptions were characterised by a lucidity and accuracy that have remained unrivalled to the present time, and his book forms the foundation upon which practically the whole of our knowledge of the physical examination of the chest is built. It may be said to occupy the same place in medicine as the "Principia" of Newton occupies in the realm of physics. In a summary such as this it may be permitted to quote Laënnec's<sup>2</sup> own account of the discovery of mediate auscultation.-

"I was consulted in 1816 by a young female who presented the general symptoms of disease of the heart, and in whose case the application of the hand and percussion yielded scarcely any result, on account of her embonpoint. The age and sex

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<sup>1</sup> Flick. Development of our Knowledge of Tuberculosis, p.357.

<sup>2</sup> Laënnec: De L'Auscultation Médiante, p.4.  
(Trans. by Member of Royal College of Physicians, 1846.

of the patient, forbidding that kind of examination of which I have just spoken. I happened to recollect a well-known acoustic phenomenon, viz, that when the ear is applied to one end of a piece of timber, we can hear very distinctly the scratch of a pin made on the other. It struck me that, in the present instance, advantage might perhaps be taken of this property of bodies. I procured a quire of paper, and formed it into a roll as compact as possible, one extremity of which I applied to the precordial region, and, placing my ear on the other, was alike surprised and gratified to hear the pulsations of the heart much more clearly and distinctly, than I had ever heard them by the immediate application of the ear.

I at once saw that this might become a useful method, and applicable not only to the study of the pulsations of the heart, but also to that of all the movements capable of producing sound in the cavity of the chest, and consequently to the exploration of the respiration, the voice, the râle, and, possibly, even the fluctuation of fluid effused in the pleura or pericardium."

Like Bayle, Laënnec dissociated such pyogenic infections as catarrh and pneumonia from pulmonary phthisis, and attributed that disease to the "development in the lung of a peculiar species of accidental production, to which modern anatomists have specially applied the name of tubercle, which in former times was generally given to every kind of morbid tumour or protuberance."<sup>1</sup> Laënnec recognised that hæmoptysis was not followed by tuberculosis but was a result of tuberculous infection that already existed. "The first disquieting symptom", he wrote<sup>2</sup>, "calculated to give the alarm respecting the disease in most phthisical patients, is commonly an hæmoptysis; but if the chest be examined we shall generally find from that period some signs indicative of the actual existence of tubercles. The hæmoptysis will

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<sup>1</sup> Laënnec: De L'Auscultation Médiante, p.255, Trans. by Member of the Royal College of Physicians, 1846.

<sup>2</sup> Ibid. p.309.

likewise be observed to reappear at different epochs in the course of the disease, whence we may conclude that it is very certain the presence of tubercles in the lung is the most frequent occasional cause of haemoptysis".

Laënnec had now placed the clinical and pathological manifestations of pulmonary tuberculosis on an unassailable foundation, a foundation that even today remains unshaken.

The work of Laënnec was further confirmed and amplified by the third great contribution to the study of phthisis to appear during the first quarter of the nineteenth century, - the "Recherches Anatomico - Pathologiques sur la Phthisis" of Louis. This book was published in 1825. It was a carefully reasoned systematic work, the signs and symptoms elicited during the life of each case being checked with the post-mortem findings. Like Laënnec he regarded haemoptysis as an indication of already existing tubercles basing his conclusion on the study of 57 cases of haemoptysis in 25 of which it was severe. He strongly advocated percussion and auscultation as part of the physical examination of the chest. "Local symptoms", he wrote,<sup>1</sup> "auscultation and percussion, these are the measures by the aid of which one can arrive at a diagnosis in phthisis".

During the second quarter of the nineteenth century percussion and auscultation made but slow progress, clinicians being reluctant to adopt new methods only the difficulties of which they could appreciate. "Its use indeed requires tact or rather experience to enable one to understand the signs it furnishes", wrote Duncan<sup>2</sup> of Edinburgh. "The information afforded by it

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<sup>1</sup> Louis: Recherches Anatomico-Pathologiques sur la Phthisis, p.223.

<sup>2</sup> Quoted by Forbes, J. in "Laënnec", p.16, 1823.

is often obscure and uncertain". Modifications to assist percussion were introduced from time to time. Piorry used a piece of ivory as a pleximeter and Louis is said by Skoda<sup>1</sup> to have used a caoutchouc pleximeter. Winterlich, of Würzburg, used an ivory disc and a small steel hammer, into the head of which a layer of caoutchouc was fixed<sup>2</sup>. These aids to diagnosis were destined gradually to become of historic interest only after the publication in 1839 of Joseph Skoda's "Treatise on Auscultation and Percussion", a work that gave the most complete and scientific exposition of the subject that had hitherto been written. The art of percussion was soon to become entirely digital, the finger being used as pleximeter. This was not only simpler, but it enabled the examiner, after he had attained to the necessary experience, to appreciate the various degrees of resistance to the finger, for the discovery of which credit was given by Skoda to Piorry<sup>3</sup>.

From the time of Skoda until the discovery of the tubercle bacillus in 1882, nothing of importance on the diagnosis of pulmonary tuberculosis was added to the facts already known, but percussion and auscultation had now become part of the routine examination of the chest. In the realm of pathology there was an enormous amount of activity and much confusion, a confusion that was heightened by the conclusions of such investigators as Niemeyer and Virchow, each of whom regarded tubercles as

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- 1 Skoda, J. A Treatise on Auscultation and Percussion, p.3, 1839, trans. by W.O.Markham, 1853.
  - 2 Ibid. P.3. The writer is indebted to Dr. James Crocket of Glasgow for his courtesy in permitting him, when a student, to use some of the instruments mentioned in the text.
  3. Ibid, p.1.

inflammatory in origin and as something distinct from phthisis. "The greatest danger to most phthisical patients", wrote Niemeyer<sup>1</sup>, "is the development of tubercles".

In 1867 there was launched from the press the "Études sur la Tuberculose" by J.A.Villemin, a work that occupies the same position in pathology as the "Auscultation Médiate" of Laënnec fulfils in clinical medicine. The logical reasoning of Villemin, based on a vast body of pathological and clinical research, silenced all effective opposition and prepared the way for the discovery of the tubercle bacillus. He proved that tubercles must exist before there can be phthisis and demonstrated also that such symptoms as "cold", bronchitis, pneumonia, and pleurisy, are not diseases in themselves that may result in the production of phthisis but that they are manifestations of pulmonary tuberculosis from the beginning. He attacked the ancient notion that tuberculosis showed an undue propensity to attack persons with a certain type of physique<sup>2</sup>, and declared that it was not more prevalent amongst individuals with ricketty chests<sup>3</sup> than in the general population. He also stressed the difficulty of making a diagnosis of pulmonary tuberculosis when physical signs were very scanty or even absent, asserting that pathological changes had to be moderately

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1 Niemeyer, Felix von: Clinical Lectures on Pulmonary Consumption, trans. by C. Bauemler, p.11: New Sydenham Socy. 1870.

2 Villemin, J.A. Études sur la Tuberculose, p.291, 1867.

3 Ibid, p.293.

advanced before physiological sounds could be appreciably altered or percussion resonance impaired, and that there must be persons with pulmonary tuberculosis in whom physical signs are entirely absent<sup>1</sup>.

Villemin concluded that pulmonary tuberculosis, following the example of zymotic diseases, was uncommon in high altitudes, or amongst scattered nomadic races, but increased proportionately with the crowding of individuals into communities; that it was contagious, and that it was due to a specific agent which could be multiplied and transmitted under certain conditions<sup>2</sup>. Tuberculosis had now become a definite specific disease due to one cause, a micro-organism. The discovery of this micro-organism was proclaimed to the world by Robert Koch in 1882.

The facts relating to the discovery of the "bacillus tuberculosis" are too well known to need recapitulation here. The discovery of the causative organism was the most important contribution to the diagnosis of tuberculosis that has ever been made. The enemy was identified. Koch made the announcement of his discovery to the Physiological Society of Berlin on March 24th. 1882, and published his thesis, in which he set forth his findings and the experiments on which they were based in the "Berliner Klinische Wochenschrift" of April 10th. 1882.

During the fifty-one years that have passed, an enormous amount of work has been done relating to the

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1 Ibid. p.322.

2 Ibid. pp.406-407.

diagnosis of pulmonary tuberculosis, to give an adequate account of which would be impossible. Tuberculin has been used in many different forms and in many different ways. As a diagnostic agent for the detection of tuberculosis in children it can be of distinct assistance provided it is employed intelligently. Its use for this purpose is of little value in adults. Since the discovery by Röntgen in 1895 that when an electric discharge is passed through a high vacuum, rays are emitted that are far more penetrating than ordinary light, the use of X-rays has been more and more appreciated. In fact, it may be said that a good X-ray plant is absolutely essential before one can set out to diagnose pulmonary tuberculosis with even a moderate degree of confidence. Without going so far as to assert that a good X-ray tube is of more value to the diagnostician than the tube of Laënnec, an attitude that only succeeds in under-estimating the importance of physical signs, it is undeniable that its use is bringing more and more to light cases with early but definite pulmonary tuberculosis in which there are few or no physical signs. The work of Assmann and others on "early infiltration" (früinfiltrat) will be referred to later in this thesis.

Much recent work has been done on erythrocyte sedimentation-rates and on changes in the shape of the nuclei of the polymorphonuclear leucocytes, work associated with the names of Fahraeus, Arneth, and Stephani. As providing visible evidence of toxicity they are of great value but are of much less importance



as diagnostic aids as they do not give results that are specific to tuberculosis.

In the foregoing pages it has been shown how the various steps employed in the routine examination of every suspected case of pulmonary tuberculosis have been the results of unwearying labour and research, and it is the intention of the writer in the pages that follow to discuss some aspects of the diagnosis of this disease that have impressed themselves upon him as being of interest and importance.

The experience of the writer, derived from seven years assiduous study of the clinical diagnosis of pulmonary tuberculosis, tempts him, on introducing this subject, to begin with a word of warning against making a hasty or facile diagnosis of this disease. Acting on the belief that the earlier the detection the brighter the outlook for the patient, there is a tendency on the part of some medical men to diagnose pulmonary tuberculosis on insufficient evidence and to place the onus on the patient of proving that he is not tuberculous. It is very easy for a doctor, who has the power and who does not know better, to inform a person whose health has received a temporary upset that he has early pulmonary phthisis, advise him to give up his work and enter a sanatorium, and at the end of four or five years inform him that he is cured. The writer has met with instances of the notification of patients who were suffering from bronchitis, emphysema, fibrosis of the lung, asthma, or protracted recovery from influenza; while X-ray films demonstrating calcified nodules about the hilum or in a lung field have been sufficient to condemn numerous symptomless victims to the life of the tuberculous. In the last case tuberculous changes had doubtless taken place in the lungs, but not such in the absence of activity to justify medical or administrative action; and yet it is not difficult to recall individuals who on equally valid evidence have been advised to leave their employment and enter a sanatorium whose subsequent careers failed to show the presence of even a dormant lesion. As an example of this the writer is occasionally asked to see patients who have been diagnosed as

tuberculous by their medical attendants almost entirely on the strength of radiological reports made by men who had not studied the patients clinically. Experience has taught him to regard such patients with the greatest caution before making a notification, as quite often notification is uncalled for. Many such cases on being notified either become lost sight of for administrative purposes or after a period of years have gone to swell the list of cured cases.

