(c) The vomiting, if delayed (four hours after taking the drug), does not mean that the drug will not be absorbed. The delayed vomiting appears to indicate that the drug is beginning to take effect. The patient is aware, sometimes, when the capsule bursts.

(d) Diarrhoea is of favourable import and is typical of the action of this drug. There are as a rule three or four fluid diarrhoeic motions a day resembling the dregs of meat extract.

(e) The restriction in diet for a month or so after treatment is important and the patient should receive advice on this point before discharge.

(f) The increase in weight is very striking after a successful course of E.B.I.

The cases referred to in this paper were all under the care of Dr. P. Manson-Bahr in the Hospital for Tropical Diseases, to whom I am indebted for his permission to use the records relating to them.

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SYPHILIS OF THE LUNG.

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Introduction.

As a certain number of patients had been admitted to this (Glenlond) sanatorium with physical signs much as one would expect in tuberculosis of the lung, with a copious sputum, in which one always failed to find tubercle bacilli, it seemed advisable to determine if any of the cases might be syphilitic in origin. Syphilis of the lung has been looked upon as a rare condition, and the diagnosis is not often made. Indeed, in the post-mortem room it is not often observed. According to the late Sir William Osler,¹ of the 2300 autopsies at Johns Hopkins Hospital lesions which were believed to be syphilitic were present in the lungs in only 14 cases. Sir J. K. Fowler² was only able to discover 12 cases in the museums of the London hospitals. Downing* found no cases among 3000 post-mortems at the Massachusetts General Hospital, while among 6000 post-mortems at Copenhagen Massia describes only two cases. Peterson,³ among 88 autopsies of patients with acquired syphilis, found lung lesions in only 11.

While these represent certain post-mortem findings, the incidence of syphilis was based upon the finding of unmistakably luetic lesions in the lungs. Extensive fibrosis of the lungs may or may not be syphilitic in origin. With the present-day serological tests every fibrosis of the lungs should have a serological test performed, and with this information finally conveyed to the post-mortem room more cases of syphilitic fibrosis might be recognised. While acquired pulmonary syphilis is spoken of as being rare and not a well-recognised post-mortem condition, in congenital syphilis it is not an infrequent pathological condition,

the picture being presented as the well-known white pneumonia.

There is a general agreement on the pathological condition seen in the lung of a new-born syphilitic child. Virchow's description of this condition is unchallenged. The lung of a syphilitic foetus is increased in size and may be marked by the ribs. It presents on section a dry, smooth, greyish or yellowish-white colour. Areas of consolidation may occur in the lungs as patches scattered throughout, or they may involve an entire lobe. The chief changes are a cellular infiltration involving the alveolar walls, and a proliferation of the interlobular connective tissue, thus giving rise to an interstitial pneumonia. Stained sections from the lungs show *Spirochaeta pallida* in enormous numbers. Difficult as is the morbid anatomy of pulmonary syphilis, the clinical picture is none the less difficult of recognition. Sir Clifford Allbutt⁴ touches on the condition in his address at the opening of the discussion on visceral syphilis at Newcastle in 1921. He points out that syphilis is taken to be rare in the lung, but that nevertheless it is well to remember that it is a possible cause of chronic indurative affections of the lungs. He points out that the physical signs are at the best equivocal, and later on he states that the appearance of a bronchitis after a luetic infection should be closely watched lest during a curable stage irreparable mischief be done.

While the final proof of pulmonary syphilis must be sought for at the post-mortem table, there is, nevertheless, a small group of cases where more than presumptive evidence points to pulmonary syphilis. Sir Clifford Allbutt puts it that the spirochaete is not above keeping company with the tubercle bacillus, and syphilis and tuberculosis may occur together, and the end-result of both diseases may, either acting independently or together, be the same—fibrosis and cavitation giving rise to a parallel set of symptoms and indistinguishable not only in local signs but in general reaction. Still, there are cases admitted to a sanatorium in which the morbid process is atypical of tuberculosis. Fishberg⁵ points out that syphilis of the lung manifests itself by cough, expectoration, slight fever, loss of weight, and even by hæmoptysis, but he observes that the course of all the cases was slow, and then the patient was not perceptibly disabled. Ficacci⁶ says that syphilis of the lung is probably more common than is generally believed, and he briefly records six cases. Clinically, he says, one may suspect syphilis if the symptoms are of long duration, if there is a positive Wassermann reaction, frequent hæmoptysis, and, if the disease affects the middle and lower lobe of the right side, with marked evidence of fibrosis of that lung, bronchiectasis, a slow course, no fever, and no tubercle bacilli—i.e., a good state of general health, other syphilitic lesions present, and no history of any other illness likely to cause bronchiectasis. Fishberg also points out that the disease is to be found in the middle and lower lobes, and if the apex is free from disease this alone should excite suspicion.

