rarely respond to treatment to any degree. Clinically and radiologically they are of acute type with diffuse areas of disease in both lungs.

Extent of Disease. Complications.—The extent of disease is important. The patient with unilateral or mainly unilateral disease has, because of modern methods of treatment, a better chance. The outlook in upper lobe disease is better than in lower lobe disease, although the advent of phrenic avulsion makes the latter less unfavourable. Complications, particularly those which are tuberculous, seriously affect the prognosis. Intestinal ulceration is rarely recovered from. To-day, tuberculous laryngitis, serious enough, does not necessarily mean a fatal termination. Artificial pneumothorax may lead to the control and ultimate cessation of sputum, thus giving an infected larynx an opportunity to heal. Of non-tuberculous complications diabetes is serious, but, with the help of insulin, is not hopeless. In my view mitral stenosis, a rare complication, can still be regarded as a deterrent to the progress of lung disease.

Special Investigations.—The results of laboratory investigations have some bearing on the question of prognosis. In this paper I am confining myself to those cases in which the sputum is positive, and thus the question of the prognostic significance of the tuberculin test does not arise, although I must add that the elucidation of its meaning in prognosis has been aided not a little by Ranke's hypothesis of the three-stage reaction. It has been held by some that the appearance of the bacillus under the microscope affords some indication of the degree of virulence. The long, thin type of bacillus is said to be the most virulent, the short stubby type with the Much's granules the least virulent. In recent years the

sedimentation rate of the erythrocytes has come to be regarded as of considerable prognostic value. I am not convinced of this. By others, emphasis is laid on the value of the Arneth count, vital capacity estimations, and so on. Frankly, I regard most of these as mere frills. The clinical judgement of the physician is, to my mind, the most valuable contribution to the evaluation of prognosis. A radiologist may miss a case of early diagnosis of pulmonary tuberculosis if his view is sought before that of the physician. Furthermore, x-ray examination cannot reveal a shadow until the lesion is of appreciable size (and most probably recognizable by the clinician). On the other hand, it commonly reveals disease deeper and more extensive than can be shown by ordinary clinical examination. In demonstrating the existence of cavitation x rays are invaluable. To the expert they indicate not only the true extent but the different forms of the disease, as shown by different types of shadows. For example, the fluffy cotton-wool patches represent an acute type of disease with unfavourable prognosis, while firm striated areas suggest a longer history, greater resistance, and a better prognosis.

SUMMARY

I suggest that the well-built person over 35 years of age with a good family history, a comfortable financial position, and with little evidence of toxæmia, has a much better prognosis than the young man of 20, of the artisan class, with poor physique, a bad family history, and obvious evidence of toxæmia. But in considering even the latter group we must not forget Samuel Gee's abiding aphorism: "Never give a definite opinion as to how long a patient suffering from phthisis will live, for the only certainty is that—if you do—you will be wrong."

PHTHISIS IN ADOLESCENCE AND EARLY ADULT LIFE*

BY

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For many years there has been a steady decline in the death rate from tuberculosis in all its forms, in both sexes, and at all ages—with one notable exception. There is everywhere a relative—and in some districts, I believe, even an actual—increase in the death rate among young females between the ages of 15 and 25 years.

A letter from Mrs. Siddons to Mrs. Galindo in 1803 describes a situation with which we are all sadly familiar. Though something of the greenroom is apparent in her writing—for even in her private sorrows she cannot quite forget that she is the Queen of Tragedy—the terror that broods over a household stricken by consumption has never been described in more moving terms. "Two lovely creatures gone, and another is just arrived from school with all the dazzling, frightful sort of beauty that irradiated the countenance of Maria, and makes me shudder when I look at her. I feel myself like Niobe, clasping to her bosom the last and youngest of her children, and—like her—look every moment for the vengeful arrow of destruction." *Sunt rerum lachrymae.*

Time was, and this in days within living memory, when a diagnosis of consumption in adolescence was rightly regarded as a sentence of death. The "churchyard cough" was the inevitable prelude to the grave, and in some country churches white gloves and faded garlands

still hang in clusters round the nave cornices in pathetic witness of virgins untimely dead. If we may judge by the novelists of the period, consumption was the normal fate of youth allied to beauty, but the Lady of the Camelias might have looked forward to a disreputable old age had she lived to-day. Many practitioners, I think, still fail to realize the change that has taken place in the outlook for young consumptives—that, owing perhaps partly to increasing racial immunity, especially in towns, but much more, as I think, to radiology and collapse therapy, the outlook for them need no longer be regarded as hopeless. The disease is, as a rule, curable in its early stages, and even advanced disease will often yield to modern methods of treatment.

