stratum of fluid; salicyl-sulphonic acid=no visible change at once or for a number of seconds; in half a minute there is an evident opalescence, and in one minute it is more marked than with acetic acid and heat.

One part albuminous urine in 400 parts: Acidulation with acetic acid and boiling=slight cloudiness; salicyl-sulphonic acid=no immediate effect nor for a number of seconds, in one minute an opalescence is present, more marked than with acetic acid and heat; this opalescence persists on boiling.

Hence it is evident that when *immediate* opalescence is made the test salicyl-sulphonic acid is intermediate between the cold nitric acid and the acetic acid and heat test. On the other hand, when the presence of distinct opalescence after one minute or more is made the determining point the salicyl-sulphonic acid test gives more delicate results than the heat test (after acidulation when necessary) or any other I have tried—picric acid, mercurio-potassic iodide, hydrochloric acid with saturated salt solution, etc.

The main points to be noticed in regard to the salicyl-sulphonic acid test as compared with the acetic acid and heat test, and the cold nitric acid tests, are:

Its use as an agent of a delicacy intermediate between the other two tests; or, if it should be wished, of greater delicacy than either. Its greater simplicity than the acetic acid and heat test; for with the latter, in the case of urines of various grades of alkalinity, care has to be exercised so as to get a correct degree of acidity, in order to obtain certain results; insufficient acidulation being attended with a danger of the albumin present not being coagulated on heating, and excessive acidulation leading to a similar fallacy by the formation of acid-albumin, especially if accompanied by slow heating, which gives more time for the formation of this substance. With salicyl-sulphonic acid there is no danger of adding excess, as, instead of a drop or two, very many drops may be added without harm. Indeed, the addition of an amount equal to the bulk of urine does not redissolve the precipitate formed. All that need be used, however, is an amount sufficient to render the fluid strongly acid—usually a drop or two.

Further, salicyl-sulphonic acid enables one to recognise the presence of albumoses and peptones, which acidulation and heat or the nitric acid test does not.

The drawbacks of the cold nitric acid test, in addition to its insufficient delicacy, are pretty well known—the possible precipitation of acid urates, resinous matters (copaiba, etc.), albumoses, etc. It is true that heat clears up such precipitates, but the application of heat—to the extent necessary to cause a precipitate of albumose to redissolve—is impracticable without involving a mixture of the strong nitric acid and the urine, and consequently a danger of albumin present being redissolved also.

In the case of mercurio-potassic iodide (a very delicate precipitant of albumin) there is the complication of its precipitating many alkaloids, bile-salts, urates in certain circumstances, etc., in addition to albumoses and peptones. And though subsequent heating may clear up the precipitate, it does not differentiate between the various substances. And unless the proportion of the reagent present is a suitable one, the precipitate in some cases fails to clear up, and so simulates albumin. With picric acid, in addition to a much lower degree of delicacy, similar difficulties are present.

To conclude: the method of testing for proteids by salicyl-sulphonic acid may be briefly stated. Take a small amount of urine (for example, 20 minims), preferably in a very small test-tube, and add a drop or two of a *saturated* watery solution⁷ of the reagent. If the urine is strongly alkaline, an extra drop or two of the acid should be added, and if no opalescence or precipitate occurs it is well to test the reaction with litmus paper, and make sure that the urine has been rendered strongly acid. On adding the reagent, shake the tube quickly so as to mix its contents. Then examine at once. The occurrence of an opalescence or cloudiness *immediately* or *within a very few seconds* (for example, 2 to 3 seconds), is a test for proteids intermediate in delicacy between the cold nitric acid test on the one hand, and the acetic acid and heat test (in favourable circumstances) on the other. The develop-

ment of an opalescence some time after (for example, $\frac{1}{2}$ to 2 minutes), is a more delicate test than even acetic acid and heat, and shows the presence of minute traces of proteid, which are probably insignificant from a clinical point of view as a rule.

