If the arrest is to be permanent. If there is fever, the child must be kept in bed until the temperature is steady. The rooms in which the child lives and sleeps must be bright, sunny, and well-ventilated. Rest, especially before meals, in cases not confined to bed is important; the amount of time devoted to play and exercise must be carefully controlled. The question of breathing exercises has been much discussed; my own opinion is that, at any rate in early cases, they are of value and should be encouraged.

In regard to diet, this should be liberal, and rich in milk, cream, and other fatty constituents. Food should be given at regular periods, and the intervals should not be long. Children, however, do not stand over-feeding very well, and it is best, by abundant open air and gentle exercise, to promote healthy appetite. A raw-meat diet is highly recommended by some authorities, and is well borne by many children. Drugs are but little needed; cod-liver oil in emulsion with malt, or some iron wine or other preparation may be given; arsenic is recommended by some authorities, and may be given in the form of one of the natural arsenical waters. The syrup of the iodide of iron is recommended, especially in the cases of tracheo-bronchial gland infection. Creosote and other antiseptic preparations I have not found it necessary to give internally. If the cough is troublesome, it may be allayed by a simple linctus or a small lozenge. If of paroxysmal character, an inhalation made of creosote and spirits of chloroform, a few drops being sprinkled on lint, is sometimes very useful. Other symptoms may be treated on much the same lines as in adults.

In regard to specific treatment, some trial has been made of the use of tuberculin in these cases. It should only be given where the disease is strictly localized, and only in very small doses, its effects being carefully followed by means of determinations of the opsonic index. A high index or a markedly fluctuating index is probably to be regarded as a contraindication, since it means that auto-inoculation with toxins is in active progress. Ganghofner of Prague reports favourably on the employment of Koch's old tuberculin in a few cases. He commenced with 0.1 mg., but subsequently reduced the initial dose to 0.01, increasing slowly by $\frac{1}{1000}$ mg. till 1 mg. or more was reached.

The tracing of opsonic curves by Wright's method shows that in the past much too large doses have been given, and Dr. Olive Riviere recommends doses of $\frac{1}{1000}$ to $\frac{3}{1000}$ mg. for infants up to the age of 1 year, $\frac{1}{1000}$ at the age of 4 years, and $\frac{3}{1000}$ at 10 years. This treatment can at present only be employed in a few cases owing to the labour and time involved in the opsonic determination, but it promises to be of real value, and may at any time become of more general application if a simpler measure of its effects than the opsonic index be found.

To sum up. The aims of the practitioner should be in the first instance to prevent infection; failing this, to establish the diagnosis as early as possible, and to employ every available means of improving the general health of the child with the object of increasing its protective powers. Under such conditions, the outlook in a considerable proportion of the cases is distinctly favourable.

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An Address

ON THE

MODERN TREATMENT OF SURGICAL TUBERCULOSIS.

DELIVERED BEFORE THE WINDSOR MEDICAL SOCIETY.

By V. WARREN LOW, M.D., B.S. LOND., F.R.C.S. ENG.

SURGEON TO OUT-PATIENTS AT ST. MARY'S HOSPITAL, PADDINGTON, AND AT THE GREAT NORTHERN HOSPITAL, HOLLCWAY.

By the term "surgical tuberculosis" I mean the infection by tubercle of such organs as the bones, the joints, the lymphatic glands, the skin, the genito-urinary system, the peritoneum, and certain abdominal and pelvic viscera, the treatment of all of which usually falls within the province of the surgeon.

During the last decade there has been a slow but steady improvement in the treatment of these conditions. In this improvement the clinicians and hygienists were, at first, our leaders; but lately the pathologist, in the person of my friend and colleague, Sir Almroth Wright, has brilliantly intervened, and has not only supplied us with scientific explanations of the success or non-success of our empirical methods, but has also made valuable additions to our therapeutic resources.