We owe a special debt to radiology, because it enables us to diagnose tuberculosis in its earliest stages without regard to the physical signs which, in this disease, are notoriously misleading—signs which, indeed, may be absent despite the presence of virulent disease. But radiology is essential not only for accurate diagnosis, but also for the control of treatment. Our most effective treatment—rest for the lung by a prolonged period of recumbency or by collapse therapy—cannot be properly exercised or adequately controlled without x rays.

SYMPTOMS IN EARLY DIAGNOSIS

Diagnosis, however, is even more important than treatment, and, if I may presume to add one word of advice concerning the early diagnosis of pulmonary tuberculosis in adolescence, I would say:

(a) Pay much attention to symptoms; they are usually more reliable than physical signs, and of the signs perhaps the patient's appearance and manner are as valuable as any.

* An address given to Essex general practitioners at Black Notley Sanatorium.

(b) Regard with suspicion any cough in a young person which persists for more than a fortnight.

(c) It is our duty to consider every haemoptysis in a young person as due to tuberculosis until the contrary is proved—the qualification is necessary, for at the other end of life the rule should be reversed.

(d) Do not neglect the psychology of your patient—the young consumptive is usually *difficile*, and almost invariably strives to minimize symptoms. Her speech is sprinkled with diminutives, but when a girl tells you that she has “only” expectorated a mouthful of blood, the diagnosis is scarcely in doubt.

(e) Lastly, if you find any suggestive clues, do not be too proud to call in scientific methods to your aid.

Examine the sputum for tubercle bacilli, and repeat your examination at least twice if the first result is negative. The last word in the diagnosis of a doubtful case usually remains with the skiagram, which will seldom let you down, provided it is of first-class quality and interpreted in the light of clinical experience. You need not, however, believe all the radiologists tell you—they are excellent fellows but incurable romanticists.

EXUDATION AND FIBROSIS

We can divide cases of pulmonary tuberculosis into two main groups: (a) the fibrotic or proliferative, and (b) the exudative. Examples of each are seen at all ages, but the former is the type prevalent in middle or later life, while the latter is usually associated with adolescence and early adult life.

Proliferative disease is characterized by insidious onset and a chronic course. The physical signs are those of pulmonary fibrosis, though these are often masked by the signs of bronchitis, by compensatory emphysema, or by pleural thickening. The *x*-ray appearances are characteristic—linear shadows indicating strands of fibrous tissue, discrete nodular opacities in areas where fibrosis has surrounded and obliterated tuberculous foci, ring shadows with dense irregular outline indicating cavities, blunting of the costo-diaphragmatic angles, and marginal shadows outlining the periphery of the lung, in whole or in part, indicating pleural adhesions and thickening. As a rule, such patients only come under observation when the disease is firmly established. There can be no resolution of fibrous tissue. Artificial pneumothorax is often impracticable on account of adhesions, and though in some patients the disease may remain stationary for years, and though in others the desperate expedient of thoracoplasty may cause arrest, in most instances chronic ill-health precedes a lingering death. If, however, an early haemoptysis—that crowning mercy for the consumptive—drives the patient to the doctor before the disease is firmly established, the *x*-ray appearances are not dissimilar from those of exudative disease, and the response to treatment is good.