Investigation.

In order to determine the incidence of syphilis among a presumably tuberculous population a Wassermann reaction (W.R.) has been done on all admissions to this sanatorium. In this way we have been able to sort out, in the first 100 examined: 6 cases which we consider pure syphilis of the lungs; 11 cases with a positive W.R. and sputum T.B.+ (in nine of these there are other syphilitic manifestations or a clear history of infection); 3 cases with a positive W.R. and sputum T.B.—, but believed to be tuberculous (in two there are signs of congenital syphilis); and, lastly, two others with positive W.R. which were not considered tuberculous—one a case of subacute infective endocarditis, and the other a case of progressive muscular atrophy.

To sum up: of the 100 admissions, 6 per cent. are syphilis of the lungs; 11 per cent. are positive W.R. and sputum T.B.+; 3 per cent. are tuberculosis

* Quoting from the Archives of Dermatology and Syphilology, July, 1921.

with W.R. positive and sputum T.B.—; 2 per cent. are positive W.R., with diagnoses other than tuberculosis.

Acquired Syphilis of the Lung.

It is proposed to discuss syphilis of the lung. Routine serological examination is not now done, but all suspicious cases, or for purposes of exclusion, serum from each patient with negative sputum is examined.

Clinical pulmonary syphilis, according to Wile and Marshall,⁷ may occur in three types: (1) as isolated gummata, (2) as a diffuse syphilitic fibrosis, and (3) possibly as a diffuse broncho-pneumonia. Norris and Landis,⁸ in their text-book, speak of three types: (1) gummata, (2) fibroid changes, and (3) areas of consolidation and catarrh.

(1) *Gummata of the Lung.*

According to Wile and Marshall, recognisable gummata of the lung are exceedingly rare, clinically or pathologically. These observers, however, believe that gummata will not be infrequent in the initial stages of a fibrosis, and if large of a later cavitation. The later assertions agree with Landis when he states that when gummata occur in the lung they are apt to be numerous, varying in size from a millet seed to a hen's egg, and that these small gummata become walled off by thick fibrous tissue, and the condition is more readily recognised as a fibrosis. Occasionally, he states, a large gumma may caseate and empty into a bronchus producing a pulmonary cavity. This is a rare manifestation, and is known as syphilitic phthisis. Larger gummata when present are stated to be found about the hilus and in the lower lobes.

Hall of Belfast⁹ records a case of gumma of the entire left lung which cleared up on pot. iod. While gumma has not been observed here in pure pulmonary syphilis, a case of double infection, syphilis and tuberculosis, clinically seemed to show a gumma of the right base. A cavity formed at the right base with most unusual rapidity, and probably both pathological states were present and active. The patient, an ex-Service man, had definite tuberculosis of both apices with a few tubercle bacilli in the sputum. The right base was noted to show weak breath sounds. He had a perforation in the anterior nares, and there was a swelling in the scrotal wall which was diagnosed as a gumma. He admitted infection during service, and his W.R. was positive. Antisyphilitic treatment was instituted, and the scrotal swelling disappeared in four weeks. Soon afterwards he was noted to have a temperature, and his sputum was loaded with tubercle bacilli. Examination showed a cavity which was commencing at the right base. In another week he was dead. A post-mortem was refused. He had had a full course of "914," with pot. iod. and mercurial cream injections. Before death his serum gave a negative reaction, and the right base showed marked cavity. I think this might readily be considered a gummatous cavity with a tuberculous infection, and there seems little doubt that the pot. iod. was responsible for the tuberculous activity. Pot. iod., with its action of opening up tissue spaces and preparing the way for the action of the "914," opened up spaces in the lungs and prepared the way for an active invasion of the tubercle bacillus.