The main principle underlying the modern treatment of tuberculosis is that the ultimate cure of the disease depends upon the elaboration by the individual attacked of certain protective substances in sufficient quantities to render innocuous the invading organisms. This protective mechanism is highly complex, and it is easily influenced for evil; but, on the other hand, it may be augmented by certain measures, some of which are the outcome of pure empiricism, while others are the result of deliberate experiment and research. Of late years it has been realized that Metchnikoff's theory of phagocytosis is not the whole truth as regards the mechanism of protection against bacterial invasion. The protective mechanism is a more complex one, including the chemical action of certain antibacterial substances in the serum and tissue fluids in addition to the vital activities of the phagocytes. These protective substances exert their influence by combining with the chemical constituents of the bacteria, and are called bacteriotropic substances. According to the effect which they produce, they are called agglutinins, bactericidal substances, and bacteriolysins. To these Wright has lately added the term "opsonins." The function of the latter is to prepare the bacteria for ingestion by the phagocytes. This has been demonstrated by a simple experiment. If white corpuscles be washed with isotonic salt solution, so as to free them entirely from serum, the corpuscles will no longer ingest bacteria; but they will do so at once in the presence of normal serum. Wright and his colleague Douglas, in addition to demonstrating the presence of these bodies, have also devised a method of estimating them quantitatively.

The method employed is to incubate for fifteen minutes at 37° C. a mixture made in a capillary pipette of equal parts of

1. Washed corpuscles, freed from all traces of plasma.
2. Emulsion of micro-organisms.
3. Serum from the patient whose blood is to be tested.

The micro-organisms ingested by 100 polymuclear leucocytes are then counted and compared with a number found in 100 leucocytes in a film made from a mixture composed of

1. Washed corpuscles.
2. Bacterial emulsion.
3. Serum of a normal individual.

The ratio of these two numbers is known as the opsonic index, and represents with considerable accuracy the patient's powers of resistance to the disease in question. It also constitutes a useful means of diagnosis, and forms a most important guide to the effect of treatment. It must be clearly understood that the term "opsonin" is a convenient phrase for a property of the serum, but does not necessarily represent a body which can be isolated. Owing to the fact that the opsonic content of the serum can be accurately estimated, the antibacterial value of any serum is usually expressed in terms of its opsonic index.

Let us now consider what practical bearing this has on the question of treatment. To Robert Koch we owe the conception that the inoculation of a suspension of dead bacteria—in this case tubercle bacilli—produces in the tissue fluids of an individual an increase in the amount of antibacterial substances available for the resistance of bacterial invasion. Thus arose the use of Koch's tuberculin for the treatment of tuberculosis, from which method so much was expected nearly a generation ago. Koch's first preparation was a concentrated extract of dead tubercle bacilli. As we all know, the amount of reaction that followed the use of the ordinary doses of this substance rendered it unsafe in the majority of cases of tubercle, and the remedy which had promised so well gradually fell into disuse. It is, I believe, still used as a means of diagnosis in cattle. Koch's new tuberculin is obtained by triturating dried cultures of tubercle bacilli, and it is this preparation that is now in general use under the name of tuberculin T.R.

Wright and Douglas doubted the sterility of this product and subjected it to a temperature of 60° C., adding to it 25 per cent. of lysol. Wright's chief contribution, however, to the vaccine therapy of tubercle lies in the increased control of the effects of the remedy by the estimation of the opsonic index. He found that tuberculin was an extremely potent agent and that the dosage had hitherto been excessive.¹ Based, no doubt, on the analogy of drugs, a general impression had gained ground that gradually-increasing doses were necessary in subsequent inoculations, and that a certain amount of constitutional disturbance was required. By estimating the opsonic index Wright found that maximal responses were often obtained from the inoculation of doses of tuberculin which did not produce any constitutional disturbance. He also found that if the dose were repeated at improper intervals the immunizing response failed altogether, and the patient's resistance was lowered. The immediate result of a dose of tuberculin (the dose usually employed is 1000 to 600 mg.) is a decline in the antibacterial power of the blood as measured by the opsonic index. To this decline Wright gives the name of the "negative phase." Its duration and extent depends upon the dose of the vaccine. It may or may not be accompanied by constitutional disturbance and rise of temperature. This "negative phase" is followed by a "positive phase," in which there is an increase in the antibacterial power of the blood. This increased power corresponds to a period of increased resistance on the part of the patient. The opsonic curve then usually sinks to normal, and in ten days or a fortnight may be at the level at which it stood before inoculation. Unfortunately, it does not seem possible, in the case of tubercle, to achieve cumulation in the direction of the positive phase, and each inoculation, therefore, has to be treated as a separate event.² On the other hand, cumulation in the direction of the negative phase is always a possibility, and doubtless accounted for the disappointing results which formerly so often followed the use of tuberculin, when the dosage, both as regards amount and spacing, was not controlled by an estimation of the opsonic index. But the control of the dosage of tuberculin does not exhaust the utility of the opsonic index. By its means we gain useful information as to the amount of autoinoculation which is taking place from the tuberculous focus. Tuberculous infections may be strictly localized, or they may be systemic. In the first case the opsonic index scarcely varies from day to day, being usually lower than that of normal blood. In the case of the systemic infection, the index fluctuates, being alternately above and below the normal. In cases of localized tubercle the focus of infection may be so circumscribed that it practically gives rise to little or no autoinoculation, with the conse-