During puberty and in early adult life the exudative type of disease is that commonly encountered. The *x*-ray appearances are in sharp contrast with those seen in the proliferative variety, except in its incipient stage. The characteristic feature of the shadows is their softness and the fact that their margins are not clearly defined. The shadows of fibroid disease are “stringy,” those of exudative disease are “fluffy.” Cavities form rapidly. They are often exactly circular and set in a surrounding haze. In other cases they are outlined by a hazy periphery two or three millimetres in thickness. The loculations often evident in fibrotic cavities are seldom apparent, and a rounded outline is the rule, although oval forms are not uncommon. The disease appears suddenly, spreads rapidly, and under favourable conditions resolves with equal rapidity. *X*-ray examination after recovery

generally shows linear scarring, but it is surprising to note that after recovery the skiagram may show an apparently normal lung.

The various types of exudative disease and their response to treatment may now be considered. It is important to remember that though the exudative forms of tuberculosis in early life are more immediately threatening than the proliferative variety, they are more amenable to treatment. But prompt recognition of the danger and immediate action are necessary if tragedy is to be averted.

MANIFESTATIONS OF THE DISEASE

I. Tuberculosis of Epi-tuberculous Type

A variety of tuberculosis resembling the condition known as “epi-tuberculosis” in childhood is occasionally met with in adolescence. The patient, who is usually a “contact,” complains of a cough, and physical examination may reveal an impaired note on percussion below a clavicle and perhaps a few crepitations. *X*-ray examination shows a diffuse shadow of uniform intensity, more or less triangular in shape, with its apex towards the hilum. The shadow resembles that due to lobar pneumonia, except that its edges are more clearly defined—especially inferiorly, where the interlobar septum forms a barrier to spread. Under treatment by rest the area may resolve as it does in early childhood, leaving perhaps some linear scarring. Resolution does not always take place; a cavity may develop, when tubercle bacilli, which are seldom demonstrable in epi-tuberculous disease, at once appear in the expectoration.

II. Early Tuberculous Foci and Infiltrations (*Rundherde and Frühinfiltrat*)

The subapical infiltrations are typical of adolescent tuberculosis. The earliest *x*-ray evidence of these is a faint circular shadow about the size of a sixpenny-piece situated in one or other subclavicular region. The centre of the shadow may be clear, indicating a small cavity. In many cases such lesions must heal spontaneously, for their scars are seen in the skiagrams of patients who give no history of disease, or are discovered at necropsy. In others healing occurs under sanatorium treatment, while in a third group the lesion progresses to the condition described in the next section.

III. Subapical Disease with Cavitation

The rapid development of a lesion similar to that shown above may lead to the formation of a large cavity at an early period of disease, a phenomenon I once had the opportunity of observing in a child aged 4 years. Physical signs are often entirely absent, or are only discovered after *x*-ray examination. The cavity which develops rapidly may resolve with equal celerity, and under favourable conditions may close within a period of a few months or even weeks.

IV. Basal Disease with Cavitation

Disease situated in a lower lobe is usually considered to be more virulent than upper lobe disease, but here again resolution may take place and permanent healing result without resort to any special form of treatment other than rest.

Such a happy termination is, however, by no means the rule, and strict *x*-ray control is necessary. A soft cavity may contract and apparently close, when a reactivation of infection results in a further disintegration of lung tissue and a vomica reappears. It is for this reason that early artificial pneumothorax is often pre-

ferable to an expectant attitude. It ensures the approximation of the cavity walls till healing is firmly established by scar tissue.

V. Pulmonary Tuberculosis with Miliary Distribution

The acute form of miliary tuberculosis of the lungs usually causes death within a few weeks. The skiagram is characteristic and presents the well-known "snow-storm" appearance. It is only in the last few years, however, that radiology has revealed a subacute or chronic form of pulmonary tuberculosis with miliary distribution. When cough first draws attention to the lungs the patient may be healthy in appearance, afebrile, and well nourished. Physical examination reveals perhaps a few scattered catarrhal sounds at a time when a skiagram proves that the lungs are everywhere mottled with small opacities. These differ only from those of a true miliary tuberculosis in being slightly coarser, and the appearance of the condition thus resembles a hail-storm rather than a snow-storm.