(2) *Fibroid Induration.*

From experiences here we find that fibroid changes are the most common. All cases show fibroid changes, but the type of induration and the site of such infection mark out some of these cases most distinctly. Two of them in particular show the same features; they have cough, sputum negative for T.B. and sometimes blood-stained, but never a hæmoptysis. They have no fever, no distress, the general health seems unimpaired, and they could be put on a high grade of work without inconvenience to themselves. The history is one of a few years' standing in each case. They were rather spare men, but showed no other syphilitic manifestations. In both the W.R. was

strongly positive. The lung lesions were the same in both. I shall illustrate the condition by the following cases:—

CASE 1.—Male, aged 40 years. This case was handed over to me when I became medical superintendent here as a third stage tuberculosis, and it is regretted that the true nature of the condition did not occur to me till after he was discharged. I got him to return to see me. Blood was taken for a W.R., and was strongly positive. His history is as follows: Joined up in 1914, wounded in France, sent home and began to cough in 1916; in 1917 was discharged from the army as unfit for further service. When first seen by me he was a thin, spare man, but musculature good. His chest showed poor movements on the right side and there were coarse crepitations from about the mid-scapula to the base on the right side. Sputum was always negative for T.B.; he brought up about 1 oz. daily. On discharge he was bringing up about 1 oz. daily and the moist sounds were fewer in number. When I saw him after discharge the moist sounds had again increased; he had no increase of temperature and never looked ill. There was nothing worthy of note in the other systems. On searching through his military history I found that he had joined the army in 1905 and was discharged with secondary syphilis as "not likely to become an efficient soldier." Unfortunately no treatment was given to help in the proof of the diagnosis.

CASE 2.—Ex-soldier, aged 38, discharged from the army in 1919. He complained at that time of bronchitis and was treated in a pensions hospital. He had had treatment at this sanatorium under my predecessor from October to December, 1919. At that time he was noted to have crepitations at both bases and slight flattening of the right base. Readmitted in August, 1921, he did not look ill; in fact he presented in appearance no obvious impairment. He had a cough, and sputum always negative for T.B. His weight on first admission was 12 st. and on discharge 12 st. 1½ lb. On second admission weight 11 st. 9 lb., and on discharge 12 st. 5 lb. He showed dullness from the mid-scapula on the right side to the base; there was bronchial breathing and crepitations over the dull area, and a few crepitations on the left side. His W.R. was strongly positive. He admitted getting a sore in Boulogne in 1916 when he was in a rest camp there, but he never reported it. Treatment was soon begun. For the first week he had pot. iod., 10 gr., t.i.d. He had a course of "914" as follows:—

Date.	Gr. Hg.	G. 914.	Gr. pot. iod. (t.i.d.).
Oct. 6th ..	—		 10
" 13th ..	1 (IM)	 0.15 (IM)	 10
" 20th ..	1 "	 0.3 "	 10
" 27th ..	1 "	 0.45 "	 10
Nov. 3rd ..	1 "	 0.6 "	 2
" 10th ..	1 "	 0.6 (IV)	 10
" 17th ..	1 "	 0.6 "	 15
" 24th ..	2 "	 0.75 (IM)	 15

On Dec. 20th the W.R. was positive. Examination showed that there was still impaired resonance but that the moist sounds had gone. It was also noted that the sputum, which varied from 2 drachms to 1 ounce daily, had now disappeared. He expressed himself as much improved. Unfortunately he decided to go home rather than have a follow-up course of treatment.

These two cases should be considered together. Both had undoubted syphilis, both are about 40 years of age, and both presented the same physical signs. The similarity to the cases described by Ficacci should be noted.