Next heat the tube to the boiling point. If the precipitate or opalescence is caused by the ordinary "albumin" (albumin and globulin) commonly present in albuminous urine, it does not disappear on heating, but, on the other hand, becomes markedly flocculent. But if the precipitate or opalescence is due to the presence of albumoses or peptones, it clears up on heating (before the boiling point is reached) and reappears when the tube cools.

LECTURES

ON THE

PATHOLOGY OF TUBERCULOUS DISEASES OF BONES AND JOINTS.

Delivered at the Royal College of Surgeons of England.

By W. WATSON CHEYNE, M.B., F.R.C.S.,

Hunterian Professor; Surgeon to King's College Hospital and to the Paddington Green Children's Hospital.

LECTURE II.

[Concluded from page 795.]

Experiments with Tubercle Bacilli on Guinea-Pigs and Goats.—Previous Experimental Work.—Spontaneous Bone and Joint Disease in the Lower Animals.

B. EXPERIMENTS ON GUINEA-PIGS.

Two similar experiments were performed on guinea-pigs, in both with positive results, but the processes did not show the same activity as in rabbits, a result like that obtained with tuberculous sputum.

C. EXPERIMENTS ON GOATS.

The most important of all the experiments were some which were performed on goats. Müller was the first to employ goats for these investigations. In his experiments he injected the pus from chronic abscesses into the nutrient artery of the tibia, and he selected goats chiefly because the parts are larger. In goats, also, the process appears to remain local for a longer time than in rabbits, and thus the changes in the part can be better studied.

I have performed three sets of experiments on goats. In the first place an emulsion of tubercle bacilli was injected into the nutrient artery of the tibia. Müller had previously performed similar experiments with pus from chronic abscesses, and it seemed to me of importance to repeat them with pure cultivations of tubercle bacilli. The mode of performing the operation, as worked out by Müller, is to expose the upper part of the tibial artery in a goat, just below the origin of the nutrient artery. This is easily done by making an incision on the anterior part of the outer side of the leg, commencing about an inch below the knee-joint. A nerve will be at once seen running downwards superficially to the muscles, and dividing into two branches. Follow the anterior branch and it will lead to an intermuscular space; open up this space, and the vessels will be seen at the bottom of it. Having exposed the artery in this situation it is ligatured and opened above the ligature. The nozzle of the syringe is then introduced into and fastened in the vessel, the nozzle pointing upwards; the material is then injected against the blood stream, and the vessel ligatured as the nozzle is withdrawn. The result of this procedure is that the fluid is forced into the upper part of the tibial artery, and the vessel being blocked below the origin of the nutrient artery it passes along that vessel, and is distributed throughout the bone.

In a second set of experiments the material was injected directly into the joints, and in a third series the injections were made into the substance of the epiphysis. The fluid used was, as before, an emulsion of a pure cultivation of tubercle bacilli.

EXPERIMENT XXIII.—The right tibial artery was exposed

⁷ It is important to notice that the solution must be a saturated one in order to obtain the best results.

at its upper part in a young goat, and about 3 minims of an emulsion of tubercle bacilli were injected in the manner above described. The wound was then closed and dressed aseptically. The animal was somewhat lame for a few days after the operation, and then recovered, but after about three weeks the ankle-joint, and somewhat later the metatarso-phalangeal joint, began to swell, and the animal limped very much, hardly putting the foot to the ground. The goat died fifty-one days after the operation.

On examining the leg the soft tissues in the neighbourhood of the seat of operation were found to be very much thickened. The ankle-joint, and more especially the metatarso-phalangeal joint, was very much swollen and much larger than the corresponding joints on the other side, the thickening apparently affecting the bones as well as the soft tissues. No abscesses or cheesy patches were seen in the muscles or tissues of the leg. The inguinal glands on that side were much enlarged. The lungs were full of minute tubercles, for the most part transparent and not cheesy; a few were seen in the liver, but none in the other organs.

Fig. 5.