VI. Progressive Disease of Exudative Type

We have hitherto been discussing examples of exudative disease of a relatively benign type. The patient's resistance and the attacking force are so nicely balanced that although she is not immune to attack when exposed to the debilitating conditions associated with unhealthy conditions of work—long hours, and travel during the rush hours—life under sanatorium conditions, complete rest, proper food, and continuous fresh air tip the scales on the side of recovery. And, as we have seen, this recovery is often surprisingly rapid and complete. The resistance of many patients is permanently raised after leaving the sanatorium, and a return to the old conditions of life is not followed by relapse. If recovery after this manner were the rule the treatment of pulmonary tuberculosis would be as simple a matter as the pioneers of sanatorium treatment conceived it. Occasionally the scars of subclavicular disease are seen in radiograms of healthy young persons who give no history of chest disease. But such cases are not common, and even sanatorium treatment without the adoption of special methods succeeds in only a small proportion of cases. An area of infiltration may spread rapidly, caseation may lead to early cavity formation, and cavities may increase in size despite the advantages of bed, rest, fresh air, and good food, and the psychological stimulus of medication, whether by hypodermic injection or mixtures.

An opportunity of studying the spread of disease in serial radiograms was afforded recently when the mother of a boy aged 16 years, who was admitted to the Harold Court Sanatorium suffering from a subclavicular infiltration, refused to allow collapse therapy to be practised. In the treatment of adolescent tuberculosis delays are especially dangerous, and artificial pneumothorax should, as a rule, be adopted directly it is obvious that cure by simpler means is doubtful. A skiagram taken in September, 1931, showed the disease in its early stage. A skiagram in March, 1932, showed that the condition had been allowed to develop to a dangerous degree with widespread infiltration and cavity formation. At this stage the parent listened to reason, an artificial pneumothorax was induced, a satisfactory collapse obtained, and the patient set on the road to recovery. Otherwise the disease would have spread throughout the lung and infection of the opposite side would have been inevitable.

A further example of rapid spread under observation is afforded by the case of a young school teacher. In this instance prompt treatment by artificial pneumothorax resulted in a satisfactory cure, and within two years of the onset of symptoms the patient was able to return to her work with the approval of the educational authorities.

VII. Unilateral Disease of Exudative Type Involving the Greater Part of the Lung

If often happens that, either because the onset of disease was latent, or because the patient has refused to pay any attention to symptoms, both lobes of one lung are extensively involved when she is first seen. Immediate artificial pneumothorax then offers the best hope, and, despite the adhesions which in cases of this type usually prevent a complete collapse, sufficient pulmonary deflation is often obtained. Sometimes the lung becomes flattened like a pancake against the posterior thoracic wall, at others, although the lung may appear to be suspended by festoons of adhesions, the diseased areas are well collapsed. Adhesions should not be interfered with unless they are preventing the closing of cavities.

VIII. Bilateral Disease

When exudative disease involves both lungs the prognosis is obviously more serious than in unilateral disease, but the outlook should not be regarded as hopeless.

(a) An area of exudation with a soft-walled cavity on one side is frequently associated with a small area of "frühinfiltrat"—subclavicular, or less commonly basal—on the opposite side. As a rule this clears up rapidly when healing commences in the more serious lesion, whether as the result of collapse therapy or simple rest treatment.

(b) A more extensive lesion may be present in the contralateral lung, either when the patient is first seen or as the result of an aspiration spread. The latter is sometimes seen after the induction of pneumothorax, and necessitates either the abandonment of collapse therapy, or a bilateral pneumothorax, or a continuation of pneumothorax on one side with phrenic avulsion on the other. An example of successful simultaneous bilateral pneumothorax illustrates the healing of a large soft cavity in each lung.