It cannot be too strongly asserted that a diagnosis of pulmonary tuberculosis is one of the most serious that a doctor is ever called upon to make. He has to consider that, apart from worry and domestic upset, the patient may lose his employment, that he incurs the stigma of notification to say nothing of the expense to the ratepayers for keeping him in an institution. In America, at the Boston Consumption Hospital, J. Earle Ash<sup>1</sup> performed 198 consecutive autopsies on patients diagnosed as tuberculous. He failed to find any active or recently active tuberculous lesion in 23 or 11.5 per cent. Of 1,000 men returned as suffering from pulmonary tuberculosis to the Base in France during the Great War, Edouard Rist<sup>2</sup> found that the diagnosis was wrong in 80 per cent, and this was proved to be so by the men's subsequent careers. Fishberg<sup>3</sup> reported the necropsy on the body of a woman who remained twenty-six years continuously in an institution; about one half of the time in a sanatorium, the other half in a hospital for advanced consumptives, where she finally

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<sup>1</sup> Ash, J. Earle: Jour. Amer. Med. Assoc., 1915, 64, 11.

<sup>2</sup> Rist, E., Jour. Amer. Med. Assoc., 1917, 69, 1266.

<sup>3</sup> Fishberg, M. Pulmonary Tuberculosis, vol. I., p. 224, (4th. ed.)

died from pneumonia. Careful examination of the viscera failed to disclose an active tuberculous lesion. His comment was as follows: "I calculated that the community spent, or wasted, over \$10,000 on this woman, not including the loss owing to her idleness. We may further mention that during the twenty-six years she kept out of the institution at least forty patients with active disease who might have benefited by the treatment". Kindberg and Delheim<sup>1</sup> found that out of 1,000 potential recruits rejected by the medical officers as tuberculous, only 1.5 per cent were eventually proved to have tubercle, and they add that in civilian practice most of the 1,000 would have been sent to sanatoria from which they would eventually have been discharged as cured. At the end of every year the writer removes from his registers a number of ex-service men in whom prolonged observation has failed to disclose the presence of any manifestation, even remotely suggestive, of pulmonary tuberculosis. One man who was taken off his list at the end of 1932 had been in no less than six different occupations being discharged from each on his employer getting word that he was "tuberculous". He was a palpable case of chronic bronchitis. Another man who was taken off the list at the same time had no appreciable defect whatsoever and was earning a livelihood as a boxing-instructor. He had been discharged from the Army in 1917 as a case of pulmonary tuberculosis although the sputum had never been found to contain the tubercle bacillus.

The above illustrations could be multiplied indefinitely but they will be sufficient to make an

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<sup>1</sup> Kindberg, L. & Delheim, A. Presse Médicale, 1917, 25, 645.

examiner ask himself what exactly is meant by a diagnosis of pulmonary tuberculosis. A diagnosis may not be sufficient that will satisfy the pathologist, nor may a diagnosis that will satisfy the radiologist, as a radiogram may show numerous calcified nodules throughout the lung fields in a person who feels well. It is not sufficient to diagnose tuberculous infection; about 90 per cent or more of adult town-dwellers have been infected with tuberculosis at some time in their lives and will give a positive tuberculin reaction. The examiner has to recognise when the patient is sick with pulmonary tuberculosis, that is, when he presents certain toxic symptoms which are due to invasion by the tubercle bacillus. He must also further recognise that similar toxic symptoms may occur in other diseases than tuberculosis so that a diagnosis based solely on such symptoms, important as they are, as cough, loss of weight, lassitude, want of appetite, fever, progressive anaemia, nervous or physical exhaustion, would rest on insecure foundations. As Osler<sup>1</sup> has remarked, fever is at once a most trustworthy and the most fallacious symptom, and that the thermometer has needlessly condemned many patients to the sanatorium. He cites the case of a flabby fat girl of ten, with an anxious mother, a foolish nurse, and an alarmist doctor. For months the rectal temperature was taken hourly during the day; the child had been in bed, there was no cough and the only physical sign a few rustling râles at one apex. The "cure" followed rapidly on the breaking of the thermometer and getting rid of the nurse. Such symptoms

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Osler & McCrae: Principles & Practice of Medicine, 9th edit. p.206.

as cough, loss of weight or loss of strength, anaemia, evening rise of temperature, are simply evidence of bacterial toxæmia and not necessarily of the toxæmia due to the tubercle bacillus. They may be caused by a variety of conditions such as influenza or the presence of septic foci in the nasal sinuses, the maxillary antra, the teeth, the tonsils, or the gastro-intestinal tract. The writer has seen more than one child who had been diagnosed as suffering from pulmonary tuberculosis undergo "cure" on removal of the tonsils. Thus, while it is true that active pulmonary tuberculosis should not be diagnosed without the presence of such symptoms as those given above, the difficulty of making a correct diagnosis becomes apparent when it is appreciated that they are common to many types of bacterial toxæmia and are not specific to any one organism. The difficulty becomes further enhanced by the fact that in the majority of cases symptoms of toxæmia present themselves before any definite physical signs can be elicited by percussion or auscultation. How then can one with reasonable confidence diagnose pulmonary tuberculosis ?

It is not the purpose of the writer to discuss in detail the classical methods of examination by inspection, palpation, percussion and auscultation. They are fully described in the text-books and form the most prominent part of the clinical examination even when supplemented by X-ray investigation. Little or no addition has been made to our knowledge of abnormal physical signs in the chest since the days of Laënnec and Skoda.

During the past seven years, four years of which have been spent in a purely diagnostic capacity, the

writer has been in daily contact with cases of pulmonary tuberculosis, and the opportunity given to him of considering the disease from different aspects has led him to give a good deal of attention to six different lines of evidence, four of which have been taken from the "five cardinal signs" of Lawrason Brown<sup>1</sup>. They are as follow :-

1. The presence of tubercle bacilli in the patient's sputum.
2. Pleurisy with effusion if otherwise unexplained.
3. Haemoptysis.
4. Rise of temperature provoked by moderate exercise and persisting after more than an hour of rest.
5. The presence of localised râles above the level of the second rib in front or the third dorsal spine at the back.
6. X-ray manifestation of infiltration into the parenchyma in the infraclavicular region.

The evidence given by the first sign is absolute. The evidence provided by signs, 2, 3, 5 and 6 is strongly presumptive, and that obtained from sign 4, when combined with physical signs, is strongly suggestive.

The presence of tubercle bacilli in the patient's sputum. This statement may appear to be too self-evident to be worthy of discussion, as a specimen of sputum containing tubercle bacilli can only come from a patient who is suffering from active pulmonary tuberculosis. If one could only be certain that the sputum comes from the patient in question the diagnosis would be accomplished, but when the clinician, owing to lack of time, has to delegate the drudgery of sputa examinations to someone else or send them to an outside laboratory, suspicion arises that the slides, in one or two instances, may have got mixed or that the examination was carried out in a

careless and perfunctory manner. This occurred so frequently during the Great War, for example, as to raise suspicions of deliberate fraud. On looking over his records the writer has found eleven patients, five of them ex-service men drawing pensions, who have been followed from four to fourteen years, in whom the sputum is reported to have been positive once, and once only, to be followed by at least fifteen negative reports, and whose subsequent clinical careers have not manifested any sign of active phthisis. One is an obvious case of asthma in whose clinical condition the passage of years has made no perceptible alteration, four have chronic bronchitis with varying degrees of emphysema, two have died within the past two years from atheroma and myocardial degeneration, and the remaining four have no symptoms whatever or X-ray manifestation of even a healed lesion. One single positive result is of course possible, but an examiner naturally becomes sceptical when that result is not supported by definite constitutional symptoms or by physical signs, that are at least suggestive, in the lungs.

For a year and a half out of the four in question, sputum examinations were carried out at a large laboratory in Birmingham with results that were on the whole, satisfactory, but the accuracy of which could not be checked. For the remaining two and a half years these examinations have been conducted at the central dispensary in Coventry with satisfactory results in that every doubtful specimen is examined by the tuberculosis physician on duty.

Of 3,563 persons of all ages from 2 years upwards, examined by the writer during the past four years, 550 have been diagnosed by him as suffering from pulmonary



tuberculosis. Of that 550, 451 or 82 per cent have had a positive sputum at some time during their illness<sup>1</sup>. The majority of the negative cases are children or patients who cannot, or who say they cannot, produce any sputum. Although the majority of these cases had tubercle bacilli found in their sputa within two or three weeks of being seen by the writer, it need hardly be said that positive sputum results are not always obtained on first examination. In some cases one year had elapsed since the initial examination; in four cases the sputum remained consistently negative for three years before tubercle bacilli were found, and in one case ( a woman) diagnosed as tuberculous seven years previously and whom the writer nearly dismissed as suffering from non-tuberculous fibrosis of the lung, the twelfth specimen of sputum was found to contain bacilli for the first time. In two cases not in this series in that they were diagnosed by colleagues of the writer, as long as five and eleven years respectively elapsed before a positive result was forthcoming. In one of them the organisms are so scanty that a concentration method has to be employed to find them, and the patient himself, as he continuously asserted his unfitness for work, incurred at one time the suspicion of being a malingerer. The other patient was diagnosed in 1921 although the sputum was negative. He refused to undergo treatment and was not seen again until 1932 when he had a breakdown in health. Tubercle bacilli were then found in the sputum in large numbers. A patient may go on to advanced pulmonary tuberculosis and finally die without the tubercle bacillus being found in the

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The doubtful cases in the preceding paragraph are omitted.

sputum, but this is very rare, and it is a useful rule when a patient who has been manifestly ill for some time and whose sputum is repeatedly negative, to refrain from making a diagnosis of phthisis until every other relevant possibility has been considered. Of the 550 cases under review, 112 sputum positive cases were classified as belonging to the first grade<sup>1</sup> of the disease, a number slightly in excess of the sputum negative cases and one fourth of all the sputum positive cases. The numbers are small on which to base conclusions but it may be inferred from them that a considerable proportion of early cases of pulmonary tuberculosis have sputa containing tubercle bacilli at some time, organisms that can be found if a careful and systematic search is made for them by a competent worker. The writer is learning more and more to distrust the sputum negative case of phthisis. In his student days he was often informed that it was a clinician's duty to be able to diagnose pulmonary tuberculosis at an early stage before the sputum became positive, because while it remained negative there was some hope of cure. Since then the entire outlook with respect to early phthisis has been altered, a new orientation that is associated with the "frünilfiltrat" researches of Assmann, Redeker, Braeuning, Lydtin and others. Their findings tend to show that in a large number of cases a positive sputum accompanies the development of symptoms. On carefully reviewing the case histories of the 112 sputum positive patients of Grade I the writer has been

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<sup>1</sup> These cases, though mild initially, did not all progress favourably, some having a fatal ending. For the Ministry of Health's definition of the three grades into which pulmonary tuberculosis is divided v. Appendix.

impressed by the fact that in at least 60 of them the onset of symptoms was moderately abrupt and only a few weeks separated the beginning of the illness and the finding of tubercle bacilli in the sputum. The sputum positive cases of the other two groups may be left out of account as the disease had been well established for a considerable time before they came under the writer's cognisance. It is becoming generally realised that the detection of the so-called very early case with negative sputum means in practice the sending of many patients to sanatoria who eventually become cured, a practice that would speak much for sanatorium treatment if one did not have the disquieting thought that most of these sputum negative patients would have progressed just as well had they been left alone.

Pleurisy with effusion otherwise unexplained.

For a very long time - since the days of Morton at least - this has been regarded by clinicians as having an association with pulmonary tuberculosis, and was asserted to be one of its predisposing causes by Bayle and Laënnec<sup>1</sup>, Graves<sup>2</sup>, quoting what was known as Louis' law declared, "It is a law of pathology, that if a pleurisy appear on one side of the chest and some time afterward show itself in the other, it in all likelihood is dependent on tubercles". The opinions of the older clinicians on this subject are even more strongly held today as it is a matter of experience that the occurrence of pleurisy with effusion is frequently followed by the manifestation of tuberculosis of the lungs. This is borne out by numerous series of

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<sup>1</sup> Laënnec: L'Auscultation Mediate; trans. by Member of the Royal College of Physicians, 1846, p.413.