This photograph (Fig. 5) is from a drawing made from the fresh section of the bone, and we see that there is a large number of cheesy deposits in the bones, more especially at the lower end of the tibia and at the lower end of the metatarsal bone; they are also very numerous, but more diffuse throughout the medulla of these bones and in the various tarsal bones. The synovial membrane in both joints, more especially in the metatarso-phalangeal joint, was much swollen and gelatinous. The deposits were not limited to the diaphysis of the tibia, but also occurred in the epiphysis, though they were not so numerous there.

The following is the result of the microscopical examination:

In the lungs there were numerous tubercles which in many places had run together, and contained numerous tubercle bacilli.

In the lower end of the tibia we see numerous caseating deposits in the bone, not only in the cancellous tissue, but also in the dense bone, in what is apparently newly-formed bone and in the periosteum. As to the character of these deposits, they consist of roundish or irregular collections of large cells undergoing caseation at the centre, but with no well-formed giant cells. Many of the cancelli are filled with this tuberculous tissue, and the margins of the trabeculae around are eroded and often completely destroyed, several cancelli filled with this material communicating with each other. There is in places new formation of bone from the periosteum.

In the epiphysis the deposits are not so numerous. The articular cartilage is almost entirely destroyed, and its place taken by tuberculous tissue with a few small giant cells. Here and there fragments of cartilage are found lying in this tissue. I think that the disease of the joint has been purely synovial in its origin, because in none of the specimens have I found any bone deposit breaking through the surface of the tibia, and the involvement of the epiphysis is comparatively slight.

The os calcis also contains large numbers of tuberculous deposits, especially beneath the epiphysal line; there are also more giant cells here than I have seen elsewhere. The articular cartilage is almost entirely intact except at one end, where a deposit is seen sprouting out of the bone, destroying the cartilage over it, and spreading over the surface of and eroding the cartilage on each side.

In the astragalus the deposits are fewer, but there are a good many in the cancelli just beneath the surface of the bone. The cartilage has been destroyed in parts, at some places apparently from the surface, at others by the tuberculous deposits beneath as seen in this photograph. The changes in connection with the destruction of the cartilage are precisely the same as those which occur in man.

The lower end of the metatarsal bone shows also a number of tuberculous deposits, very numerous indeed immediately above the epiphysal cartilage, and one or two very large ones in the epiphysis. The synovial membrane in this joint was also much thickened.

Here, then, we have as the result of the injection of tubercle bacilli into the nutrient artery of the bone and the deposition of these bacilli in various parts of the bone and

Fig. 6.

periosteum, the formation of caseating tuberculous deposits, destruction of the bone, new formation of bone both in the interior and from the periosteum, thickening of the synovial membrane, and destruction of the articular cartilages, both from the surface and from soft caseous deposits in the bone bursting into the joints; in fact, all the changes characteristic of tuberculous disease of bones and joints in man. And, as in man, in the specimens which I examined for bacilli, the organisms were few in number and imperfectly stained.

EXPERIMENT XXIV.—Small portions of a very dilute mixture of tubercle bacilli were injected into the nutrient artery of the right tibia in the usual manner, into the left knee-joint, and into the proximal end of the left metacarpal bone. As a result, the knee- and wrist-joints became swollen, but there was no apparent disease in the right hind limb. As the goat was weak and ill, and apparently suffering pain, it was killed forty-seven days after the injection.

On *post-mortem* examination, tubercles were seen in the lungs, spleen, and kidneys, all of small size. The right tibia showed nothing abnormal to the naked eye, and there was no swelling of the joints as in the previous case, but the muscles around the seat of operation were much thickened and infiltrated with tubercles.

There was great thickening of the synovial membrane of the left knee-joint (Fig. 6), more especially in the neighbourhood of the crucial ligaments, and the synovial membrane was covered with pendulous villous growths. These growths

were most numerous where the synovial membrane joined the bone, and also between the condyles of the femur. There was no pus in the joint, and nothing abnormal seen in the bones. (In Fig. 7 the patella has been turned outwards, and the villous synovial membrane is well seen.)