The patient, a girl aged 15 years, was admitted to the Black Notley Sanatorium suffering from pulmonary tuberculosis involving the whole of the right upper lobe. A soft-walled cavity had already formed in the subapical region. A small area of stippling, seen in the skiagram, in the left middle zone indicated secondary infection of the opposite side. Artificial pneumothorax was induced on the right side in December, 1928. Satisfactory collapse of the lung was obtained, and tubercle bacilli disappeared from the sputum within a month. The patient made excellent progress until June, 1930, when signs of active disease were elicited over the left axillary region, tubercle bacilli reappeared in the sputum, and a skiagram showed the formation of a cavity about the size of a walnut in the left middle zone. In July, 1930, artificial pneumothorax was induced on the left side, while a low-pressure pneumothorax was maintained on the right. The right lung was allowed to re-expand in December, 1930, when, apart from slight linear scarring of the upper lobe, no evidence of disease was apparent. Collapse of the left lung was maintained for two years, and after re-expansion its condition was similar to that of the right. The patient was discharged to her home in good health.

(c) As already noted, in some severe infections both lungs may be riddled with minute foci constituting a form of miliary tuberculosis of subacute or chronic type.

As a rule the prognosis of chronic miliary tuberculosis is grave. Neighbouring foci coalesce, caseation follows, and the ultimate picture is that of fibro-caseous disease of chronic type. But such a tragic result is not invariable. Resolution may occur as in other types of exudative diseases. The opacities melt away, and in the course of a few months there is a return to the normal picture, and a careful inspection of the skiagram after resolution may fail to supply any evidence of scarring. In other cases resolution may apparently be complete in most areas while progressive disease is apparent in one lobe. We can then direct our efforts to the healing of the local area with

some hope of success. Thus, in the case illustrated, after the miliary foci had resolved, phrenic avulsion was performed on the right side where a soft-walled cavity had developed in the subapical region. Within four weeks of the operation the cavity had shrunk to half its original size, and its complete closure is now anticipated.

SURGICAL MEASURES IN SUPPORT OF COLLAPSE THERAPY

When artificial pneumothorax is impracticable or inexpedient, phrenic avulsion is often of great value in giving a measure of rest to the lung, and, by relaxing tension within the hemithorax, allowing scar tissue to contract. After phrenic avulsion soft-walled basal cavities often heal rapidly—an example of a very large cavity closing within a few weeks of the operation is given—and in some instances even apical cavities will close in a similar manner. An upper lobe cavity persisting after artificial pneumothorax owing to an adherent apical cap may heal in this way. Phrenic avulsion may also be employed to close a basal cavity on one side while artificial pneumothorax is carried out for the opposite lung. The risks inseparable from a bilateral pneumothorax may thus be avoided.

When a cavity is situated beneath the pleura the overlying visceral pleura is usually inflamed, and unless artificial pneumothorax is induced at a very early stage pleural adhesions form. When the remainder of the lung collapses the area in which the cavity is situated remains anchored to the chest wall, forming a cone of pulmonary tissue containing the vomica. Severance of the adhesions is then essential. A thoracic endoscope, similar in principle to a cystoscope, is introduced into the pneumothorax cavity through a cannula. A second trocar, inserted through another intercostal space, permits of the introduction of a cutting instrument—either diathermy knife or actual cautery. After coagulation of the adhesion by diathermy to prevent haemorrhage, the adhesion is then divided as near to the chest wall as possible. The latter precaution is essential, because lung tissue is always present in the base of the cone, and perforation of the lung is attended by disastrous consequences. Thoracoplasty, sometimes beneficial in the fibroid forms of disease common in later life, is rarely indicated in adolescence or early adult phthisis, and need not be considered here.

Drug treatment, except as a palliative measure, is of no avail, but the intravenous injection of gold salts is sometimes followed by resolution of recent disease of exudative type. Thus, when, as sometimes happens during the collapse of one lung, a flare of exudation appears in the opposite side, sanocrysin or some similar preparation may lead to rapid resolution of the fresh area of disease and disappearance of tubercle bacilli from the sputum. The method of action of gold salts is obscure, and as they are apt to cause serious reactions their use should be restricted to selected cases. One might compare the effect of sanocrysin to that of a bucket of water in a case of fire—it is useful to extinguish an incipient outbreak or to suppress local outbursts after the main fire is under control, but more than this must not be expected.