quence that there is an insufficient stimulus to the manufacture of protective substances. The lesion, therefore, tends to persist indefinitely. This is well illustrated by an ordinary case of lupus. In systemic infections the autoinoculation is in excess, with the result that there is a danger of a cumulation in the direction of the negative phase with its accompanying constitutional disturbance. These considerations are of the greatest importance in devising methods of treatment.

In the localized infections therapeutic inoculation is indicated, and it is also most important to bring the tissue-fluids, with their increased opsonic power, into contact with the infected area. In the systemic cases therapeutic inoculation becomes difficult, and is often contraindicated, so that endeavour should rather be made to limit the circulation through the diseased focus in order to decrease the amount of autoinoculation. The therapeutic value of rest is at once obvious in this class of case, and operation should be avoided during the negative phase in order to escape the risk of still further depressing the resistance by the inevitable inoculation that follows the manipulation of an operation.

Not only have we, then, to raise the opsonic value of the circulating fluids, but we have also to ensure that these fluids have ready access to the infected area. The tubercle bacilli cultivate themselves within the organism in regions where the tissue-fluids contain antibacterial substances in smaller proportion than the circulating blood. The first-arrived bacilli will rob the lymph of some of its protective substances, and will then possibly succumb to the phagocytes; but as each successive batch of bacilli arrive they will encounter lymph less and less provided with antibacterial substances, till finally an area will exist in which the fluids are inert as regards their powers of resistance to the tubercle bacillus.³ This stagnant inert material will, by its mere mechanical presence, obstruct the access of the circulating fluids to the area described. Here we have an explanation of much that was formerly a mystery to us. Long before tuberculin and opsonins were known, it was a fact well recognized by surgeons that, if the abdomen of a person suffering from tuberculous peritonitis were opened, the fluid allowed to escape, and the abdominal wound closed, such a patient would often recover. The result was ascribed to many causes, such as the destruction of the bacilli by irrigation; drainage when it was employed; and even to the influence of daylight. In the light of our present knowledge the explanation is simplicity itself. The abdominal cavity is filled with fluid, practically devoid of antibacterial substances; in this the bacilli can thrive and work their will on the tissues. This fluid, by its mere presence, prevents the free interchange with the circulating fluids, whose opsonic index may be above normal. When the stagnant fluid is liberated, the parts are immediately doused with lymph charged with protective substances, whose value as bactericidal agents is far in excess of any chemical reagent. This fact is well illustrated in the case of a boy under my own care. This case is of special interest, inasmuch as he was one of the first, if not the first patient, on whom Wright was able to demonstrate this particular fact.

A boy aged 17 was admitted to St. Mary's Hospital on August 29th, 1904. He had been taken ill, fourteen days before admission, with abdominal pain and distension. The amount of fluid in his abdomen, and the absence of any serious symptoms of acute abdominal disease, suggested the possibility of tuberculous peritonitis, and this proved to be the case when the abdomen was opened. The peritoneal cavity contained a quantity of fluid, with flakes of lymph, and the whole peritoneal surface, both visceral and parietal, was studded with innumerable tubercles, some as large as sago grains. The fluid was allowed to escape, and the peritoneal cavity was washed out with sterile saline solution. The boy left the hospital apparently in good health, and has been so till three months ago, when, as I hear, tuberculous disease of the spinal column made itself manifest. From this he is still suffering. The patient's blood and peritoneal fluid were examined by Sir Almroth Wright, with the following results:

Patient's blood ingested ...	25.4 bacteria per cell
A. E. W.'s blood ...	17.0 "
Patient's peritoneal fluid ...	4.6 "

Opsonic index of patient's blood was 1.5 but that of his peritoneal fluid five times less.⁴

In this case the abdominal cavity was flushed with fluid of five times the bactericidal value of the fluid displaced.