CASE 3.—This case, which came under my notice, is of the same type. A man, aged 54, had been coughing for nearly 20 years. Both bases are dull but the area of dullness is more extensive on the right side. The upper lobes on both sides are emphysematous. He is a marked bronchiectasis with a copious sputum, but no T.B. and no foetor. Fingertips clubbed. There was also a swelling over the right fibula and this was diagnosed as a gumma. His early history was that he had been a ship's carpenter, worked as a young man in Newcastle, and got infected there. W.R. strongly positive. His urine had a low specific gravity, but it was decided to begin antisyphilitic treatment by "914" injections, Hg cream and pot. iod. "914" soon had to be stopped as he became slightly jaundiced. The gumma over the fibula became less in size and was ultimately absorbed, but the chest condition was unaffected by treatment. Treatment was not begun again, but six months later his condition seemed unaltered.

CASE 4.—This case, almost similar to the third, does not belong to the 100 whose sera were examined, but is worth a note. An old regular soldier was admitted to Glenomond in 1919, aged 37; he had seen service in India, went to

France in 1914, and was discharged in 1915 with "hernia and fits." This case was brought to my notice by the ward sister. He had not stayed long, and had never been under my care. From the notes of his case I find "hæmoptysis several times. Extensive dullness down the right side and many crepitations towards that base. Left side? He had various hæmoptyses while under treatment. Sputum was always T.B. negative, and very foetid." I have seen this man since discharge. He is a thin subject, with round shoulders, clubbed finger-tips, and thickened arteries. Both bases are dull, the right side from the mid-scapula. Crepitations are numerous at both bases and the apices seem of normal breadth. The W.R. is strongly positive. This patient lives in a common lodging-house and spends his time doing nothing beyond taking exercise and liquor. He refuses to give any history about himself.

Clinical Course.—The clinical course of these cases of fibroid induration is slow. First, age is important; no one of this type is below 38, and in considering the age one should remember the age of patients with aneurysm. Secondly, the length of time between the initial sore and the appearance of symptoms referable to the chest is important. The shortest time in my cases is three and a half years. The second case had a sore in 1916, and complained of bronchitis in the end of 1919; this man also showed the fewest clinical signs. The first case showed an interval of 11 years between his secondary syphilis and his first complaint as regards his chest. The other two cases show advanced bronchiectasis, and the interval between the infection and the present condition is anything around 20 years. The general course of the condition is slow, and for at least the first few years the patient is not seriously inconvenienced. Indeed, the second case would not have paid much attention to his condition had he not been trying to obtain a pension. Doubtlessly, all cases left untreated would in time become classical cases of bronchiectasis.

Diagnosis of Fibroid Induration.—This type of syphilitic disease seems to be sharply marked out. If the apices are of normal breadth and the bases, especially the right base, dull, syphilis should be suspected. The W.R. must be positive, and it would be an additional point if antisiphilitic treatment brought about a disappearance of the symptoms. In Case 2 treatment brought about a decided improvement. The symptoms of the disease simulate those of pulmonary tuberculosis, but the patient is not so ill, is not so much affected by stress, and the sputum is negative for T.B. All fibres of the bases are not syphilitic in origin. The histories must be searched; if there is no adherent pleura, old tuberculosis, foreign body, or asthma, and particularly if the apices are clear, syphilis should be suspected.

Lewis and Landis¹⁰ state very plainly that the diagnosis is usually made by exclusion. "Thus if the symptoms and physical signs are those characteristic of tuberculosis, and the sputum does not contain T.B., or the progress of the disease differs from that usually encountered in tuberculosis, the possibility of some other exciting cause should be thought of." Phipps, of Boston,¹¹ in 1917, says that the symptoms of pulmonary syphilis are essentially those of pulmonary tuberculosis, except that they are less pronounced; night sweats and fever are apt to be less. A W.R. should always be obtained, but must not be too readily considered diagnostic. It is a link in the chain of diagnosis, and cannot replace a carefully searched history. It is to be used as confirmatory if the history and physical examination suggest a syphilitic origin. In Cases 1 and 2 syphilis is admitted. In the third case a gumma of the fibula is found, and the fourth case will give no history.

The Pathological Process in Fibroid Induration.—Sir J. K. Fowler¹² speaks of a thickening extending from the hilus around the bronchi and vessels. Landis,¹³ again, considers that the indurative changes commence at the hilus and extend outwards along the bronchi and blood-vessels.