<sup>2</sup> Graves: Clinical Lectures, 1842, p.453.

cases observed for long periods of time by various writers, particularly Bowditch, Sears, Hamman and Oeffner,

Two extensive series of cases of pleurisy were investigated by Allard and Kōster. In the first series 200 cases of idiopathic pleurisy consisting of 180 cases of serous, and 20 of dry pleurisy, Allard found that from 16 to 28 years later 87 patients were alive and well, 28 were tuberculous, 61 had already died of tuberculosis, and 24 had died from other causes. Kōster analysed 371 cases of idiopathic pleurisy consisting of 334 cases of serous and 37 of dry pleurisy extending over a period of fourteen years and found that 164 were alive and well, 118 were tuberculous, 62 had died from tuberculosis, and 27 had died from other causes. When both series were combined, the observers found that of the cases of pleurisy with effusion no fewer than 47.7 per cent developed pulmonary tuberculosis, and that after dry pleurisy 42 per cent of cases developed tuberculosis of the lungs. The number was much smaller in childhood than after pleurisy in later life, probably due to the fact that many cases of pleurisy amongst children are rheumatic in origin. They concluded that in the majority of cases (85 per cent), symptoms of pulmonary disease develop within five years of the pleurisy, and that after that interval there was little likelihood of the disease developing. Surveying the converse side of the picture Allard and Kōster found that a moderately high proportion of tuberculous patients gave a history of pleurisy before the onset of their illness. Of 2123 cases of

pulmonary tuberculosis, 650 or 30.6 per cent had suffered from pleurisy<sup>1</sup>. In two series of 1,767 cases of phthisis and 518 cases of the same disease, Pierce<sup>2</sup> gave figures as high as 35 per cent and 52 per cent respectively for the incidence of previous pleurisy.

In the present series of 550 cases, 95 or 17 per cent gave a definite account of having had pleurisy within the previous five years, and 16 or 3 per cent an almost equally definite history of pleurisy more than five years before the onset of symptoms. No definite figures can be given for dry pleurisy or pleurisy with effusion, but in at least 40 cases there was a history of fluid having been removed from the chest. Of the 95 cases, 10 were suffering from pleurisy with effusion when diagnosed as tuberculous, the diagnosis being confirmed in five instances by guinea-pig inoculation. A small number of the patients examined had received previous treatment in hospital, this consisting chiefly in aspirating as much of the fluid as possible, keeping the individual in bed for a few weeks, and then discharging him. A typical case may be cited. In September, 1932 the writer examined a young man aged nineteen who was extremely ill and had manifest signs of pulmonary tuberculosis in both lungs, particularly the right. He had been treated three years previously in a general hospital as a case of pleurisy with effusion, but beyond paracentesis and rest in bed nothing had

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<sup>1</sup> Hygeia, 1911, 73, 1105.

<sup>2</sup> Pierce, E.A.: Northwest Med., 1918, 16, 79. His figures were taken from the years 1905 to 1918. A review of the literature is given by Fishberg: Pulmonary Tuberculosis, vol. 2.

been done. He returned to work and continued at work until a fortnight before the writer saw him when he brought up a large quantity of blood. Such a case may quite reasonably be considered to have been tuberculous from the onset of pleurisy and that the pleurisy itself was simply the expression of an unrecognized phthisis. As is well known, the tubercle bacillus is seldom demonstrated on culture, and guinea-pig inoculation is advisable. Of twelve apparently sterile samples of pleural exudate withdrawn by the writer while medical officer in a sanatorium, every one set up tuberculous disease in guinea-pigs five or six weeks after injection. When no organism is found, and the case is doubtful, a guinea-pig inoculation should be carried out if possible.

Included in the above figures was one case of tuberculous pleuro-pericarditis which the writer saw in hospital in December 1931. The patient, a youth of 18, had a short rapid illness with continuous high temperature ending in wasting, cachexia and death. He showed clinical signs on admission of left-sided pleurisy with effusion, the fluid being straw-coloured, rich in lymphocytes, and apparently free from bacilli on culture. A few days after admission he developed acute pain over the precordium and an X-ray film showed enlargement of the heart shadow to the right of the thorax. A needle was inserted into the pericardial sac and a quantity of sero-sanguineous fluid withdrawn which yielded an abundant growth of tubercle bacilli in pure culture. An interesting pathological feature of the case was

the presence of a large number of organisms in the pericardial sac as contrasted with their exceeding scarcity in the pleural effusion<sup>1</sup>, It is of further interest to observe in this case that a younger brother aged sixteen developed pleurisy with effusion a few months later. It cleared up uneventfully and at the time of writing he appears to be well. The parents refused to allow him to go to the sanatorium for observation. Eighteen months later the writer was asked to examine the father who presented manifest symptoms and signs of advanced phthisis, there being extensive cavitation in both lungs. He gave a history of having suffered from "bronchitis" for at least ten years. In all probability he was the source of infection and had escaped detection earlier by refusing to be examined as a contact of his deceased son.

The fact that 17 per cent of the 550 cases of phthisis examined gave a definite history of pleurisy within five years previous to the onset of symptoms, while lower than the figures quoted by the authors cited above, is nevertheless sufficiently impressive to deserve comment. A more satisfactory estimation of the relationship between idiopathic pleurisy and pulmonary tuberculosis could be obtained if all cases of pleurisy met with or giving a definite history of recent pleurisy could be kept under observation for at least five years. For obvious reasons this is very difficult, not only because patients become lost sight of but also on account of the difficulty of obtaining a convincing history of pleurisy in a considerable number of cases. The writer has found from

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<sup>1</sup> v. Muir, R. Text-Book of Pathology, p.338, 2nd. Edit.

experience that even the statement of the medical attendant, that the patient is, or has recently been suffering from pleurisy, is not always to be relied upon, as a number of cases examined by him throughout the past four years who had been diagnosed as having pleurisy showed no clinical or X-ray manifestation of that disease. A period of four years is rather short on which to base any conclusion that can pretend to accuracy but it has been found on examining the case-histories of 3,563 persons examined as tuberculous suspects, that 450 of them gave either a moderately definite history of pleurisy within the previous five years or were suffering from pleurisy at the time of examination. Of this number 95 have developed pulmonary tuberculosis. The fate of some of the others is unknown, but a check can be kept on those residing in the writer's district who may develop consumption at a later date. It is worthy of note that 92 of the 95 patients in this series were over the age of 14 years, and that in the majority of them the course of the disease has been comparatively mild. The symptoms in the three children, however, were rapidly fatal. One of them, a girl of seven, who had been recovering from whooping-cough when pleurisy with effusion supervened, died within a few weeks from tuberculous meningitis.

One patient, a farmer, not included in the 95 cases cited above, developed a cold abscess over one of his ribs two years after an attack of pleurisy with effusion, and at operation a piece of carious rib was removed. The pleurisy occurred in 1929 and up till the present (1933) he has been free from pulmonary symptoms.

As far as is known, therefore, only about



one-fifth of the 450 cases of pleurisy occurring within a period of nine years have exhibited symptoms of pulmonary tuberculosis. An endeavour is made to keep under prolonged observation every case of pleurisy examined but as a proportion of these patients is migratory the actual number that have now developed tuberculous changes in the lungs is probably higher than 95. The period of observation, although short, is sufficient to indicate that one should not be unduly pessimistic over every case of pleurisy. J.P.Bramwell<sup>1</sup>, for example, reported 21 cases of pleurisy kept under observation for a long period of time, of whom only three died of phthisis, while Coriveaud<sup>2</sup> observed 27 cases for many years only four of whom died of tuberculosis. "That the menace of tuberculosis", writes Fishberg<sup>3</sup>, "however significant, is not threatening every patient, is attested by the experience of physicians of long years in practice; they all have many patients who have had pleurisy, dry and with effusion, and remained well for years. To be sure, in hospital practice we encounter patients who have become tuberculous after pleurisy, but those who remain well do not come into hospitals. It is therefore important to bear in mind that while a large proportion of cases of pleurisy is due to tubercle, not all cases are, and not every one develops active and progressive tuberculosis subsequent to an attack of pleurisy. In fact, more than three-fifths the number of patients with pleurisy pass through life without developing phthisis". He also points out that even when pleurisy is due to the

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<sup>1</sup> Edin. Med. Jour. 1880, 2, 909.

<sup>2</sup> Jour. de Med. de Bordeaux, 1887-88, 17, 601.

<sup>3</sup> Pulmonary Tuberculosis, vol.2. p.98, (4th.edit.)

tubercle bacillus, active pulmonary tuberculosis does not follow in all cases<sup>1</sup>.

Haemoptysis. The spitting of blood or even of blood-stained phlegm has from time immemorial been associated with pulmonary tuberculosis. "The spitting of blood is followed by the spitting of pus" was an aphorism of Hippocrates, who believed that haemoptysis was frequently followed by phthisis, a belief that prevailed until the beginning of the nineteenth century when it was declared by Laënnec simply to be an indication of pre-existing tubercles. "It is very certain the presence of tubercles in the lung is the most frequent occasional cause of haemoptysis"<sup>2</sup>. Of the 550 patients who were diagnosed as suffering from pulmonary tuberculosis, haemoptysis occurred in 143 or 26 per cent. It was an early symptom in 91 (16.5 per cent) and occurred at a later stage in 52 (9.5 per cent). Forty-five of the 52 patients had been diagnosed earlier from other symptoms. The amount of blood brought up varied from a little streaked sputum to a brisk haemorrhage which actually proved fatal in at least three cases.

In 127 of the 143 patients whose clinical symptoms were associated with the bringing up of blood, the presence of tubercle bacilli was detected; in most of them organisms were found from one to three weeks of their being referred to the writer. A typical history was that of cough of fairly definite duration preceded or accompanied by an indeterminate period of languor and the appearance of frothy bright red phlegm or unaltered blood itself, which was nearly always followed for a

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<sup>1</sup> Ibid, vol.2. p.98.

<sup>2</sup> Laennec: Auscultation Médiante, 1809, trans. by Member of Royal College of Physicians, 1846, p.309.

Number  
having  
Haemophys.

40

30

20

10

Under  
5

5  
to  
9

10  
to  
14

15  
to  
19

20  
to  
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to  
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30  
to  
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35  
to  
39

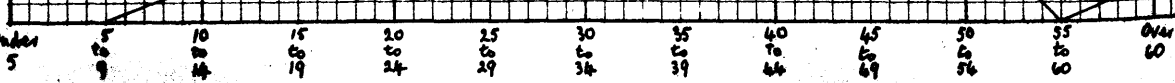
40  
to  
44

45  
to  
49

50  
to  
54

55  
to  
59

Over  
60



few days by sputum mixed with blood streaks or small clots. A few patients, mostly young adults, brought up at night while in bed, or early in the morning, a varying amount of pure blood which generally came up without effort and for no apparent reason. The initial haemoptysis occurred in most cases when the disease was fairly early and as it presented to the patient striking evidence that something was wrong, it may be considered a symptom of very great value. Three patients, not included in this series of 143 cases of haemoptysis, had severe epistaxis as prominent initial symptoms. There was a slight preponderance of men patients with haemoptysis over women (75 men to 68 women).

The following table shows the incidence in age groups of haemorrhage amongst the writer's cases. As one would expect there is a strong preponderance of young adults presenting this symptom, and also a moderate number of patients between the ages of 45 and 50. The latter group consisted largely of chronic fibrotic cases in whom the spitting of blood came on late in the disease; in some of them it was very severe, two cases having a fatal ending.