Fig. 7.

There was also great swelling of the left wrist-joint and marked thickening of the synovial membrane. In the proximal end of the metacarpal bone there was a large cavity containing soft material which communicated with the carpometacarpal joint. In this joint there were villous projections on the synovial membrane similar to those in the knee, and when the joint was laid open the appearance was exactly like that of a carious wrist-joint. The synovial membrane was thickened and highly vascular, and encroached on the articular cartilage and the bone; in fact, very little of the cartilage could be seen. The intercarpal articulation was also affected, but the radiocarpal joint was practically healthy.

Microscopical examination of the various parts gave the following result: In the lower end of the right tibia two tuberculous deposits were found presenting similar appearances to those in the former case. One of these was situated beneath the epiphysal cartilage, and the other somewhat higher up in the medulla. The articular cartilage was also destroyed at one part. Evidently very few bacilli had been arrested in the vessels in the bone.

The synovial membrane of the left knee-joint was greatly thickened, the new tissue being composed of young granulation tissue with tuberculous infiltration and a few small giant cells. There were no distinct tubercles, but there were here and there patches of caseating tissue exactly as in the wall of a chronic abscess. In some places the collections of epithelioid cells were more limited, and almost formed definite tubercles.

If a section of the lower end of the femur is examined, it is seen that towards the posterior part of the articular cartilage the point of attachment of one of the crucial ligaments is tuberculous and thickened at the surface. Passing backwards from the point of attachment of the ligament to the bone, we see that the tuberculous tissue has spread in between the cartilage and the bone, and has caused detachment of the former for a considerable distance, and there is sclerosis of the bone at this part. At the anterior and posterior points of reflection of the synovial membrane the tuberculous tissue is seen spreading over the surface of the cartilage. The cancelli immediately beneath the cartilage are filled with inflammatory tissue, but, except in the immediate vicinity of the crucial ligament, I can make out no tuberculous deposit in the bone. The peculiar flask-shaped pro-

jections of soft tissue into the cartilage from the superficial cancelli, as described in my last year's lectures, are well seen.

The sections of the synovial membrane of the wrist-joint show tuberculous deposits scattered throughout the fibrous tissue, some of them with commencing caseation.

This photograph is taken from a complete section of the wrist-joint (Fig. 8). Towards the posterior part of the metacarpal bone (at the upper part of the figure) there is a tuberculous deposit at the seat of injection. This deposit has destroyed the bone and the articular cartilage over it, and has thus spread into the joint; a number of the cancelli under the cartilage are also filled with the same material. On the anterior surface of the end of the metacarpal bone there is a considerable amount of new periosteal bone, and the bone around the deposit is much sclerosed. The synovial membrane in the articulation is much thickened and villous both in front and behind, and

Fig. 8.

shows the presence of caseating patches. The adjacent carpal bone shows destruction of the articular cartilage at the lower and posterior part, and penetration of the tuberculous tissue into the bone in this situation. There is much new periosteal bone in front, commencing destruction of the bone from the surface at the anterior and lower part, and great sclerosis in other places; in the soft textures behind there is a commencing abscess.

If, now, we examine the middle articulation, we find the same villous thickening of the synovial membrane and commencing destruction of the cartilage over the upper carpal bone, with sclerosis of the bone in the neighbourhood. The upper articulation is comparatively healthy, but even there the synovial membrane is beginning to spread over the cartilage at the posterior part of the surface of the radius, and slight thickening of the synovial membrane is taking place.

Compare this appearance with this section of the wrist-

joint from the human subject (Fig. 9), where the disease has also begun in the end of the metacarpal bone, and we find that the two appearances are essentially alike. Here also there is a deposit in the end of the metacarpal bone which has burst into the joint, and led to destruction of the carpo-metacarpal articulation. It has spread into the intercarpal joint, which is less involved, and is commencing to attack the radio-carpal articulation where the new tissue is beginning to spread over the cartilage of the radius.