During the same month I operated upon another boy, aged 13, who had been brought to the hospital on August 11th with abdominal pain and distension. According to the history given, the condition had only been present for four days, and he had been walking about up to the time of his admission. He was opened, and an appearance similar to that in the last case was found. The same procedure was followed, and the boy left the hospital in three weeks, apparently well. He was an inmate of an industrial home, so that I was able to keep in touch with him, and found him, eighteen months after the operation, to be a well-developed, sturdy boy, looking considerably over 15 years of age and 10 st. in weight. He has since emigrated to Australia, and is, I hear, in excellent health.

These two cases are only examples of a type of disease of which all of you have seen many examples, and I only mention them to demonstrate the fact that a very extensive invasion of tubercle can be cured merely by the liberation, under aseptic conditions, of the inert material which has accumulated in the infected area. This result was attained without the employment of any chemicals or drainage, reliance being placed only on the flushing of the infected area by the normal fluids of the body, charged with their protective substances. It follows, of course, that in such a case the opsonic index of the blood should first be estimated, and if this is found to be low, the protective powers of the blood should be raised by therapeutic inoculation.

We have now to consider by what means the circulating fluids may be brought into contact with the infected area, and it is at this point that I would speak of operative procedure. One of the main obstacles to the free access of the circulating fluids to the diseased focus is that the latter is often surrounded by tissues or fluids which have been almost entirely deprived of any antibacterial substances. We have already considered one example of this in the case of tuberculous peritonitis. The pus of a psoas abscess surrounding a tuberculous focus in the body of a lumbar vertebra is another excellent illustration. The caseous, hard, often calcareous glands removed from the neck do not readily suggest the possibility that healthy lymph could be brought to them in sufficient quantities to cause their absorption. In these cases it is obvious that the mechanical removal of this inert material is necessary before the infected part can be irrigated with healthy lymph. This should be the guiding principle for our operative measures.

The operative treatment of surgical tuberculosis during the last fifteen or twenty years has passed through several phases. At first tuberculous conditions were treated on the same lines as pyogenic infections. Abscesses were opened and drained, while in those joint cases which came to operation the kindest surgeon was he who earliest amputated the limb. Tuberculous glands were opened and scraped. We can probably all here remember such cases. Psoas abscesses which discharged profusely for months, cases of hip-joint disease with four or five sinuses, knee-joints which had been opened and drained, and for whom an amputation had to be performed. Almost invariably the end came from hectic fever, exhaustion, lardaceous disease, or generalized tubercle. All these are but manifestations, as I shall mention later, of the same process—namely, sepsis, whether acute or chronic.

As the surgeon felt more confidence in his asepsis he endeavoured by earlier and more extensive operations to eradicate the diseased focus altogether. Consequently, joints and glands were excised as widely of the disease as possible without much regard to the consequent deformity. Foci of tubercle, if only partially accessible, as in spinal caries, were attacked with various chemicals, such as carbolic acid, chloride of zinc, sulphur, or iodoform, and the surgeon's prime object was, as I have said, to eradicate the local seat of the disease. The results during this period were a distinct improvement on what had gone before, but many unnecessary excisions were performed, and I need scarcely dwell on the importance of this in the case of joints.

Owing to the magnitude and importance of the operative measures involved, the surgeon's whole attention was concentrated on the local conditions, so that constitutional treatment was often neglected, though its importance was theoretically recognized. The modern surgeon realizes that it is rather on the reaction of the organism that he must depend for his good results, and that his operative procedure must be directed towards removing

inert and valueless material, and thus allowing the free circulation in the diseased area of tissue fluids of high bactericidal value. Above all things he must avoid sepsis, and to emphasize this becomes the more important when we realize that asepsis is difficult of attainment in these cases. Healthy tissues are capable of dealing with a slight amount of contamination, but tissues already the seat of microbic invasion are less resistant.