Table showing incidence of haemoptysis in 5-yearly age-groups amongst 143 cases:

10-14	15-19	20-24	25-29	30-34	35-39
2	27	36	30	10	2
40-44	45-49	50-54	55-60	over 60	
8	21	5	0	2	

Total 143.

These figures are represented on the attached graph.

Although nearly all (80 per cent) of the hæmorrhagic cases were found to have bacilli in the sputum soon after the initial examination, in 10 patients it was over three months before organisms were found, and 16 patients have hitherto remained sputum-negative. Most of the latter, however, have only recently been diagnosed, and it is possible, unless prevented by active treatment, that the sputa of some of them will be found to contain tubercle bacilli. They include two patients who have manifest X-ray signs of pulmonary tuberculosis but whose sputa have failed to reveal tubercle bacilli on frequent examinations extending over more than a year. In one case, not included in this series, the patient had a hæmoptysis in 1923. He was diagnosed as tuberculous by a colleague of the writer's although the sputum was negative. No less than ten negative reports were obtained until 1932 when, following several severe hæmoptyses, tubercle bacilli in large numbers were found. Such cases are rare in the opinion of the writer as he has not seen many patients for the first time with manifest signs and symptoms who gave a history of blood-spitting as long as two or three years previously, and whose sputa were still negative for tubercle bacilli. An initial hæmoptysis is such a dramatic symptom that the disease does not long escape being diagnosed. When hæmoptysis due to tuberculosis brings a patient to his doctor, physical signs are nearly always present.

It need scarcely be added that other symptoms may resemble or give rise to hæmoptysis, such as epistaxis<sup>1</sup>, bleeding gums, bronchitis, fibrosis of the lung with or without bronchiectasis, and diseases of the

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<sup>1</sup> Three cases of pulmonary tuberculosis had epistaxis as a prominent initial symptom.

cardio-vascular system, particularly mitral stenosis. A leaking aortic aneurism may cause a spitting of blood as likewise syphilis of the lung. Of the 3,563 suspected persons examined, 282 gave a definite history of the bringing up of blood or of blood-stained phlegm. When the 143 patients whose haemoptyses were due to tuberculosis are excluded 139 are left, 136 of whom were classified as non-tuberculous. A considerable number were miners suffering from chronic bronchitis. The following table shows the categories into which all persons in whom the spitting of blood or of blood-streaked phlegm was a symptom were placed:-

Pulmonary Tuberculosis	..	..	143
Epistaxis (3 patients tuberculous)	..	..	6
Pyorrhoea and stomatitis	..	..	10
Faucitis and naso-pharyngeal sepsis	..	..	14
Bronchitis	..	..	44
Pulmonary fibrosis with or without bronchiectasis	..	..	15
Asthma	..	..	1
Mitral stenosis	..	..	5
Myocardial disease and arteriosclerosis.			17
Aortic aneurism	..	..	2
Interstitial pneumonia (+ive Wassermann)			3
Neoplasm	..	..	5
No apparent cause	..	..	17

The last group, consisting chiefly of women between the ages of twenty and thirty-five, required prolonged observation lasting for fully six months and although some of them continued to complain of this symptom, no other indication pointing to phthisis could be found, and repeated physical and X-ray examinations failed to show anything suggestive of pulmonary tuberculosis.

A careful examination of the nasal sinuses by an expert laryngologist would probably have settled the diagnosis. Post-nasal discharge was a feature of these cases. No cases of so-called "vicarious menstruation" were met with; if they were, they were not recognised. One patient, a woman, in whom haemoptysis was the predominant symptom and whose sputum contained tubercle bacilli, was discovered to have dextrocardia.

As will be seen from the above figures, 136 persons who complained of the bringing up of blood, a number almost equal to the tuberculous, were not found to be suffering from phthisis. Many of them, particularly those grouped in the class "Bronchitis" were coal-miners, mostly elderly men, who had worked as coal-getters for many years. Their lungs all showed varying degrees of anthracosis, some being very extreme examples. Blood-stained sputum is by no means uncommon in this class. Most of the 17 cases of myocardial degeneration were also elderly miners. Degenerative cardio-vascular changes set in fairly early in life amongst men who follow this occupation. A few labourers from sandstone and granite quarries, who also had varying degrees of silicosis, also appear in these two groups and among the 15 classed as "Fibrosis". The single case of asthma was a young man aged 19 who worked as an attendant in a mental hospital. He did not present any physical signs referable to pulmonary tuberculosis but had several severe haemoptyses, and the writer sent him twice to the sanatorium for observation, on the second occasion at the earnest request of his doctor. Careful X-ray examination failed to show the presence of even a quiescent lesion in his lungs; his temperature remained normal throughout all the

exercise tests and the sputum failed to show tubercle bacilli on numerous inspections. In spite of the fact that he brought up quantities of blood at frequent intervals varying from a drachm to several ounces, his general physical condition showed little or no deterioration whatever, and he appears to be as well today as he was three years ago when first seen by the writer.

Some of these 136 cases, particularly young adults, required careful examination combined with numerous sputum inspections for tubercle bacilli before tuberculosis was excluded, and every one was X-rayed. This applied particularly to cases where no adequate reason could be found for the bringing up of blood. Most of these 136 cases, however, were over forty years of age and were obviously not suffering from phthisis. In fact, the correct diagnosis of the majority had been made by their doctors who simply sent them along for confirmation and advice if possible. The variety of their ailments gives one a good idea of the diversity of cases seen in a tuberculosis clinic. A few of them had been placed under what was to them the stigma of notification by medical men who confidently told them that they should give up their employment and enter a sanatorium. It is hardly necessary to say that if such advice had been taken the correct diagnosis would ultimately have been made in the sanatorium, but this would not have annulled an unnecessary amount of inconvenience and actual suffering to say nothing of needless expense to the ratepayers.

Rise of temperature provoked by moderate exercise and persisting after more than hour of rest.  
According to Daremberg<sup>1</sup> this "fièvre provoquée" gives conclusive evidence of phthisis. Without going so far as

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<sup>1</sup> Daremberg : *Traitement de la phthisie pulmonaire*, vol 2, pp. 75-81.  
Daremberg + Chuguet : *Histoire de tuberculeux guéris*, Comptes Rendus du Congrès internat. de la Tuberculose, 1905.



to assert this, the writer believes it to be of considerable value as an aid to the diagnosis of early tuberculosis when physical signs are indefinite, and when other conditions are ruled out, such as chlorosis, obesity, and the presence of septic foci anywhere, e.g. gums, nasal sinuses &c. The patient's temperature is taken, after which he goes for a walk of a mile and a half or two miles and the temperature is taken again. A rise of  $1^{\circ}$  or more is strongly indicative of phthisis, particularly in young adults. It must, of course, be correlated with other signs and symptoms. The temperature, moreover, still remains elevated for more than an hour of rest, sometimes two hours or over. In normal subjects a physiological rise in temperature may occur after exercise but it returns to normal within half an hour of rest. The test can be more accurately carried out at a sanatorium where each patient is under control than at a busy dispensary. Moreover it takes up a good deal of time and is not very satisfactory in those patients who have travelled some distance to be examined. In a few early cases, however, the writer has obtained satisfactory results where time permitted. In ten cases of pulmonary tuberculosis, for example, the patients who were all young adults complained of nothing further than a little cough and of lassitude particularly in the afternoons. Physical signs were indefinite in all of them and screening of the lungs gave ambiguous results in three. A moderately fast walk of ~~an hour~~<sup>a mile</sup> and a half, however, was sufficient to cause elevation of temperature in all ten, in some by as much as  $2^{\circ}$ , and also a marked increase in pulse-rate. Within two months each of the ten patients was found to have a positive sputum.

The value of such a test as this is appreciated when one considers the insidious onset of many cases of

phthisis, particularly in adults. An acute "cold" in the chest may leave a man with a cough which may be severe, or which may only consist of clearing of the throat in the mornings, and gradual loss of strength, although he may continue at his work in spite of it. Physical examination of the chest may not reveal any signs indicative of pathological changes in the lungs. As Fishberg<sup>1</sup> observes, a diagnosis of "cold" may be made and valuable weeks allowed to pass until someone thinks of having the sputum examined, or until a haemoptysis occurs, thus opening the eyes of the patient as well as those of the doctor. One of the most reliable manifestations of the toxæmia of early phthisis is an elevation of temperature after moderate exercise and the temperature remains elevated for more than an hour.

Another fact that may be mentioned with respect to raised temperature in tuberculosis is the lack of apparent physical discomfort even when the temperature is pyrexial, and the fact that appetite may not be much affected. "A patient suffering from phthisis", writes Goodall<sup>2</sup>, "may be quite comfortable with a temperature of 103° Fahr. while a patient suffering from typhus fever with the same temperature will be lying prostrate in bed with marked febrile symptoms". Of the 550 cases of pulmonary tuberculosis in this series, 310 attended the dispensary, some of them travelling considerable distances<sup>3</sup> even on foot. Of this number, 95 had a temperature of 100° Fahr. or over. Fifteen patients had a temperature at the time of examination of 102° Fahr. and in four the temperature was 103° Fahr. Only two of them

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1 Fishberg, Pulmonary Tuberculosis.

2 Goodall & Washbourne, Infectious Diseases, 3rd.edit.P.58.

3 In a few instances as far as 10 miles by bus and 2 or 3 miles on foot.

complained of undue discomfort, both fainting during examination. The others felt moderately well although sensations of chilliness and vertigo were experienced by some of them. None of these patients presented the appearance of one who is suffering from an acute pyogenic infection although the malar flush and sparkling eyes of some of them told its own tale. The extreme rapidity of the pulse in every case was a disquieting feature. A person whose temperature is 100° Fahr. or over, whose appetite is not much impaired, and who says that he feels moderately well, should be looked upon as a possible case of pulmonary tuberculosis and further investigated. An unexpected example of this occurred to the writer at the end of 1929 when he was examining the contacts of a young man who had gone to the sanatorium a few days previously. One of them was his sister, a young woman of twenty. She said that she felt quite well and that she was free from cough or other symptoms. Her temperature was 99.7° Fahr. and the pulse was 105. Physical signs were entirely absent. She refused to be X-rayed as this entailed a journey of ten miles to the central dispensary and the loss of an afternoon's work at a hosiery factory. Three months later her doctor asked the writer to see her. She was very ill and was totally confined to bed. Active disease in both lungs was manifest and she died two months later. Undoubtedly she had the toxæmia of early phthisis when first examined which expressed itself in moderate elevation of temperature and increase in pulse-rate.

Is the converse statement true, that failure to provoke a rise in temperature after moderate exercise is indicative of the absence of active pulmonary tuberculosis? The writer has never seen a patient under forty years of age with active pulmonary tuberculosis in whom

exercise failed to show an elevation of temperature, but he can point to several patients (chiefly men) over the age of forty suffering from old-standing chronic phthisis, in whom a walk to the dispensary of one mile failed to produce a rise in temperature of as much as 1°. The temperature in such cases gives little or no indication of the extent of pulmonary involvement, but physical signs are so obvious that no-one would think of introducing exercise tests to establish a diagnosis that can easily be made on other grounds.

The following case confirmed the writer in his opinion, as the result of a strenuous exercise test, that a person was not suffering from active pulmonary tuberculosis, if indeed he had tuberculosis at all:-

T.S. aged 37, discharged from the Army in 1917 as a case of pulmonary tuberculosis. Tubercle bacilli never found in sputum. On a hot afternoon in June 1933 he cycled 12 miles to the dispensary to be examined. Temperature on examination 98.3. Pulse 75. General condition moderately good. Physical signs consisted of slightly diminished air entry into both lungs and a few catarrhal crepitations at the bases. X-ray examination showed no evidence of pulmonary tuberculosis. Patient has drawn a pension for sixteen years as a case of pulmonary tuberculosis.