Consider for a moment what happens in the formation of aneurysm. There the process starts as a peri-arteritis, the adventitia is first affected, then the intima—which becomes soft, either wholly or in

patches—and with the increased pressure of a forcible heart action, aneurysm will ensue. Does not the same process take place in the lung? Are we not dealing with a peribronchial inflammation, a softened bronchial wall, and the strain of coughing will then dilate the bronchi? While that is taking place there is an overgrowth of connective tissue between the bronchi, and this will contract and pull on the bronchi. The result is that the end stage is a clinical picture of pulmonary fibrosis or bronchiectasis.

Why should these cases have hæmoptysis? It may be that there is a small gumma which has softened, and a gumma is not so avascular as the tubercle formation. What is more probable is that there are syphilitic changes in the blood-vessels. These changes will begin from without and travel inward and may end in obliteration of a vessel. The softened vessels will readily yield, and a sudden sharp hæmorrhage is not unlikely. Microscopically, the fibroid tissues will be found arranged around the vessels and bronchi.

(3) Areas of Consolidation and Catarrh.

Syphilis is so diverse in its manifestations that, although a fibrosis is the most common manifestation of the disease of the lungs, focal lesions are to be expected. Landis states that the general opinion has been that the apices are but rarely affected, but he describes¹⁰ six cases in which the physical signs pointed to a focal lesion in the apex, and in which the evidence seemed conclusive that a latent syphilitic process was at work. During the secondary stage of syphilis changes similar to those in the larynx and trachea may occur in the lungs. This type of the disease comes on earlier than fibroid induration. Indeed, it could follow the initial sore at an early date, and the patients are younger persons. The symptoms are much the same as in other cases, but it was noted that the two cases observed were decidedly anæmic. Pathologically some observers consider such a case as a true syphilitic pneumonitis; others consider that the changes are due to a mixed infection on a lung already weakened by syphilis. Careful and repeated examinations of sputa for the *Spirochaeta pallida* would require to be undertaken. I have no dark-ground illumination, and I have never been able to satisfy myself as to these by stain. Therefore, I can only say that *Spirochaeta pallida* has not been looked for. I can record two cases of this type which have come under my notice and care.

CASE 1A.—A woman, aged 30, admitted to Glenomond in November, 1920, was sent in as a case of pulmonary tuberculosis and tuberculosis of the skin. The skin lesions were deep-seated ulcers, they were bilateral, situated on the outer and posterior aspects of both upper arms and on both sides of the neck. The most extensive ulcer was 5 in. long; in all the whole skin was involved. Parts of the ulcers were crusted and the bases oozed and gave off a dirty greenish sero-sanguineous fluid. The patient's voice was a trifle husky and the vocal cords were rather red and swollen. She had had a cough for four years. Her lungs showed a patchy dullness—e.g., the right apex posteriorly was flat and the breathing bronchial but no crepitations. The left apex was impaired, and again on the right side the middle lobe was rather flat and the breath sounds weak. She brought up about 4 oz. of sputum per day and this was always negative for T.B. Her W.R. was strongly positive. She had been married for eight years and had no living children; some miscarriages, the last one two years previously. She had a course of antisiphilitic treatment, and at the end of it her skin lesions were healed but the W.R. was still positive. Her husband wanted her home, and she left in January, 1921. I went to see this patient on May 26th, 1922, and found her very well, and the mother of a healthy child, aged 7 weeks. She has no cough but the voice is still a little husky. The lungs show an impaired note over the upper lobe right side and there the breathing is bronchial but no crepitations. The bases seem normal. This case should be compared as to the skin lesions with a case described by Hollander and Narr.†

CASE 2A is that of a young man, aged 30, admitted to Glenomond on Jan. 15th, 1921. He gave a history of cough and spit since July, 1920, and stated that off and on from then he had suffered from hoarseness. He was a thin, spare

† Archives of Dermatology and Syphilology, August, 1921.