In another experiment an extremely diluted cultivation of tubercle bacilli was injected into the nutrient artery of the right tibia of a goat and into the right wrist-joint. The tibia remained unaffected. The wrist-joint began to swell in the course of about three weeks, and this swelling steadily increased for about eight months. When the animal was killed nine months and a half after the injection this swelling was, however, distinctly less. On making a *post-mortem* examination there was no sign of internal tuberculosis; the wrist-joint was considerably swollen, the synovial membrane was thickened, and the bones, especially the metacarpal bone, en-

Fig. 9.

larged. My belief is that recovery was taking place, and that had the animal been allowed to live the part would have got completely well. This result would not have surprised me, for goats are probably not more susceptible to tuberculosis than man, while in this case such a very small dose of the virus was introduced in the first instance that I hardly expected any result; and, as I have found in the more acute diseases, the subsequent course and severity of the affection depend to a very great extent on the initial dose of the virus, especially where the susceptibility of the animal to the disease is not very great.

Thus, in the case of goats, we again see that all the characters of tuberculous diseases of bones and joints in man can be faithfully reproduced by the injection of tubercle bacilli into the nutrient arteries of bones, into the bones themselves,

or into the joints. We see the same caseating deposits, the same new formation of bone and subsequent erosion by the tuberculous growth, the same modes of destruction of cartilage, the same villous thickening of the synovial membrane, etc. We also see that, as in man, the tubercle bacilli are difficult to find in the diseased tissues, although the disease has been produced by them alone. In the lower animals we seldom see well-formed tubercles as in man, but rather patches of tuberculous infiltration which are undergoing caseation.

These experiments seemed to me sufficient to establish the causal connection between the tubercle bacillus and tuberculous diseases of bones and joints, more especially when taken in connection with the work of previous investigators with coarse tuberculous materials, and I have not therefore thought it necessary to pursue the matter further at present. Nor have I thought it necessary to perform an extensive series of control experiments, for it has already been sufficiently demonstrated that this specific disease can only be set up by the tuberculous virus, and experiments in which bones and joints have been injured for other purposes—such as Kocher's experiments on osteomyelitis—are numerous, and have in no instance been followed by the development of these tuberculous lesions. Nor have these changes followed the injection of pigment granules, other bacteria of various kinds, etc., into the blood stream, although one of the chief seats of deposit of these foreign bodies is the medulla of bone, especially in the neighbourhood of the epiphysis.

These experiments are completed by a work just published by Professor Krause, in which he has repeated Schüller's experiments and injured the joints of animals previously inoculated with cultivations of tubercle bacilli. Like other observers, he has found that severe injuries, such as dislocations, are not nearly so readily followed by tuberculous joint diseases as lighter injuries, like sprains; and he has also found that fractures of bones in tuberculous animals heal without any trouble. Of joints which were dislocated or severely injured, a few became tuberculous, but of joints which were sprained the majority ultimately showed evidences of disease. In the great majority of cases the form of the disease was a tuberculous thickening of the synovial membrane resembling primary disease of the synovial membrane in man. In a few cases he found isolated tubercles in the epiphyses, but in three he found larger caseating tuberculous deposits. He also calls special attention to the difficulty of finding bacilli in these parts, although they were numerous in the tubercles in the internal organs.