The presence of localised persistent râles heard above the second rib in front or the third dorsal spine at the back. On collating the records of the 550 patients in this series, it was observed that persistent localised râles in the above areas could be heard in 67 of them. In most of them, but not in all, percussion resonance was perceptibly impaired. It has to be remembered, of course, that râles "per se" are not

pathognomonic of phthisis, that their presence has to be correlated with any other signs, and that the disease may exist and be moderately advanced when there are no râles present. In the words of the late Clive Riviere this sign is frequently found in catarrh of all varieties of causation, and unless the râles are consonating or there is an accompanying loss of percussion resonance, there is no justification for any diagnosis beyond that of catarrh. Such cases should be referred for further investigation. In a patient who looks toxic, who has a cough, who has brought up some blood or who has lost weight and energy, a few sticky crepitant râles at the end of inspiration, particularly after coughing, are of great diagnostic significance. They continue and may be more numerous after coughing, or, if previously absent may be provoked by coughing. As the disease advances and softening sets in, the sounds become moist, have a consonating or resonant quality and can be heard throughout expiration as well as inspiration. Such sounds are well localised and can be heard best over the supraspinous fossa, and/or immediately below the clavicle; indeed, French clinicians have mapped out an area with great precision and given it the dramatic title of the "zone d'alarm", which is found by drawing a line from the space between the spinous process of the 7th cervical and that of the 1st dorsal vertebra to the tubercle of the trapezius on the spine of the scapula. A circle about an inch and a half in diameter whose centre is in the middle of this line constitutes the area in question<sup>1</sup>. According to Chauvet, this is the site where breath sounds are first heard to undergo alteration, becoming rough, granular, or cogwheel in character and

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<sup>1</sup> Chauvet: *Le Monde Médical*, 1913, 22, 1121;

*La Clinique*, 1913, 8, 437.

where crackles may first be heard at the end of inspiration. The writer is not prepared to assert that he has heard altered breath sounds more frequently in this precise area than in any other position above the third dorsal spine and is therefore not inclined to give it great significance.

A considerable proportion of the cases in this series had manifest tuberculosis when first seen and there was little difficulty in arriving at a diagnosis in 40 of the 67 cases mentioned at the beginning of this section; but in 27 cases the disease was sufficiently early to make the presence of altered breath sounds or inspiratory crepitations in the upper part of the lung, particularly in the supraspinous fossa, of diagnostic significance. The writer was asked to see a youth of 18, who, a week previously, for no definite reason and in the midst of apparently good health had brought up several mouthfuls of blood. He was acutely ill at the time of examination, the temperature ranging from 101°F. to 103°F. There was very little cough. In spite of the sudden onset of severe constitutional symptoms his doctor was unable to elicit any apparent abnormality on careful and repeated physical examination. The appearance of the patient was suggestive of acute pneumonic phthisis but on examination of the chest the only abnormality that could be detected was slight roughening of the breath sounds in the right supraspinous fossa accompanied at the end of inspiration by a few faint sticky crepitations. A week later, physical signs of active disease in this area had become manifest.

Another case referred for diagnosis was a man aged 37 who for the previous two or three months had been steadily losing strength and weight. Lassitude had become so extreme that the slightest physical effort was a

drudgery. As he had become increasingly anaemic his doctor had treated him on liver therapy, no apparent benefit resulting. There was a slight cough and clearing of the throat in the mornings, to which he had paid little attention. The patient's appearance on inspection alone was strongly suggestive of well established phthisis, but percussion resonance showed only slight impairment over the right supraspinous fossa and over the right clavicle while in the supraspinous area the breath sounds had assumed a roughened character and were diminished in intensity. The sputum was found to contain a small number of tubercle bacilli.

The above two cases illustrate a point that is insufficiently understood by many doctors, that the toxæmia of pulmonary tuberculosis may be much more intense and the prostration far more profound than the physical signs would lead one to expect. That a patient who is losing weight, who is running a pyrexial temperature and who has had a productive morning cough should not have physical signs that would be manifest to a tyro may seem strange, but the fact remains and it largely accounts for the large number of individuals who are permitted to sink into the final and hopeless stage of tuberculosis before the disease is recognised. It also helps to explain why so many cases of chronic bronchitis and bronchiectasæ are sent to the tuberculosis clinic. Such cases have adventitious sounds in plenty and one or two may also have tuberculosis, but a moderate experience should suffice for the diagnosis of the majority of them.

A parenchymatous lesion shown by X-rays in the infraclavicular region. Within recent years there has arisen a considerable difference of opinion as to the starting-point of pulmonary tuberculosis, the older view of

the pathologists that it commenced in the apex and progressed toward the base having been challenged by the radiologists, particularly Redeker<sup>1</sup> and Braeuning<sup>2</sup>, who hold that this opinion is not based on observation but on inference. Braeuning found that patients with apical lesions seldom develop active tuberculosis, this occurring in only 7 per cent of his patients with apical lesion under observation at the end of seven years. The conclusion of most workers who have combined clinical study with radiological observation is that apical lesions are seldom progressive however debilitated the patient may be and that the death-rate from this form of phthisis is not higher than that of the general population<sup>3</sup>. Without entering into controversy, it may be said with reasonable certainty that in most cases of progressive pulmonary tuberculosis the earliest lesion demonstrable by X-ray means is situated in the infraclavicular region, while the apex remains clear. This opinion was foreshadowed as long ago as 1882, when radiology was unknown, by William Ewart<sup>4</sup> in the Goulstonian Lectures for that year, who said that "a careful diagnosis will not fail to convince us that the early consolidations are more commonly seated in the infraclavicular region than in the apex". A few years later Sir J. Kingston Fowler<sup>5</sup> declared that "the extreme apex of the lung is not often the site of the primary lesion. It is situated from one inch to an inch and a half below the summit of the lung". The opinions of Ewart and Fowler did not receive the attention they deserved and the lung apex held

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<sup>1</sup> Redeker and Walter, *Entstehung und Entwicklung der Lungenschwindsucht des Erwachsenen*, 1929 (2nd. edit.)

<sup>2</sup> Braeuning, *Beitr. z. Klin. d. Tuberk.* 1928, 51, 1.

<sup>3</sup> Douglas, *Amer. Rev. Tuberc.* 1929, 19, 153; 1930, 21, 305.

<sup>4</sup> Ewart, *Brit. Med. Jour.* 1882, 1, 369.

<sup>5</sup> Fowler. *The Localization of the Lesions in Phthisis*, 1888.



its place in the minds of clinicians as the primary seat of infection until the entire question was revived by the radiological work of Assmann<sup>1</sup> in 1923, and Wessler<sup>2</sup> in the same year. In 1924 a series of cases was reported by Assmann<sup>3</sup> under the heading of "A Typical Form of an Isolated Tuberculous Lesion as the Clinical Beginning of the Disease". These cases had a short history of ill-health, little or no physical signs and a typical radiological appearance. Both Assmann and Wessler pointed out that the initial lesion appears on the screen or film as an exudative broncho-pneumonic process varying in size from a small patch about the size of a pea to a large diffuse shadow extending across the lung, that such a patch is usually irregular in outline, and that the centre is denser than the periphery. Such a patch is usually found on a level with the third or fourth rib, near the axillary portion of the lung, and, as it may be partially concealed by a rib it is usually as well to screen the patient in order that he may be turned round, or better still, to take stereoscopic films. Such is the opinion generally held at the present time and it is in accordance with the experience of the writer throughout the past seven years.

The demonstration of such a lesion by X-rays may be the only evidence obtainable that a pathological change is taking place in the lungs although its existence may have been suspected on clinical grounds, and the writer has not hesitated to make a diagnosis of pulmonary tuberculosis, even when the sputum was negative, in a few cases in whom constitutional symptoms were present, in whom the X-ray

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1 Assmann: Beitr. z. Klin. der Tuberk., 1923, 60, 526.

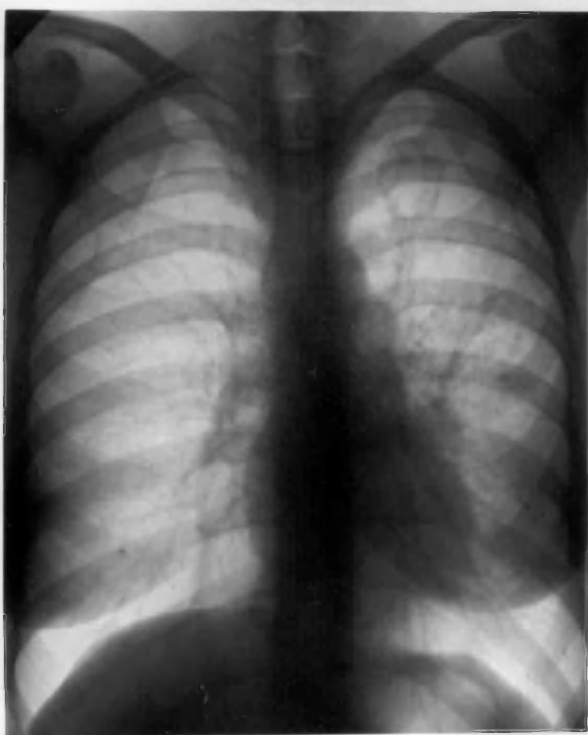
2 ~~Jacks~~ Jacks and Wessler: "Clinical Roentgenology of Diseases of the Chest", 1923.

3 Assmann: Beitr. z. Klin. der Tuberk, 1924, 60, 527.

picture showed a parenchymatous exudative lesion below the shadow of the clavicle but in whom physical signs were not evident. The number of such cases seen for the first time at a tuberculosis clinic is small, and it is generally the saving grace of a brisk haemoptysis that brings such patients under the notice of the tuberculosis officer. Three examples may be cited:

1. R.S., Bank Clerk, aged 23 years. Cough, night sweats and lassitude for two months. Brought up several mouthfuls of blood a week before examination. Physical signs indefinite. Screening showed a circular shadow about one inch in diameter in the infraclavicular zone. Sputum negative at first but positive result obtained a few weeks later. No films were taken in this case.

2. Female aged 24. Five months history of cough, lassitude and loss of weight. Physical signs present. Skiagram shows an infraclavicular cavity draining into a bronchus, and also spread of disease towards the middle zone of the left lung.



3. Female aged 34. Five months history of cough. Physical signs indefinite, sputum negative. Skiagram shows

infiltration in the lower zone of the right lung in the neighbourhood of the hilum.



Cases such as the third above have been described by Redeker<sup>1</sup> in which the infiltration occurs in the middle zone or lower lobe of the lung. Unfortunately, in a busy dispensary where one has to combine the screening of a large number of patients with other routine work such as artificial pneumothorax refills, it is very difficult to obtain films of suitable cases of early infiltration.

The fluffy shadows of exudative disease are, of course, typical of pulmonary phthisis in young adults. They are rapid in onset and in spread, and when conditions are favourable respond quickly to treatment. Of the 550 patients investigated, 110 were young adults below the age of 25 showing the above type of disease. In the majority of them, however, X-ray examination showed disease that was too pronounced for a hopeful prognosis to be given. In some instances, broncho-pneumonic spread had taken place into the other lung. Of the 110 patients mentioned, it has been possible to collect 17 in whom one or two ill-defined patches

of exudative disease could be seen. Screening has its limitations for this type of work. There is a strong opinion in Germany<sup>1</sup> that cases of early infiltration have at some time been in close contact with an open case of tuberculosis. The writer's figures are too small on which to base an opinion, only three of the 17 cases mentioned having been to his knowledge in contact with an open case.