man and exhibited a considerable pallor. Sputum was always T.B. negative. The chest was thin and showed poor movements on the right side. Both apices were dull and the dullness extended to the second interspace on the right side and behind to mid-scapula. The larynx showed considerable thickening of the cords but no ulceration. His larynx was examined in Edinburgh Royal Infirmary in October, 1920, and a diagnosis of "tuberculous laryngitis" was made. This man did not improve and did not get worse at Glenomond. His sputum remained T.B. negative. He left of his own accord in May, 1921. As the course of this case was unusual I asked Dr. G. M. McGillivray, tuberculosis officer to the county, to watch him as the question of diagnosis was doubtful. Later Dr. McGillivray found a specific ulcer in the floor of the mouth and he sent the patient to Edinburgh for a further examination of his larynx. The report reads: "On laryngoscopy there was considerable infiltration of the left arytenoid cartilage and the left false cord. There was no ulceration however. Blood was taken for a Wassermann reaction and the result was strongly positive. I therefore changed the diagnosis to tertiary syphilitic disease of the larynx." On searching through this man's (military) history, I find that he had a chancre in 1915. This was called a "soft chancre" and no further examination seems to have been made. He was not then retained in hospital. When the diagnosis of syphilitic disease of the larynx and lungs was made, active anti-syphilitic treatment was given at the Royal Infirmary, Edinburgh, and I learn that the lung condition has cleared up, but that the voice has not returned to the normal.

Clinical Course.—Consider the condition from the pathological standpoint. The secondary stage of syphilis is considered by many to be a stage of invasion of the blood-stream by the *Spirochaeta pallida*, and therefore the spirochaete very soon reaches the lungs as well as the other organs. The normal way of the spirochaete is to travel by way of the lymphatics.¹⁴ Pathologically, then, visceral syphilis is a disseminated lymph-arteritis, and therefore the lung may be involved at an early stage. In the secondary stage of syphilis there are in some cases lesions broncho-pneumonic in type, which have, no doubt, not cleared up completely, and we get a state of secondary infecting organisms keeping up a patchy catarrhal condition. This condition will come on early after the initial infection, and the patient will have more or less cough continually. Curiously both my cases exemplifying this condition had some laryngeal trouble. Both were hoarse, one had cords rather red, and the other thickened cords, but neither showed ulceration. Allowed to progress this patchy, catarrhal condition of the lungs would probably end in a fibrosis of the affected areas with dilatation of some bronchi and perhaps collapse of small areas of lung tissue. The root glands would doubtlessly show some enlargement; and clinically this is borne out by enlarged venules over the chest and back in both patients. The condition is readily influenced by treatment, and early treatment should clear the condition up entirely.

Diagnosis.—When a case of patchy bronchitis which persists in spite of treatment is found, syphilis as a possible cause should be kept in mind. Search for other manifestations of syphilis, have the blood examined serologically, inquire into the history, and watch the effect of treatment. In Case 1 the skin lesions were sufficient to put one on the right track.

Congenital Syphilis of the Lung.

Acquired syphilis as it affects the lungs has been described; at the commencement of this paper will be found a reference to the condition of white pneumonia, the well-known pathological state found in the lungs, and sometimes one lung only, of a syphilitic foetus. Of course, the pathology has been described after examination of the lungs of the stillborn foetus, but surely a less virulent form may be compatible with life. Virchow describes the lung as being increased in size, and surely the case about to be described is a modified state of the pulmonary condition known as congenital syphilitic pneumonitis. Still¹⁵ considers that congenital syphilis would explain many cases of fibrosis of the lungs in children.

CASE 1B.—The first case of this condition is a child, aged 8, the eighth of a large family. The oldest died at 6 months, the fourth died an infant, and there was a

miscarriage before the present child was born. The other children are stated to be healthy, but only two other members of the family have been examined. This child has an atrophic rhinitis, pegged teeth, scars at the angle of the mouth, and a W.R., which is strongly positive; she has a cough, and brings up a small amount of sputum negative for T.B. On inspection the right side of the chest is seen to bulge just a little and to show poor movements. Measuring from mid-sternum to spine there is found to be a circumferential difference of three-quarters of an inch more on the right side. The percussion note is impaired almost the whole way down the right back, and the breathing is bronchial with an occasional crepitation. She had a course of "914," 0.345 g. in all, with Hg cream and pot. iod., and later a follow-up course of 0.3 g. of "914." The ozæna has gone, she has put on weight, the dullness has gone from the whole base of the lung, but the upper lobe is still impaired, though probably it is now as well as it will ever be. The W.R. is now a weak positive. Cough has disappeared and there is now no sputum. Measurement of the two sides shows a difference of half an inch greater on the right side.