Time fails me to go into the previous work which has been done on this subject, but the two most important researches, besides that just mentioned, are those by Tricomi and Müller. Müller's experiments were performed with pus from chronic abscesses, and Tricomi's with various tuberculous materials, chiefly sputum, pus from chronic abscesses, finely broken up tuberculous synovial membrane. Their results are practically identical with those which I have described, the only differences as regards Tricomi's work being the more rapid progress of the disease and death of the animals in his cases. This is, I think, chiefly accounted for by the fact that he employed materials such as sputum, which were not altogether pure, and that his results were probably in some cases the consequence of mixed infection. If this is the explanation it supports the conclusion to which I have come, that the presence of sepsis aids the extension of the tuberculous process. Müller's experiments were chiefly performed with the object of testing König's view that the osseous deposits, more especially the sequestra, are due to emboli of tuberculous material. The experiments were performed on rabbits and goats, and the material employed was pus from chronic abscesses. In one rabbit, which lived for about twelve months after injection of pus into the femoral artery, there was typical synovial disease of the ankle-joint, with pus in the joint, and in the middle of the articular surface of the tibia there was a sequestrum, quite loose, round, and of the size of half a pea. In a goat which lived for thirteen months after injection of pus into the nutrient artery of the tibia, there was no disease of the internal organs, but the knee-joint was much enlarged, and contained a quantity of sero-purulent fluid, and the synovial membrane was from six to ten times thicker than normal,

and had patches of caseation on its surface. In the external tuberosity of the tibia there was a sequestrum 1 centimetre in diameter, surrounded by brownish red granulations and the opposing surface of the femur showed several defects in the cartilage and bone filled with caseating tissue. On making a vertical section through the tibia the sequestrum was seen to be triangular in shape with the apex towards the shaft of the bone. In the internal tuberosity of the tibia there was a soft deposit containing brownish red and whitish material. Other deposits were found in the end of the femur.

TUBERCULOUS DISEASE OF BONES AND JOINTS OCCURRING SPONTANEOUSLY IN THE LOWER ANIMALS.

Very little appears to be known about these diseases in the lower animals, and after searching much literature and inquiring among veterinary surgeons both at home and abroad, I only succeeded in 1888 (when I looked into this matter) in finding one paragraph in which there is any description of the disease, and that was in a paper by Ostertag on "Oertliche und allgemeine Tuberkulose," in the *Archiv f. wissenschaft. u. prakt. Thierheilk.*, xiv, 4 and 5. I may quote Ostertag's statement. He says, speaking of general tuberculosis in animals, that tuberculosis of bones and joints "is found chiefly in the dorsal vertebræ, ribs, sternum, and the long bones, or the hip- and knee-joints. The tuberculosis of the bone usually starts from the medulla, or the spongy portions of the bone, more rarely from the periosteum, and leads to the formation of greyish red granulation deposits, which attain a considerable extent by lacunar absorption of the bone. The centre of the growth soon undergoes caseation, and ultimately a cavity is formed, which frequently only shows a narrow border of granulation tissue. As a rule, only isolated deposits are met with, but it sometimes happens that almost half the dorsal vertebræ are affected. The process may spread to the joints from the epiphysis, but an osseous deposit is not necessary for the formation of a tuberculous arthritis. In swine I have seen two forms of tuberculous inflammation of joints—(1) an empyema articulare tuberculolum, in which the synovial membrane is infiltrated with tubercles, moderately reddened and swollen, and distended with muco-purulent exudation; (2) an arthritis fungosa, where the synovial membrane is swollen, and converted for the most part into a granulation tissue with tubercles scattered through it, this tissue filling up the cavity of the joint without any great exudation into the joint."

From specimens which I have had the opportunity of examining, I believe that most of the so-called scrofulous joints of animals are not tuberculous but most probably rheumatic, but I have, through the kindness of Professor Schütz, of Berlin, obtained six specimens of true tuberculous disease of bones in the lower animals. [Photographs of five of these were shown.]

One section of the lower end of the humerus of the cow shows an extensive caseating patch in the medulla of the humerus, which reached as far as the articular surface, and had destroyed the cartilage over it. The soft deposit is surrounded by sclerosed bone, in which we see fresh tuberculous nodules, which apparently commence in the Haversian canals.

In another specimen from the sternum of the cow we see a considerable area of soft issue, and also roundish soft caseating masses. The small masses are composed chiefly of more or less perfect fibrous tissue, caseating in parts, and showing a few small giant cells, with marginal nuclei. The smaller patches are evidently in the Haversian canals, and consist of a central artery, with greatly thickened walls, surmounted by some fibrous and cellular tissue.