Of the "stringy" shadows of fibrotic disease as seen in adults suffering from chronic tuberculosis, little need be said except that such patients constitute the greater part of the clientele of every tuberculosis dispensary. The elongated fibrous-tissue shadows, the nodular opacities where tuberculous foci have been obliterated by fibrous tissue, the irregular cavities, the areas of pleural thickening and adhesions are all indicative of fibrotic or proliferative disease, a disease whose chronic course may last for years. Such cases are not difficult to diagnose. Socially and economically they are a burden to themselves, their relations and the ratepayers, many of them becoming the recipients of public assistance. They are nearly all chronic carriers of infection. Many of the writer's patients are of this type and the disease is usually well established when they come under observation, "chronic bronchitis" or "general debility" having been the labels attached to them by their doctors many months or even years previously.

Cases have been referred to the writer in whom pulmonary tuberculosis was suspected on account of limitation of movement of the diaphragm on screening. Attention was drawn to this over thirty years ago by F.H. Williams who considered it to be diagnostic of early tuberculosis and that it was due to loss of elasticity of the lung tissue. Further

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<sup>1</sup> e.g. Rehberg & Zürcher: Zeitschr. f. Tuberk, 1928, 50, 370. They found open contacts for 50 per cent of their cases of early infiltration. See also Morlock: Tubercle, 1929, March, 267; Morlock: Tubercle, 1930, January, 148, for description of early infiltration in adults over 25 years of age.

investigation by Fishberg and others, however, has shown that the cause is more probably pleurisy with involvement of the phrenic nerve in adhesions. The writer has never seen limitation of diaphragmatic movement in either early or well-established disease of the lungs in which there was no co-existing pleurisy; in fact, he looks upon limitation of diaphragmatic movement as an indication of pleurisy.

In a thesis of this size it would be impossible to give a full account of each of the numerous and diverse symptoms met with in the cases examined that could directly or indirectly be referred to phthisis. Such symptoms as cough, production of sputum, lassitude, loss of weight, night sweats, loss of appetite, pain in the chest, occur with such frequency that any attempt to assess their importance from their severity or frequency would be futile. This work has recently been done with a fair amount of success by L.R. Williams and Alice M. Hill<sup>1</sup>, who, in an investigation of the histories of 1,499 patients found that the five symptoms of tuberculosis that appeared in greatest number were, in order, cough with or without expectoration, lassitude, loss of weight, loss of appetite, and pain in the chest, pleuritic or otherwise. "The entrances are many, however sole the exit", wrote a layman, himself the victim of phthisis. There are three interesting groups of symptoms, however, which have impressed themselves upon the writer as being of considerable interest and importance. They are cardio-vascular symptoms, gastro-intestinal symptoms and amenorrhoea.

That palpitation in young people who are also anaemic may be an indication of early phthisis has long been recognised, and may account for the saying that when a patient

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<sup>1</sup> Williams and Hill. Tubercle 1930, April, p.312.

complains of palpitation it is as well to examine his lungs and to examine his heart when he complains of dyspnoea. As the two symptoms are frequently met with in the same patient the dictum cannot be considered to have very much value. Of the 550 patients in this series, ~~109~~<sup>99</sup> were between the ages of fifteen and twenty, and palpitation was a prominent and early symptom in seven of them, of whom six had haemoptyses, more or less severe, but the small number would not justify one in concluding from the cases in question that there is a relationship between palpitation and the spitting of blood. In two young women it was very pronounced, the excitement of being examined occasioning such acute vaso-motor disturbance that adequate examination was out of the question. In each case there was violent fluttering of the heart, precordial distress, sweating and pallor alternating with flushing. Attacks, less severe, are not infrequently encountered and the writer has been sufficiently impressed by them to take care, when giving a refill of air to a young adult undergoing artificial pneumothorax treatment, that the anaesthetic is free from adrenalin<sup>1</sup>. Beyond making the statement that this symptom is a manifestation of the toxæmia of tuberculosis resulting in anaemia and disturbance of the sympathetic nervous system it is difficult to give an adequate reason for it. It is not surprising, therefore, that such patients, when seen for the first time should be suspected of having heart-disease, incipient Graves' disease or even neurasthenia. A careful examination of the patient will reveal other symptoms more consistent with tuberculosis, and signs are not likely to be absent from the chest. A phthisical patient may have

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<sup>1</sup> Several proprietary anaesthetics on the market contain small quantities of adrenalin hydrochloride. On giving a refill to a girl aged eighteen at her home, the writer used for the first time a preparation called "Novutox". Almost immediately after the injection of a few minims the patient cried out "Oh, my heart", and suffered from such violent palpitation that the proceeding was delayed for nearly an hour. The refill was then given with novocain.

neurasthenia; he may even have cardiac disease, but he is very unlikely to suffer from hyperthyroidism, although the literature on the subject is not wanting in cases.

Exophthalmos may occasionally develop in an adult with old-standing fibrotic disease<sup>1</sup> but the other manifestations of this type of goitre are seldom if ever found.

Apart from the subjective symptom of palpitation, tachycardia is very frequent in all stages of phthisis; indeed, the pulse is accelerated out of all proportion to the height of the temperature. A patient with a temperature of 100°F. may have a pulse-rate of 120 or more. In the present series of 550 cases, 180 persons of all ages, or nearly 33 per cent had a pulse-rate of over 100 when first examined. In 25 cases, 20 of whom were young women, it was over 120<sup>2</sup>. As the pulse-rate was taken by a nurse some time before the patient was examined, and in another room from that of the writer, it is unlikely that nervousness would play much part in the acceleration of the pulse, although this has to be considered.

With respect to arterial tension it is a well known fact that hypotension is the rule in pulmonary tuberculosis. Of 300 patients in a sanatorium belonging to all ages and in all stages of the disease, who were examined by the writer, only one patient had a systolic blood-pressure as high as 140 mm. Hg. He was a man of forty-five years whose arteries were sclerosed, and who had a pronounced "arcus senilis"; he had suffered from chronic fibrotic disease in both lungs for a considerable number of years. Amongst the others, the systolic blood-

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1 The writer has seen one such, extreme exophthalmos coming on after the patient, a man over 40, had been ill with tuberculosis for seven years. He did not have Graves' disease.

2 This includes the seven cases of palpitation in the preceding paragraph.

pressure ranged between 90 and 110 mm. Hg. No apparent relationship could be found between the blood-pressure and the occurrence of haemoptysis. Only a small number of the 550 patients in this series have had their blood-pressures taken by the writer but he has become so impressed by its value as a diagnostic aid that he now employs the sphygmomanometer on every adult patient examined. If a low blood-pressure is the rule in active pulmonary tuberculosis can one say with certainty that a patient with a high blood-pressure is not suffering from this disease? Is an elevated blood-pressure antagonistic to tuberculosis? It is well to hesitate before making a diagnosis of pulmonary tuberculosis in the case of persons whose blood-pressures are high, even amongst the elderly. The writer has never seen active phthisis in a person whose systolic blood-pressure was over 150 mm Hg.

It may be said in brief, therefore, that in active tuberculosis the pulse is rapid, or more rapid than one would expect from the temperature, and the arterial tension is low.

With respect to gastro-intestinal symptoms, there is one symptom occasionally seen in early phthisis that is not a true gastric symptom in that it is not accompanied by any sign of indigestion, but which nevertheless deserves mention, namely, the emetic cough or cough ending in vomiting, ("signe de Morton", or "toux émétisante" of French authors)<sup>1</sup>. It usually comes on at the end of a meal, the patient experiencing a sensation of fulness in the epigastrium accompanied by a tickling in the throat. Coughing results and continues

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<sup>1</sup> v. Paillard: La toux émétisante des tuberculeux, Paris, 1911.



until vomiting supervenes. When the stomach has been emptied the patient obtains relief and the coughing ceases. It is probably a reflex action due to irritation of the gastric ends of the vagus by stomach contents and hyperexcitability of the respiratory centre in the medulla. There is little or no nausea or impairment of appetite. This annoying symptom occurs in probably more than 30 per cent of all cases of pulmonary tuberculosis at some time in the course of their illness and it is a symptom of sufficient frequency early in the disease to be of diagnostic significance. In the present series of cases it was a prominent early symptom in 35 or 6.4 per cent, in all of whom the sputum contained tubercle bacilli. Other diseases, of course, must be excluded, particularly whooping-cough, the pharyngitis of chronic alcoholism, and cancer of the lung. Every sanatorium physician is familiar with the emetic cough of Morton, as it is a difficult symptom to treat effectively.

Patients are occasionally met with who present at the onset of their illness abdominal symptoms such as dyspepsia, diarrhoea, fulness after eating, and flatulence. They are not very numerous as examples of incipient phthisis although the writer can detect 17 cases (3 per cent) in his series in whom gastro-intestinal symptoms were sufficiently severe to mask the clinical picture. Some of them were disastrous, the medical attendants being completely misled before the true state of affairs was realised. In ten of them, at least, pulmonary phthisis could have been diagnosed reasonably early if the obvious symptoms had been correlated with more characteristic symptoms some of which were invariably present. For example, every patient had a productive cough, in a few instances the phlegm being blood-stained; they all ran

pyrexial temperatures and tachycardia was evident when the pulse was counted. Yet many of them were assiduously dieted on large quantities of milk and raw eggs by well-meaning but misguided doctors. Less than half-a-dozen of these seventeen patients were seen by the writer at a time when sanatorium treatment could be expected to yield beneficial results. Two examples may be taken.

Case 1. Mrs. G.M. whose previous health had been good consulted her doctor on account of epigastric pain and discomfort coming on almost immediately after the ingestion of food. Pyrosis and flatulence were annoying concomitants. A slight morning cough which caused her to "clear her throat" in the mornings had been present for several weeks but this was overlooked. There was a moderate degree of anaemia present. Dietetic treatment failed to yield beneficial results, and she was advised to see a surgeon as a likely case for gastroenterostomy. The surgeon, however, decided not to operate. Dietetic treatment continued, until, six months after the onset of symptoms, the patient, convinced that she was receiving little or no benefit changed her doctor. The new physician referred her to the writer as he was "dissatisfied with the state of her lungs". When seen by the writer she was totally confined to bed and showed a moderate degree of anaemia and wasting. The temperature was swinging between 99° and 102° or 103° and the pulse was never below 100. Physical examination of the chest showed active and well established tuberculosis in both lungs. As she was confined to bed at home an X-ray examination could not be made. The abdomen was slightly scaphoid and there was tenderness above the umbilicus. There were no enlarged glands to be felt and the omentum

was not palpable. The bowels were confined. The sputum contained tubercle bacilli in moderate numbers. On being placed on a liberal diet this woman improved sufficiently to enable her to go to the sanatorium where she remained for six months, the abdominal symptoms having greatly diminished on her return. If the patient's original doctor had examined her chest with a reasonable degree of care the true nature of the illness would have been detected at an earlier stage.

Case 2. W.D. an ex-service man, aged 47. He had been a prisoner-of-war in Germany where he had suffered from pleurisy with effusion. He made a good recovery but pleurisy recurred in 1927 after which he had been troubled with a little cough. For a year before being referred to the writer he had suffered from epigastric pains coming on immediately after food, sickness, and occasional diarrhoea. His doctor steadfastly dieted him on milk and raw eggs until pulmonary symptoms became so pronounced and wasting so extreme that it occurred to him that it might be worth while to have the sputum examined. This was found to contain tubercle bacilli in large numbers. When the writer saw the patient he had the Hippocratic facies of advanced consumption and died a few days later. In a case such as this a consideration of the previous history should have been sufficient to put the doctor on his guard.

In spite of the fact that the true nature of so many of these gastro-intestinal cases is overlooked, it would be untrue and unfair to assert that general practitioners are not alive to it. The writer finds on surveying his records that he has examined no fewer than 230 adults with various abdominal complaints who were

suspected to be suffering from pulmonary tuberculosis. Seven of these were fairly early cases of phthisis.