The effects of a secondary pyogenic infection in a case of tuberculosis are indeed far reaching. This has long been a matter of clinical observation, and has been demonstrated by actual experiment. Under the influence of sepsis the tuberculous process becomes more locally malignant, causing a wider destruction of the tissues, even leading in rare cases to erosion of a vessel and secondary haemorrhage, and, in the case of joints, producing destruction of bone, and ultimately firm osseous ankylosis. Of even more serious import is the fact that the dissemination of tubercle is markedly accelerated by secondary septic infection. This fact may have been at the root of the objection, amongst certain old practitioners, to have any operation performed on a case of surgical tuberculosis, on the plea that an operation might cause dissemination. A surgeon's chief aim, therefore, in dealing with tuberculous bone disease, is to avoid the formation of sinuses. In order to achieve this, I have for some years in these cases discarded the use of drainage tubes; and, in order that I might safely dispense with them, have avoided the use of irritating chemicals, only using sterile normal saline solution when any fluid is necessary.

In dealing with an abscess in connexion with tuberculous bone disease, such as psoas abscess, the operation is timed to correspond with a high opsonic index, whether the latter is obtained by therapeutic means or by autoinoculation. The incision is designedly made as far as possible from where the abscess may possibly be pointing. The abscess cavity, after the pus has been liberated, is carefully wiped out with sterile swabs, and any loose sequestrum is removed. The deeper parts of the incision are then sewn up, layer by layer, with catgut, and the skin separately with silkworm gut. In a few cases such an abscess may refill in the course of a few months, and the process may have to be repeated; I am then careful to avoid the site of the old scar when making the second incision. I do not use any of the powerful chemicals, as it appears to me that their presence will only interfere with the natural processes of cure.

In the operations for tuberculosis of joints surgery is becoming more and more conservative. Fewer operations are performed, and, when they are unavoidable, arthrectomies take the place of excisions, while only rarely does amputation appear necessary. Drainage is omitted if possible, and in only a few cases when, for some reason, I have not been able to wear rubber gloves, do I leave a tube in for twenty-four hours, with a loose stitch to tie when the tube is removed. In most cases of advanced tuberculous adenitis a clean excision of the infected glands is still the best treatment, but I consider it highly important that this step should be preceded by an effort to raise the opsonic index, in order to prevent both that speedy recurrence which sometimes takes place and also the worse misfortune of a diffuse local infection of the tissues with tubercle. Of this condition several illustrative cases were published in the *Clinical Society's Transactions* for 1905 by Messrs. Corner and Dudgeon. In connexion with the removal of tuberculous glands in the neck it is important to remember that possible sources of sepsis may exist in carious teeth, otorrhoea, impetigo, etc. These must be dealt with before any aseptic operation can be performed.

In a few cases of suppuration in isolated cervical glands I have, at the suggestion of Sir Almroth Wright, aspirated the pus by means of a sterile syringe. I have generally found it necessary to repeat this aspiration, and it has not always been successful, but in those cases in which it has succeeded an operation with its accompanying anaesthetic has been avoided, and there has been no scar. These two advantages are much appreciated by the patient. Such cases have, of course, been treated simultaneously by inoculation of tuberculin.

It does not always require a surgical operation to give the circulating fluids free access to a tuberculous focus. In the earlier stages, where there is no definite collection

of inert material, such means as fomentations and the use of certain mild irritants—for example, linimentum iodi and Scott's dressing—may suffice. Dr. Bulloch, with exceptional opportunities at the London Hospital of judging, considers that the Pinsen light acts mainly by producing a local inflammation with great vaso-dilatation and the transudation of large quantities of plasma in the areas exposed to its action. If the serum is poor in antibacterial substances, the results of the light therapy are disappointing, and he suggests that this means of treatment should be used in conjunction with inoculation.⁶

In this connexion may be mentioned Bier's treatment by passive hyperaemia. The treatment consists of causing a passive congestion in the part by blocking the venous return without obstructing the arterial supply. This can be effected in a limb by the careful application of a Martin's bandage. Bier claims that the tissues are flooded with the constituents of the blood in the same way as a meadow through which runs a stream would be flooded if a weir were placed at the outlet of the stream, the inflow and outflow meanwhile remaining approximately the same.

The use of a Bier's bandage should be controlled by the estimation of the opsonic index, because in this, as in all other autoinoculations, the dose is not constant. I have used this method of treatment in a considerable number of cases of joint tubercle with a fair measure of success. The time and frequency of the application of the bandage is determined by the opsonic index.