CASE 2B.—A second case of congenital syphilis of the lung shows considerable disease down both sides with much sputum, always T.B. negative. This child presents the usual features and is now having the antisyphilitic treatment.

Prognosis: All Types.

In acquired pulmonary syphilis the prognosis seems to depend upon early recognition and prompt treatment of the condition. In cases of early consolidation there seems no reason why the condition should not clear up completely. In fibroid cases early treatment means a speedy relief and the disappearance of the symptoms, but a complete return to the normal condition cannot be expected. Treatment is not likely to influence the condition when the disease is one of long standing. The third case where treatment had to be stopped was not influenced so far as the pulmonary condition was concerned, though the gumma disappeared. It is difficult to see what benefit could result from treatment when bronchiectasis is marked. In congenital pneumonitis treatment seems to be of real value. The first child showed a marked diminution of the dull area and the ozæna disappeared, while the child gained in weight. The second child is making good progress.

Summary.

1. Acquired syphilis of the lung may occur in three conditions: (1) Gummata, (2) fibroid induration, (3) areas of consolidation and catarrh.
2. Fibroid induration is the most common.
3. In these cases the initial lesion would appear to be at the right base.
4. No patient of this type was under 35 years of age.
5. The shortest time between infection by the spirochaete and symptoms referable to the chest was three and a half years.
6. Antisyphilitic treatment in the early stages is to be recommended, but when bronchiectasis is well established treatment is not likely to lead to improvement.
7. Two cases of focal disease were found.
8. Both improved on treatment. This condition will occur in younger patients.
9. Congenital syphilis of the lung may be common, and responds to treatment.

I desire to express special thanks to Prof. W. J. Tulloch, bacteriologist, Dundee, through whom the serological results were obtained; and to Dr. Leslie Lyall, Edinburgh, through whose kindness I was able to obtain full histories in the military cases. Associated with me in this investigation were Dr. G. M. McGillivray, tuberculosis officer, Fife County; and Dr. James Irvine, Kinross County.

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SEROLOGICAL CLASSIFICATION OF THE STAPHYLOCOCCI.*

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SINCE Pasteur first discovered the pathogenic properties of the staphylococci their classification has exercised many minds; the golden and yellow organisms have been admittedly pathogenic from the first, but it was for long undecided whether the white kind were all pathogenic until it was realised that there were two groups with white colouration, one of which was practically identical with *S. pyogenes aureus* and another which belonged to a supposed harmless saprophytic group, *S. epidermidis albus*. The question, however, whether staphylococci belonging to this latter group were always so harmless as alleged was frequently debated, but to-day the general opinion appears to be in favour of their non-pathogenicity.

The literature of the staphylococci is much too large, and, for the purpose of this paper, unprofitable, even briefly to survey, but the latest work on the subject which I can find is embodied in a series of papers by Winslow and his colleagues in America. Winslow, Rothberg, and Parsons, in the last paper¹ classify these cocci by a combination of chromogenic, cultural, and biochemical characters, though hardly touching upon their pathogenic features, nor were either serological or immunological observations attempted. The authors finally state that they agree, in great measure, with the classification advanced by Gordon in his report to the Local Government Board in 1903. Kolle and Otto,² and Otto,³ produced agglutinating sera from dogs, which they state differentiated pathogenic from saprophytic staphylococci, though the experiments, as reported, did not deal with any large number, and no absorption of agglutinin experiments were tried. Klopstock, van Durme, Fraenkel and Baumann, and several others have confirmed the above observations, though for reasons which will be understood later they appear to have been lucky in their selection of cocci. I can find no further references in the literature of importance in regard to agglutination and similar tests.