That amenorrhoea can be associated with phthisis has been known from ancient times. Hippocrates, for example, cited amenorrhoea as a cause of phthisis. It is now understood to be a manifestation of the disease and a frequent one in those women who suffer from advanced pulmonary tuberculosis. This is understandable when one considers the disordered metabolism and calcium deficiency of the patient in the later stages of tuberculosis. In a small number (eight)<sup>of</sup> young women, in seven of whom the disease was acute and in whose lungs it showed rapid spread, amenorrhoea was a symptom from the onset and of sufficient prominence to obscure the clinical picture. There are not many young women in whom cough or loss of weight will occasion as much concern as a hiatus in their menstrual periods, so that when this does occur it is the symptom of which they complain most to the doctor. In the eight women concerned a cessation of the menses was the chief complaint and it was only from the fact that they looked ill that intrapulmonary disease was suspected. They were all under 25 years of age, six being under the age of twenty and in seven the disease was acute in onset. Five of them responded well to artificial pneumothorax treatment. Two cases may be cited to illustrate the difficulty in making a diagnosis:

Case I. G.P. aged twenty-four complained to her doctor two years previously that her periods were in abeyance, that she had lost strength and weight and that she had a cough. As she looked anaemic she was treated accordingly,

the menstrual flow returning in six months after its cessation. Lassitude and cough continued although she remained at her work in an artificial-silk factory, in spite of her disability, for two years. At the end of this time she was referred to the writer by another doctor with the complaint that she had not had a menstrual period for nearly three months. On examination she was thin, ill-looking, anaemic and dyspnoeic. Temperature was 100° and pulse 125. Physical examination of the chest elicited signs of old-standing fibrotic disease, and the sputum contained tubercle bacilli in moderate numbers. Undoubtedly this was a case of pulmonary tuberculosis of at least two years duration and the cessation of the menses and anaemia were only symptoms. The original doctor failed to recognise the disease that lay behind them.

Case 2. A girl aged eighteen, whose previous health had been good and whose family history was negative for tuberculosis, complained to her elder sister that her periods had been in abeyance for over two months. Her sister who had recently been under the care of a surgeon brought her along to him. This gentleman, after making a pelvic examination, failed to find any abnormality and referred her to her own doctor. The doctor at first was frankly puzzled, but on questioning her closely, obtained the information that she had had a cough for three months, that she was sweating at night and that she had lost weight. He informed the writer that he had to "dig this information out of her". The sputum was found to contain tubercle bacilli in moderate numbers. When seen by the writer she had been in bed for a week during which time the temperature had ranged between 100° and 102° F. The pulse was 110. She was pale and ill-looking and there

were physical signs in the lungs of active pulmonary tuberculosis. The X-ray picture attached shows pronounced exudative disease involving the upper two-thirds of the left lung, and a cavity commencing below the left clavicle. There is also a secondary diffuse infiltrative process extending throughout most of the right lung. The patient's doctor assured the writer that the physical signs were much less pronounced only a fortnight previously, which, considering the apparent lack of resistance of the patient is quite credible. In this instance, even with a careful and painstaking examination, the disease had already become pronounced by the time it was detected and the clinical history of this case is not far removed from those of the other patients in the same category examined by the writer.



In all the other women examined, with the exception of four who were pregnant, there was no history obtained of any pronounced abnormality in menstruation.

In the foregoing pages nothing has been said about the diagnosis of pulmonary tuberculosis in children, and this thesis cannot be concluded without a few references being made to this thorny and controversial subject. The words of warning concerning the facile diagnosis of pulmonary tuberculosis given at the beginning should here be repeated with emphasis, and the examiner should carefully consider every other relevant possibility before deciding that a child is suffering from pulmonary tuberculosis. The writer has learned from experience, both in the sanatorium and in dispensary work, to adopt a cautious and conservative attitude with respect to phthisis in children. It is a well known fact that active or clinical pulmonary tuberculosis is a very uncommon disease in children between the ages of two and fifteen. The generalised form of the disease with acute symptoms and rapid progress that occurs in infants may be omitted here as practically all the children whom the writer has had occasion to examine were above the age of two years.

The total number of children examined as possible cases of phthisis during four years amounts to 761, and of these 490 were contacts examined in the normal routine of the dispensary. Nearly all the above cases, including contacts, were screened, as well as subjected to careful physical examination. At first the Mantoux intradermal test consisting of the injection into the skin of the forearm of 0.1 c.c. of 1 in 1,000 Old Tuberculin was employed as part of the examination, but so many positive results (particularly in contacts) were obtained in children who presented no clinical symptoms that it was given up as tending to cloud the issue. In the case of contacts, this

test, as being an expression of the allergic response of the individual to tuberculous infection, could only be expected to be positive, and throughout the past two years the writer has restricted his use of the Mantoux reaction. Of the 590 contact children, seven (1.4 per cent) were notified as having pulmonary tuberculosis and referred to the sanatorium for treatment. In all seven cases, cough, loss of weight or failure to gain weight, anaemia, and loss of appetite were the chief symptoms. They were described by their parents as "ailing". These seven contact cases showed a marked degree of hilum enlargement on X-ray examination and they have all progressed favourably. The Mantoux reaction in each was strongly positive.

The remaining 271 children were referred by their doctors or by the Infant Welfare and school medical clinics for examination, and of these 29 (10.7 per cent) were notified by the writer. They have been classified into the following categories:-

- |    |  |     |     |    |
|----|--|-----|-----|----|
| 1. | "Adult type" of disease and tuberculous broncho-pneumonia.   | ... | ... | 5  |
| 2. | Miliary Tuberculosis   | ... | ... | 2  |
| 3. | Pleurisy with effusion   | ... | ... | 3  |
| 4. | "Juvenile type", i.e. cases showing calcareous nodes in the lungs and calcareous deposits (Ghon's tubercles) in root lymph glands; the so-called "hilum" tuberculosis (all Mantoux positive) | ... | ... | 19 |

There were no cases seen that could be considered to correspond to that clinical condition described by Eliasberg and Neuland<sup>1</sup> under the title of "epituberculosis", although the writer would not

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Eliasberg, H. & Neuland, W. Jahrb. f. Kinderheil, 1920, 93, 88; 1921, 94, 102.



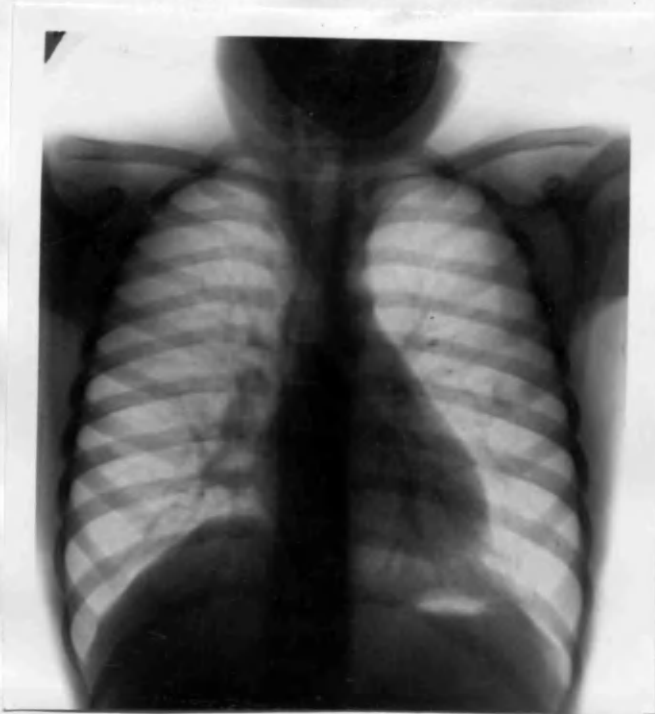
maintain from its apparent absence in his cases that it is so much of a clinical curiosity as has been suggested by some authors. Its absence from the above cases is largely accounted for by the fact that it is met with far more frequently in children under the age of two years, many of whom do not appear to be strikingly ill. Its apparent rarity may be due to the fact that it is seldom diagnosed.

Of the above 271 children, 52 were reported to have been, at some time, in close contact with a patient suffering from phthisis, but only 40 of these were Mantoux reactors, a positive result being obtained with 1 in 1,000 tuberculin. The remaining 12 might have reacted to an intradermal dose of 1 in 100 tuberculin but this was omitted. As far as could be ascertained, eleven of the 29 notified cases had been in contact with tuberculous patients.

Of the total 761 children examined, therefore, in not more than 36 (4.7 per cent) did the signs and symptoms appear to the writer to be such as to warrant a diagnosis of pulmonary tuberculosis, and of these, 26, or more than two-thirds belonged to that somewhat nebulous and elastic group known as "hilum tuberculosis". The children placed in this category presented symptoms of ill-health in the shape of cough, lassitude, failure to put on weight, and loss of appetite. They looked below par at the time of examination and in a few of them physical signs indicative of enlarged mediastinal glands could be detected, but an X-ray examination in every case was necessary to establish a diagnosis of hilum tuberculosis.

The attached skiagram illustrates one of these cases, a boy of <sup>five</sup>~~six~~ years whose father had active

pulmonary tuberculosis and a positive sputum. He was diagnosed as a case of hilum tuberculosis.



A close study of this group has been made by Opie and McPhedran<sup>1</sup>, who insist on the care with which "nodes" should be diagnosed especially in the median half of the lung fields where bronchi seen end-on may be mistaken for them. It is worthy of note, as Fishberg<sup>2</sup>, Burton Wood<sup>3</sup> and others point out, that the juvenile type of infection can only clearly be recognised after calcification has taken place and when immediate danger is over. It is undeniable that the tracheo-bronchial glands are a favourite site for tuberculous infection and that they may rupture to set up widespread tuberculosis. The greatest care, therefore, has to be exercised that no case properly belonging to this group should be excluded, but the problem of including the proper children and excluding

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<sup>1</sup> Opie & McPhedran: Amer.Rev. of Tuberc. 1926, 14, 347.

<sup>2</sup> Fishberg: Pulmonary Tuberculosis, Vol II, p.42, (4th.edit)

<sup>3</sup> Burton Wood: Tubercle, 1929, I, 10.

others remains an exceedingly difficult one, and the "juvenile" or "hilum" case continues to be one of the most exasperating with which a doctor can be confronted. Most of these children would do as well in the pre-ventorium or open-air school as in the sanatorium.

It has already been stated that upwards of nine-tenths of the children sent by their doctors to the writer were dismissed as unlikely to be suffering from pulmonary tuberculosis. The diseases accounting for this large exclusion may be briefly summarised:

1. Bronchitis was considered to account for 120 (50 per cent) of the remaining 242 children. In every case there was a history of cough more or less continuous but recurring with greater severity every winter or during wet weather. None of the children in this category appeared to be unduly upset by their symptoms, although, developmentally, they were below normal. Many of them suffered from naso-pharyngeal sepsis, enlarged tonsils and adenoids, while dietetic errors formed a prominent place in the histories of a large number. Adventitious sounds in the shape of râles and ronchi were general rather than localised to any particular area and the X-ray picture showed well-marked bilateral striations without loss of translucency in any part of the lung fields.

2. "Chronic pulmonary catarrh". Under this generic title Leys<sup>1</sup> grouped such conditions as "unresolved pneumonia", "recurrent basal bronchitis", "chronic interstitial pneumonia", and "pulmonary fibrosis". The writer found evidence of chronic pulmonary catarrh in

65 of the 242 non-tuberculous children examined or nearly 27 per cent. Each of these cases had a history of pneumonia with or without measles or whooping-cough, recovery from which had been slow and unsatisfactory. The disease in most cases had occurred in infancy or early childhood. The thorax nearly always showed faulty development and the fingers of a few of them were clubbed. Recent decided falling-off in health was not a feature in these children. All of them had a varying degree of bronchiectasis. Physical signs indicated fibrosis at one or both lung bases, and, on screening the patient, increased linear striations and diminished translucency could be seen between the hilum and diaphragm. The upper zones of the lungs were clear. Lipiodal was not used as a diagnostic aid in these cases. Here again, naso-pharyngeal sepsis was a common accompaniment.