I may here mention Klapp's suction apparatus, which is also employed to secure an increased lymph tension in a limited diseased area; such, for instance, as a sinus. Of this, however, I have had no personal experience. For sinuses, Wright recommends the use of a lotion containing NaCl gr. xx, citrate of soda gr. iij, to the ounce of boiling water, in order to decalcify the discharge, and allow a freer lymph stream through the diseased area.

Therapeutic inoculation is not the only means at our command for increasing the patient's resistance to tubercle. The efficacy of fresh air and sunshine in the treatment of tubercle has always been realized, but it is only of late years that their full benefits have been obtained, and that the open-air treatment of tubercle has been carried out in a properly organized manner and with a full appreciation of the importance of detail. This has been thoroughly realized in respect of pulmonary tuberculosis, but in this country we are rather slow to extend the full benefits of open air and sunshine to cases of surgical tuberculosis. On the Continent and in America numerous hospitals during the last few years have been built for the treatment of surgical tuberculosis in children. In these hospitals operative measures can be carried out side by side with properly organized open-air treatment. In one hospital near Boston, U.S.A., the children live in open verandahs, or in wooden buildings termed "shacks," which are so constructed with sliding doors that half of each side of the building can be open to the air at the same time. These doors are only closed for short periods, in order that surgical dressings and other necessary details can be carried out. The children lie practically day and night in the open air. At night use is made of flannel sleeping bags with woollen gloves and hoods, but it is remarked how little the patients appear to regard the cold of even a rigorous New England winter. The results at these and other open-air hospitals have been most encouraging. Patients have improved in weight and colour, sinuses have healed, and enlarged glands have subsided. Perhaps the one fact that stands out more saliently than others is that the climate of any special locality is unimportant if only pure air and sunshine are secured. A sandy or gravelly soil, with some shelter from the prevailing winds, is all that is required in the matter of site; and in this connexion the seaside does not appear to be essential.

This is an important point to emphasize, as, in a large proportion of the patients suffering from surgical tuberculosis, the question of expense prohibits the search after what is considered a suitable climate, and, if climate is considered the important element in the cure, many invalids would easily become discouraged. The only exception which I would make is the smoke-charged atmosphere of our big cities; but even in these unpromising surroundings efforts have lately been made at some of our children's hospitals to utilize their roofs as

what the Americans term "sun parlours." In the *BRITISH MEDICAL JOURNAL* for October 26th, 1907, I see that the success which has followed this method has induced the authorities of the Presbyterian Hospital, New York City, to build an open-air roof-ward on the top of the hospital. I do not advocate this, at any rate for metropolitan hospitals. What we require is that at a convenient distance in the country small hospitals should be built with facilities for open-air treatment. The buildings should be of the simplest description, consisting of an administrative block with shelters, which could be extended and renewed at a comparatively slight cost. I feel that it is presumptuous for a mere surgeon to criticize his medical colleagues, but I have often wondered whether the solid and stately structures in bricks and mortar which are erected under the name of sanatoriums are really the best form of building for an infectious disease like tubercle, and whether in the future our successors will not consider an occasional fire a necessary measure of hygiene.

Such hospitals as I have suggested should be considered as extensions of our city hospitals, whether metropolitan or provincial, and to them cases of surgical tuberculosis would be transferred. Each hospital should be properly equipped for the performance of surgical operations, and these should be undertaken by the staff of the mother hospital which first undertook the responsibility of the case. Resident medical officers would be responsible for the care of the patients, in the absence of the honorary staff, and on them also would devolve the routine blood examinations and therapeutic inoculations, under the guidance of the pathological department of the hospital. At the present moment very inadequate provision is made for this class of patient. The ordinary convalescent home will not take them—in fact, quite a high standard of health is required for admission into many convalescent homes. The usual history of these cases tells of constant readmissions to the same or another general hospital, and I am afraid that, in too large a proportion of cases, the patient ultimately succumbs. The mortality appears less than it really is, owing to the number of readmissions of the same patient. How often we find that the patient whom we had fondly hoped we had cured of hip-joint disease has ultimately succumbed to caries of the spine! But I expect that the medical officers of our workhouse infirmaries could tell you more of this than I can. Could such a scheme as I have outlined be adopted, it would at once free 10 to 15 per cent. of the surgical beds of our big hospitals, for the treatment of short or acute cases, and this would mean that for many years to come there would be no necessity to increase our hospital accommodation, or to build in London in order to provide more surgical beds.