Clinical experience of the staphylococci shows their importance. They are admittedly the almost exclusive cause of carbuncles, boils, and osteomyelitis, and appear frequently as a cause of many other septic conditions, notably some virulent septiciemias which, once established, are nearly always fatal. Tonsillitis, otitis, empyema, broncho-pneumonia, and abscesses, both chronic and acute, together with some chronic skin affections, are among the commoner manifestations of staphylococcal activity, though often also caused by other organisms. While chronic staphylococcal infections are often benefited by vaccines, in more acute conditions this remedy, which might be expected to be of some value, is not so usually satisfactory as it is, for instance, with streptococci. Some patients also are very intolerant of vaccines of staphylococci, even in very minute doses, and, in contra-distinction again to the streptococci, there seems no way of sensitising a staphylococcal vaccine effectively—probably because of the difficulty of producing a good anti-serum—such serum as has been produced failing lamentably when administered in the more serious infections, as well as when used for sensitising vaccines.

Necessity for Classification into Serological Types.

We are apparently at the position occupied till recently by the meningococcus and pneumococcus with regard to anti-sera and to some extent also by the streptococcus. The secret of progress appears to be primarily in the classification of these organisms

into serological types, and their identification as regards these types in disease processes. The more frequent success of autogenous vaccines is doubtless due to this cause, but when sensitised vaccines have to be used it is logically necessary to define first the type or the sensitisation must be haphazard. It becomes, therefore, of the first importance, apart from academic reasons, to determine whether the staphylococci are subject to the same serological differentiation as the others, or our treatment, whether by serum or vaccine, is bound to give disheartening and irregular results. I have, accordingly, collected from cases at St. Bartholomew's Hospital a number of strains (about 90) of staphylococci, taking them without selection as they became available, but not neglecting to include a certain number of specimens supposed to be examples of *S. epidermidis albus*. After isolating each coccus in pure culture from a single colony, and verifying it microscopically with Gram's stain, I examined it with regard to its agglutination reactions, having made monovalent sera as a beginning from three cocci, two of which turned out to be identical. I paid little attention to any other characters except its power of producing acid in mannite broth and its chromogenic properties.

So soon as it appeared that there were at least two, if not more, serological groups of the staphylococci, and that agglutination tests alone were often doubtful and did not suffice to fix their position accurately, I proceeded to submit all cocci to absorption of agglutinin tests as well, and then at once began to get clear-cut results. At first each coccus was tested in this manner against all available sera; but later, after a considerable number had been so tested, experience showed that a coccus only completely absorbed the agglutinin of one serum, and that, whatever the amount of co-agglutinins present, the original specific agglutinin was hardly, if at all, diminished by absorption by a heterologous coccus—i.e., there appears to be little inter-relation between the groups. Then, having once placed a coccus in its group by absorption, no further tests with other heterologous sera were made. The type cocci themselves were, however, all fully tested against all available sera.

Method of Making Agglutinating Serum.

The method of making agglutinating serum which I have found to be most suitable is to be content when one has obtained a titre of about 1 in 800 showing obvious agglutination. To obtain this, young rabbits of about a kg., or a little more, in weight are given doses into the marginal aural vein of a killed, phenolated suspension of the coccus to be employed, first of 5000 million, then in five days a second dose of 10,000 million, which is repeated in five more days. After a further interval of five days they are bled up to about 25 c.cm. and the serum separated. On the succeeding day they receive a fourth dose of 10,000 to 15,000 million of the coccus and are bled again five days later; the serum from these two bleedings is pooled. I find that usually the titre of the serum is at its highest five days after the injections and that it frequently falls off very rapidly; hence the advisability of the second injection and pause before the second bleeding. The pooled serum is phenolated and tested in the usual way for agglutinins and keeps well in the cold after a preliminary drop during the first few weeks, the titre eventually being in the region of complete agglutination in 1 in 200 to 1 in 400, with well-marked agglutination up to 1 in 800 or a little higher. Higher titres can be obtained by more prolonged and massive dosage, and I have made sera showing marked agglutination in dilutions of 1 in 2000 or 3000; I see no advantage, however, in using or making these higher titred sera, as the lower titred ones are more readily made of even strength, and become, therefore, more suitable for comparison of results.

Agglutinations have in all cases been made with suspensions of cocci, of a strength of 2000 million per 1 c.cm., estimated by the opacity method, and killed, to stop autolysis, by half an hour's heating at

* A Report to the Medical Research Council.

¹ Jour. of Bact., March, 1920.

² Zeit. f. Hyg. in Infect., Band xli.

³ Centralb. f. Bact. Orig., xxxiv., 1903, p. 44.