3. Of the remaining 57 children many were found to be suffering from malnutrition, in whom sepsis, e.e. otitis media, rhinitis, played an important part. A few had infections of the urinary tract and some had latent rickets. Chorea, with or without rheumatic carditis accounted for an appreciable number. Most of these children came from poor homes.

Pervading the above three groups were children presenting that form of intestinal dyspepsia which received from Eustace Smith the name of "mucous disease", and the two characteristic symptoms of wasting and cough rendered the exclusion of phthisis a necessity. Most cases were between the ages of five and eight, they were languid and peevish, had variable appetites and were constipated. In many of them a definite history of

jelly-like material covering the stools was obtained and a history of worms was frequent. Varying degrees of albuminuria were found in such children and the urine always contained a large quantity of urates. Examination of the tongue and throat was always sufficient to make one sceptical of tuberculosis. The tongues of such cases were furred and the fungiform papillae were enlarged, while in some, irregular patches of denuded epithelium gave the tongue a mapped-out appearance, the so-called "geographical tongue". The throats of all these children were unhealthy, chronic pharyngitis and faucitis, enlarged tonsils, and exuberant adenoids being invariably met with. The carrying out of simple advice on diet combined with the removal of unhealthy tonsils and adenoids was usually sufficient to clear up their symptoms<sup>1</sup>.

Most of the important ailments that the child is heir to are seen at every tuberculosis clinic and have to be excluded before one can reply to the question whether or no the child has pulmonary tuberculosis. The difficulty in answering this question becomes apparent when one considers the numerous delicate or debilitated children who every year are labelled "tuberculous", who succeed in reaching an uneventful adult life and who never again require examination as possible cases of phthisis. One would like to believe that in every instance the diagnosis was correct and that the disease became arrested or cured before reaching adult life. The writer's experience of tuberculosis, however, has induced him to be very suspicious of juvenile tuberculosis that cannot be proved. A certain observation which

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<sup>1</sup> v. Hutchison R. Lectures on Diseases of Children, 1931, p.171. (6th. edit.)

appeared to be at least curious, occurred to him when he was a resident medical officer in a sanatorium.\* In this institution there was a large annexe containing about 100 children who had been notified as suffering from pulmonary tuberculosis, and it had been used for a considerable number of years to harbour presumably tuberculous children. Out of 300 adult in-patients, however, seen by the writer in the course of a year, he met with only one who had received treatment in the annexe as a child. The childhood of all the others was healthy. The conclusion appears to be that the tuberculous boy is not the father of the tuberculous man, and that large numbers of badly nourished delicate children are diagnosed and notified as tuberculous without sufficient evidence.

Three groups of cases are given by Burton Wood<sup>1</sup> in which a diagnosis of pulmonary tuberculosis and notification are called for, and they are worth quoting:-

1. When physical signs indicate disease of adult type and tubercle bacilli are found in sputum, gastric contents, or faeces. Also, when with signs of broncho-pneumonia, tubercle bacilli are found.
2. When signs or symptoms of miliary tuberculosis are confirmed by X-ray evidence.
3. When pleurisy with effusion is present, and is not due to any other demonstrable cause (e.g. rheumatism).

It is the opinion of the writer that when the clinical condition of an ailing child does not fit into any of the above three groups, a diagnosis of pulmonary tuberculosis should be withheld until every other possibility has been considered and excluded. But the so-called "juvenile type" is the group that creates most

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<sup>1</sup> Burton Wood: Tubercle 1929, I, 12.

\* City of Leicester Isolation Hospital and Sanatorium.

difficulty, and before a child is relegated to that category the words of Krause should be remembered, "Enlargement of the mediastinum or "chronic mediastinitis" runs through the roentgen ray reports, especially those of children's examinations, like a song; with a monotony that makes one wonder whether mediastinal changes are not normal in the young".

The inference is obvious and the verdict should be emphatically endorsed.

### SUMMARY

The foregoing thesis is based upon the examination of 3,563 cases of suspected pulmonary tuberculosis, including contacts, of all ages from two years upwards, during a period of four years, of whom 550 were diagnosed as having pulmonary tuberculosis. It discusses certain features that have appeared to the writer to be worthy of attention, viz:-

1. Presence of tubercle bacilli in the sputum:

absolutely conclusive and very often found early in the disease when carefully looked for. A few cases are mentioned in which the sputum had to be examined a large number of times and over long periods before positive results were forthcoming, but such cases were relatively infrequent. Of the original diagnosis of phthisis in ex-service men, whose sputa were reported in the Army to contain tubercle bacilli, but who, since then, have presented no apparent manifestation of the disease, the writer is doubtful. Of the 550 diagnosed patients, 451 were found to have tubercle bacilli in the sputum.

2. Pleurisy with effusion. Ninety-five cases of phthisis or 17 per cent, gave a definite history of pleurisy within the previous five years, and, of these, at least 40, or 8 per cent, were known to have had effusion. Ten of these patients had pleurisy with effusion at the time of examination, and, in five, guinea-pig inoculation gave positive results.

It was difficult to obtain an accurate history of antecedent pleurisy, several patients making the vague statement of having had pleurisy and



pneumonia simultaneously, but 450 of the total number examined gave a definite account of previous pleurisy or were suffering from it at the time of examination, and these contained the 95 cases diagnosed as tuberculous. There is therefore room for reasonable optimism that a fair number of cases of pleurisy are not tuberculous, or do not result in clinical tuberculosis, but the figures given must be accepted with caution as not every case of pulmonary tuberculosis although notified, is reported to the writer, and some of the individuals under consideration have left the neighbourhood. The period of time moreover is short.

3. Haemoptysis was a symptom, in some cases a prominent one, in 143 cases (26 per cent), and 127 (80 per cent) of these developed a positive sputum. In most of them organisms were found within a week or two of the initial examination, but a few remained sputum-negative for a considerably longer period, and 16 are still sputum-negative. In nearly all the writer's cases physical signs were present from the beginning. Other diseases associated with blood-spitting are mentioned, and together they account for nearly as many cases as tuberculosis. Early haemoptysis due to phthisis is a valuable symptom.

4. Rise of temperature provoked by moderate exercise and persisting after more than an hour of rest. This test is difficult to carry out in dispensary work but it has been found of value in a few cases in whom physical signs were absent or ambiguous. When exercise fails to raise the temperature it is unlikely that the person is suffering from active disease. The older the patient and the more chronic the illness the less

likely is the temperature to show elevation, but the provocative fever is never in complete abeyance. Reference has been made to the facies of febrile patients.

5. Localised râles above the level of the second rib in front or the third dorsal spine at the back. This sign was found to provide assistance in the diagnosis of 27 cases that would otherwise have remained ambiguous. As some of these patients were acutely ill there was no possibility of making an X-ray examination. When the sputum is negative some of these cases are exceedingly difficult to diagnose and the writer knows of at least two whom he "missed" by regarding these adventitious sounds as simply catarrhal in character. They reappeared later with the disease established beyond doubt. Apart from tuberculosis, localised râles were heard at an apex (usually the right) in persons who were making a protracted recovery from influenza and in children with chronic pharyngitis resulting from enlarged tonsils and adenoids. Krönig<sup>1</sup> considered the latter to be due to partial collapse of the lung apex resulting from obstruction.

6. X-ray manifestation of a parenchymatous lesion extending into the infraclavicular region. Of the 550 cases few gave an X-ray picture that could be described as very "early", but in 17 patients, in whom few or no physical signs could be detected, one or two small exudative patches could be seen. In most

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<sup>1</sup> Krönig, C. Deutsch. Klin., 1907, 11, 634.

of them the lesion was in the infraclavicular zone, and in 3 cases it was well below this region. The two types of disease - exudative and proliferative - have been discussed. The majority of cases gave an X-ray picture of well established disease and this is probably typical of most other tuberculosis clinics.

In the examination of his cases the writer has consistently kept the foregoing six cardinal signs in view and has found them of great value in making or excluding a diagnosis of pulmonary tuberculosis in most of the doubtful cases that have been sent to him. They may appear to be so obvious as to leave one open to the criticism that by adhering to them, particularly the first, one would seldom diagnose a case of really "early" phthisis. A doctor said to the writer recently, "Can you not detect the person who is going to suffer from tuberculosis, the person who has not yet got a positive sputum, who has not yet contracted pleurisy, who has not yet had an haemoptysis ? Are there no prodromal signs ?" The only reply to this is the further question, Whether is it better to send ten patients who have definite pulmonary tuberculosis to an institution or to send fifty who might take tuberculosis ? For every person diagnosed as having pulmonary tuberculosis by the writer, about five are presented by their doctors as possibly tuberculous. As in every other disease, the diagnosis of pulmonary phthisis must depend primarily on the clinical acumen of the examiner.

Supplementary to the signs discussed are other indications of secondary importance but nevertheless of considerable interest. These are symptoms

referable to the cardio-vascular system, the gastro-intestinal system, and cessation of the menses. These have been discussed.

In the four years under review, 761 children between the ages of two and fifteen were examined and the following table shows in brief their classification:-

Total examined	...	...	761
Contacts	...	...	490
Contacts notified as tuberculous...			7
Non-tuberculous contacts	...		483
Cases referred by doctors or clinics			271
Diagnosed as tuberculous and notified			29
Non-tuberculous cases	...		242
(a) Bronchitis	...	...	120)
(b) Chronic Pulmonary catarrh (Leys)			65)
(c) Malnutrition including sepsis of various organs ...	...	...	57)

Cases of "mucous" disease occurred in all three groups (a), (b), and (c).

As will appear from the above a conservative attitude has been adopted with respect to the diagnosis of pulmonary tuberculosis in children, particularly with respect to hilum tuberculosis. Many of the children examined came from over-crowded and heavily infected families, but only those who were clinically tuberculous were diagnosed as having the disease. The others, including numerous positive Mantoux reactors, were excluded. Many of these children particularly those who gave a positive reaction to tuberculin or who came from tuberculous homes were examined at least twice a year and will be kept under observation for several years. Such children should receive attention in special institutions such as preventoria or open-air schools.

APPENDIX

CLASSIFICATION OF PATIENTS SUFFERING FROM PULMONARY  
TUBERCULOSIS.

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Class T.B. minus, viz, cases in which tubercle bacilli have never been demonstrated in the sputum, pleural fluid, faeces, etc.

Class T.B. plus, cases in which tubercle bacilli have at any time been found.

Group I. Cases with slight constitutional disturbance, if any; e.g. there should not be marked acceleration of pulse nor elevation of temperature except of very transient duration; gastro-intestinal disturbance or emaciation, if present, should not be excessive.

The obvious physical signs should be of very limited extent as follows: Either present in one lobe only and, in the case of an apical lesion of one upper lobe, not extending below the second rib in front or not exceeding an equivalent area in any one lobe; or where these physical signs are present in more than one lobe, they should be limited to the apices of the upper lobes, and should not extend below the clavicle and the spine of the scapula.

No complication (tuberculous or other) of prognostic gravity should be present. A small area of dry pleurisy should not exclude a case from this group.

Group 3. Cases with profound systemic disturbance or constitutional deterioration, with marked impairment of function, either local or general, and with little or no prospect of recovery.

All cases with grave complications (e.g. diabetes, tuberculosis of intestine, etc.) whether those complications are tuberculous or not, should be classified in this group.

Group 2. All cases which cannot be placed in Groups I and 3.