In surgical tuberculosis, as in any other condition, early diagnosis is an important element in successful treatment. I have already indicated the use of the opsonic index as a means of diagnosis. There is one point, however, which I should like to emphasize in connexion with this. A normal index does not necessarily mean absence of tubercle, the curve might have been tapped as it crossed the normal line. It is only a repeatedly normal index that should lead us to negative tubercle.

Another important means of early diagnosis is the *x* rays. I need not labour this point, but will show you this photograph, which happens to be the last instance of this kind that I have had. This boy was brought to me at the Great Northern Hospital some two months ago, the complaint being that he limped. His hip-joint moved perfectly, and there was no swelling or tenderness in its vicinity. An *x*-ray photograph showed this light patch in the shadow of the neck of the affected femur. I lost sight of the boy for a few weeks, and when he came up again there was an elastic swelling to be felt on the front of the thigh. The movements of the hip-joint were still unaffected. I admitted him to the hospital and treated the abscess in the way I have indicated, and was able to verify the disease in the neck of the femur. The wound has healed, and he will be sent out on a Thomas's hip splint.

It is particularly in cases of genito-urinary tubercle that early diagnosis is important, as general treatment has a far better chance of success. By means of the cystoscope, tubercle of the bladder or kidney may be diagnosed even

before bacilli have appeared in the urine. Therapeutic inoculation and open-air treatment are the best means of dealing with these patients, except in a few cases where a nephrectomy or the removal of a tuberculous testicle may be indicated. In the former operation, the cystoscope, combined with improved methods of estimating a patient's renal efficiency, minimizes the risk of removing the less diseased of the two kidneys, an occasional surgical tragedy of the past.

SUMMARY.

I would thus summarize the treatment of these cases of surgical tuberculosis:

1. In all cases "open-air treatment" should be organized to meet the circumstances and requirements of the particular case.

2. The patient's powers of resistance to the disease should be periodically measured by suitable blood examination.

3. Where the resistance is found to be low and there is no evidence of excessive autoinoculation, use should be made of inoculations of Koch's new tuberculin, in doses that are accurately controlled, both as regards their amount and repetitions, by examination of the blood.

4. For patients in whom there is evidence of excessive autoinoculation, absolute rest, with, in the case of a limb, absolute fixity of the diseased part, should be prescribed.

5. In the cases of circumscribed tuberculosis, efforts should be directed to increase the circulation through the infected area. I have already indicated the means we have at our disposal to effect this object.

6. Operative procedures should be directed to the removal of the inert material, whether caseous glands, carious bone, or collections of pus, and allowing the access to the infected area of healthy lymph. The necessary operations should be conducted with the most scrupulous asepsis.

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A CASE OF ACTINOMYCOSIS (STREPTOTRICHOSIS) OF THE LUNG AND LIVER SUCCESSFULLY TREATED WITH A VACCINE.

By WILLIAM H. WYNN, M.Sc BIRM., M.D.,
M.R.C.P. LOND.,

CASUALTY ASSISTANT PHYSICIAN AND VISITING CLINICAL PATHOLOGIST
TO THE GENERAL HOSPITAL, BIRMINGHAM.

FORMERLY actinomycosis was regarded as a single disease occurring in man and cattle, caused by one definite organism—the ray-fungus (*Actinomyces bovis*, Harz)—the parasitic nature of which was first fully described in cattle by Bollinger in 1877. The disease was diagnosed by the discovery of the ray fungus in the affected tissues or discharges, but the parasites were not isolated in pure culture and studied, and, in spite of variations in structure, the identity of the ray-fungi in all cases of actinomycosis, whether in man or cattle, was assumed.