Not every case of tuberculosis is curable. Some patients go downhill despite all our treatment. The cynic might remark that many patients recover in spite of all our treatment. But I hope the examples shown have demonstrated that modern treatment is effective in curing many cases of grave disease, and that early treatment cures most of the less virulent forms. Delay in diagnosis, whether due to the patient's reluctance to admit ill-health or to the doctor's neglect of warning symptoms, is responsible for many, if not for most, of the deaths from consumption in early life. As a rule, the patient's ultimate fate is in the hands of the general practitioner, because the first complaint is made to him.

Memoranda

MEDICAL, SURGICAL, OBSTETRICAL

SPONTANEOUS RUPTURE OF THE SPLEEN DUE TO NITROBENZENE POISONING

The following record of an unusual case appears to be worthy of publication.

The patient, a man aged 39, was a chemical worker, dealing chiefly with nitro-compounds of benzene. Several times he had had to give up his work for periods of two to three weeks owing to attacks of "chemical intoxication," the main symptoms of which were headache and lassitude and the main sign cyanosis, but for a whole year before the illness now being described he had been steadily at work. On January 7th, 1930, he had to give way to increasing fatigue and malaise, and again ceased work. His wife thought that he looked slightly cyanosed, and one of his usual "attacks" was diagnosed. Two days later, while in bed, he was seized with severe pain localized to the left hypochondrium, passing off in an hour or two. When the pain was at its height his temperature was 101° F. After two days the pain again returned, this time continuing until his admission to hospital, three days later, on March 15th, 1930. On admission he was extremely pale and looked very ill. There was a suggestion of conjunctival jaundice. He was complaining of severe abdominal pain, by now quite generalized, aggravated by an occasional ineffectual cough. He said that he felt sick, but there was no vomiting. He was not constipated. The pulse rate was regular at 100 per minute, respirations 28, and temperature 100.2°. Despite careful inquiry no history of trauma could be elicited. The abdominal respiratory movements were normal and there was no distension. Definite resistance could be made out in the left hypochondrium, with a dull percussion note here and in Traube's space. The left upper quadrant was very tender. There was no evidence of any intrathoracic lesion. The urine on examination gave no information. Laparotomy revealed a haemoperitoneum, the origin of which turned out to be a tear, about 1 inch long, on the hilar surface of the spleen, near its lower pole. Splenectomy was performed. The patient recovered satisfactorily and is still in good health. Two days after the operation the blood count (done for the first time) showed a normal picture. The platelet count was 277,600 per c.mm. The spleen was normal in size and consistency, and apart from the tear, which was quite superficial, looked quite healthy. Microscopical examination revealed only some thrombosis in veins near the surface. The appearance was otherwise normal. There was no subcapsular haemorrhage. The Liverpool city analyst reported that the spleen contained a trace of nitrobenzene.

DISCUSSION

Spontaneous rupture of the abnormal spleen occurs most commonly in malaria—of the natural or therapeutic variety. It sometimes happens in typhoid fever, in the acute infections in general, in blood diseases, and in pregnancy, parturition, and the puerperium. In all these conditions either damage to vascular endothelium by circulating toxins is liable to occur, or upset of the platelet balance may take place, predisposing in both cases to thrombosis. Spontaneous rupture of the apparently normal spleen is very rare indeed. Susman¹ collected six cases and reported another, Bailey² collected four more and reported one, while Byford,³ Nixon,⁴ and Dardinski⁵ have reported one each—a total of only fifteen cases.

Why does the spleen rupture? Three factors must be considered. First, it is to be noted that there is generally a fairly considerable subcapsular haemorrhage. Now a subcapsular haemorrhage due to a breach of the endothelial continuum would tend to accumulate and increase if the opening were valve-like, but probably not otherwise.

¹ Susman, M. P.: *Brit. Journ. Surg.*, 1927, xv, 47.

² Bailey, H.: *Ibid.*, 1929, xvii, 417.

³ Byford, W. H.: *Arch. of Surg.*, 1930, xx, 232.

⁴ Nixon, P. I.: *Journ. Amer. Med. Assoc.*, 1932, xcvi, 1767.

⁵ Dardinski, V. J.: *Ibid.*, 1932, xcix, 831.