The appearances in the sacrum of the cow are essentially the same. At the anterior part there is new bone and sclerosed bone, with here and there circular caseating deposits in it; at the posterior part the osseous tissue has disappeared, and in its place is a patch of soft tissue, in which are similar round caseating deposits. In some parts the bone has become absolutely dense.

In a specimen of the vertebræ of a pig the chief seat of the disease is in the laminae. To the naked eye the tuberculous mass seems to be composed of an aggregation of small nodules. There are also deposits in the bodies of the vertebræ. In one of the bodies there is a cavity of considerable size, filled with cheesy material and opening on the surface. In

a photograph of a section is seen, chiefly in the situation of the laminae, the tuberculous mass which consists of fibrous tissue replacing the bones, the tuberculous deposits being in roundish groups, and clearly commencing in connection with the blood-vessels. There are generally two or three deposits in each group, and some giant cells, but not much caseation.

In a photograph of a fowl's tibia peculiar caseating patches are seen in the medulla of the lower end of the tibia, and two similar patches in the cancelli of the epiphysis. These patches are surrounded, more or less completely, by a reddish ring, and we find here and there in the caseous material smaller red rings, which are apparently composed of fibrous tissue, and are probably formed around the blood spaces. The specimen had been badly preserved, and did not stain well.

The general character of the disease in cattle is the formation of large and small roundish, caseating nodules in the substance of the bone, accompanied in the first instance by sclerosis of the bone. These nodules commence in connection with the blood vessels in the Haversian canals, or in the medulla of the bone. In the Haversian canals the walls of the blood vessels are thickened, and in various parts we can trace all stages, from commencing thickening of the vascular wall to the complete development of a caseating tuberculous mass. The tuberculous growth evidently commences in and around the walls of the vessels, and soon becomes surrounded by a fibrous envelope. As it enlarges, the bone around becomes absorbed, and thus we come to have small and large round spaces in the bone, containing tuberculous tissue caseating in the centre; this caseous material falls out in preparing the sections. These deposits are not always round; in the process of absorption of the bone larger cancellous spaces are opened into, and thus we find elongated or irregular-shaped deposits. In these tubercles giant cells are not usually numerous nor large; and in the specimens which I have examined—which, however, were not well preserved—the bacilli were few in number. I have not met with sequestra in any of these specimens.

INTRALARYNGEAL INJECTIONS IN THE TREATMENT OF CERTAIN LARYNGEAL AND PULMONARY AFFECTIONS.

By J. WALKER DOWNIE, M.B., F.F.P. & S. GLASGOW,

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ON November 8th, 1889, I read a paper before the Medical Section of the Medico-Chirurgical Society of Glasgow, bearing on this subject, and giving details of several of the cases which had been under my care during the six months previous to that date. The majority of the cases there detailed had been treated in the wards of the Western Infirmary, where, through the kindness of several of my colleagues, every opportunity was afforded me of testing this method of treatment. Among the conditions treated were cases of tuberculous laryngitis in an ulcerative condition without detectable pulmonary lesion, and others with varying degrees of pulmonary implication, cases of early phthisis pulmonalis, pulmonary cavity, bronchiectasis following long standing bronchitis, and some few cases of bronchial asthma. Every case to which I shall refer was examined by one or more medical gentlemen, independent of any examinations made by myself, and all particulars here given of the condition of the patients are founded on the opinions of those gentlemen.

Solutions Employed.—At first I employed solutions of menthol in rectified spirits varying in strength from 10 to 15 per cent., but on account of the glottic spasm produced by its introduction into the larynx in several cases, I substituted at an early date olive oil, used by Rosenberg and other experimenters, as the solvent and vehicle of the drug exhibited. Recently I have made use of vaseline oil as the solvent. When this is employed, the solution remains for a lengthened period perfectly clear, and it is readily borne by those who object to the smell of olive oil. Pure carbolic acid, creasote