Bostroem in 1890 published an account of the characteristics of some ray-fungi isolated from cases of human and bovine actinomycosis, which he regarded as belonging to the same species; but Wolff and Israel in 1891 published an account of a ray-fungus isolated from a case of human actinomycosis, which differed in a number of characteristics from that of Bostroem, and evidently belonged to a different species. Since then a considerable number of species, more or less well defined, have been described. Some confusion was caused by the description of some of these species, which differed in various respects from *Actinomyces bovis*, as pseudoactinomycosis or pseudo-tubercle. It is now, however, admitted that there are many forms of actinomycosis, and the significance of the term has been widened so that it is used to designate a class of diseases each of which is caused by a distinct species, or at any rate variety, of parasite. Two generic names for these parasites are in use—namely, streptothrix and actinomycosis; the former was recommended for

adoption by a committee of the Pathological Society of London in 1899, and is generally used by British and American pathologists, but actinomycosis is still in use, especially on the Continent.

The following case seems worthy of being reported, as the organism obtained from it was isolated in pure culture, and its growth on various media studied, but especially because it is the first case, so far as I am aware, that has been treated with a vaccine prepared from the infecting organism according to the methods of Sir A. E. Wright:

F. G., a schoolboy, aged 14, was admitted to the General Hospital, Birmingham, under the care of Professor Saundby, on December 19th, 1906. He then complained of a troublesome cough, with abundant sputum having an offensive odour, and also of pain and swelling on the left side of the chest.

History.

The family history was unimportant. As long as he could remember he had suffered from bronchitis during the winter. Six years ago he had been in hospital with pneumonia, and in December, 1905, was again in hospital for eight days with a severe attack of bronchitis. At that time it was noticed that his sputum was abundant and very offensive; his fingers were also slightly clubbed. There is no record of a bacteriological examination of the sputum.

He remained fairly well until May, 1906, when he suddenly began to cough and bring up much fetid sputum, and was feverish. After three weeks in bed he improved, and was able to get about again until the first week of November, 1906, when he complained of severe pain in the left side of the chest. Since then he had remained in bed, and on December 15th he had another severe attack of coughing, and is said to have brought up "nearly two pints of offensive matter." He felt bad all over, and on the day before admission a rounded tender swelling appeared on the left side of the chest, just below and outside the nipple. For some days he had been unable to lie down for fear of choking, and for three or four months he had been losing weight, and often had night sweats.

Condition on Admission.

He was a well-developed boy, showing signs of slight recent wasting. Respiration was shallow and rapid, the left side moving less than the right. There was a well-marked Harrison's sulcus, and the left side was more prominent than the right. On the left side, below and to the left of the nipple, was a rounded swelling, the most prominent part of which corresponded with the sixth intercostal space. This swelling was red, tender, and fluctuating, and was evidently a pointing abscess. The lower half of the left side of the chest anteriorly and laterally below the fourth intercostal space was absolutely dull on percussion, no breath sounds could be heard, and vocal fremitus and resonance were absent; posteriorly resonance was impaired, and moist râles were heard. Elsewhere the lungs were free from dullness or abnormal sounds.

The cardiac impulse could not be felt, and the outline of cardiac dullness was difficult to determine. The liver was just palpable below the ribs, but the spleen could not be felt. The abdomen otherwise was normal. The urine was scanty and had a specific gravity of 1028, acid reaction, many urates, but no albumen and no sugar. He passed about 30 oz a day. The fingers and toes show slight clubbing but no bony enlargement. The diagnosis of an empyema pointing through the chest wall was made.

Operation.

The patient was operated upon on the evening of the day of admission. Chloroform was given, and an incision made over the fluctuating swelling. About 8 oz. of very offensive pus at once squirted out. The seventh rib was felt beneath the incision, and about 1 in. of it was removed. A ragged cavity could then be felt with the finger running upwards to the axilla and apparently in the lung itself.

Examination of Pus and Sputum.

The pus and sputum were sent to me on the following morning for examination. The pus was very thick and tenacious and had the colour of pale anchovy sauce. It contained large numbers of small yellow granules. The sputum consisted of similar pus mixed with mucus. On staining by the Gram method an enormous number of mycelial threads were revealed, in places forming dense masses. Numerous spores were seen but no clubs. Here and there the "ray-form" was present, but the organism was mostly in the form of a diffuse mycelium. No portion of the threads could be stained by the Ziehl-Neelsen method. In the pus the organism was apparently present in pure culture, but the sputum also contained various cocci and bacilli. No tubercle bacilli could be found. Both sputum and pus had a feculent odour. The staining and cultural characters of the organism will be described in detail later.

Diagnosis.

From the characters of the pus there was no doubt that we were dealing with a case of streptotrichosis of the lung and pleura.