The Brown Lectures.

FURTHER INVESTIGATIONS ON ANTHRAX AND ALLIED DISEASES IN MAN AND ANIMALS.

Delivered at the University of London on December 13th, 1880,

BY PROF. W. S. GREENFIELD, M.D.

LECTURE I.

PROF. GREENFIELD commenced by stating that he had reverted to the subject of anthrax and anthracoid diseases because recent experiments were such as to throw an entirely new light on many of the problems relating to them, and to reverse views previously entertained, besides adding new, important facts. Anthrax had been investigated for many years; for it is the first disease in which a definite bacterial organism was found to constitute its specific contagium. If it can be brought under the category of epidemic diseases, the study of its specific organism is of the greatest value in the investigation of other like diseases; and the conditions of its propagation, of its maximum virulence, and of the influence whereby that virulence may be delayed or destroyed, become of the highest importance. The experimental study of anthrax has led to striking results in this respect, showing that the relative virulence of the disease, as propagated by inoculation or contagion, is identical in its properties with small-pox under like conditions; and if that is true the law holds good of nearly all contagious epidemic diseases—viz., that of natural recurrence, or recurrence in a modified form. The disease is more prevalent in man than is usually supposed, and although at present instances of it are confined mainly to woolsorters, it is yet widely prevalent where as yet its existence is unsuspected.

He would first describe experiments made during the past year which throw a new light upon its pathology. It was strange that so few attempts had been made at its prevention by protecting animals by inoculation. The striking results formerly obtained by small-pox inoculation had been obscured by the greater merits of vaccination in substituting a non-contagious for a contagious disease. It was only comparatively recently that any systematic attempt had been made to extend the principle of inoculation to other diseases; but there could be no doubt of its value in pleuro-pneumonia of animals, and now also as regards splenic fever. In his lectures last year he stated his intention to ascertain whether a bovine animal could be inoculated with a non-fatal form of the disease, so as to afford protection against any subsequently acquired or artificially produced attack. Dr. Sanderson and Mr. Duguid had shown that such inoculations could be practised; but their experiments, which had not been published, did not lead to the suggestion of protective inoculation, but rather negated this idea. Professor Greenfield then described his own experiments in detail. A cow (A) was inoculated with a second generation of anthrax bacillus, derived from the guinea-pig. There were no symptoms for twenty-four hours except slight swelling at the seat of inoculation. Forty hours after the inoculation the temperature rose to 104° (normal being 101°), and the animal became drowsy, stupid, and lost appetite. A slight evening fall of temperature to 102.4° was followed by a rise to 106.4° next morning, and for three days it ranged between 105° and 107°, the animal being seriously ill. There was very marked cedema at the seat of inoculation, subsiding on the sixth day. On the eighth day the temperature fell to 104°, on the ninth to 101°, and speedy recovery ensued. Six weeks later a second inoculation was performed, the fresh spleen of a guinea-pig dead from anthrax and swarming with bacilli being used. The temperature rose to 102.6° next day, but on the third day the animal was well. A week later a third inoculation was made on this cow, and at the same time another cow (B) was inoculated

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for the first time. No result occurred in A, but in B there was rise in temperature on the second and third day, but no loss of appetite or local cedema; and on the fourth day the animal was found dead, and presented the post-mortem appearances of splenic fever, the blood swarming with bacilli. A fourth inoculation was performed on A three weeks later with the fresh spleen of a guinea-pig, swarming with bacilli, and again without result. Two weeks later a fifth inoculation from a sheep which had died of anthrax, resulted only in the formation of a local abscess. A calf (C) six months old was inoculated with the fifth generation of anthrax bacillus; nine days later it was reinoculated, this time with the first generation; local cedema, rise of temperature, and other symptoms followed, but recovery took place. Five months after a third inoculation produced no effect. Experiments were also made on two young heifers (D and E) about the same age and size; D was first inoculated by the cultivated bacillus of a third generation. Next day it was stupid and drowsy; and there was extensive local swelling; the temperature reached its maximum on the third day, when the constitutional symptoms were most severe; with the subsidence of the fever rapid recovery took place. Neither in this nor in other cases did any pustule form, nor had the local swelling any resemblance to the emphysematous swelling of "black quarter." The blood contained no bacilli. Ten weeks later an inoculation with the thirteenth generation of the cultivated virus produced no effect; and an inoculation with the spleen of a guinea-pig produced no symptoms beyond slight local swelling. E was inoculated five days after D with the eighth generation of bacillus. No symptoms occurred; nor after a further inoculation with the seventh generation, and one with the thirteenth, practised at the same time as the like inoculation on D. It being thought possible that protection might be conferred by inoculation with the very attenuated virus, each of these animals was, three months later, inoculated with half a drachm of blood from a man who had died of general anthrax (woolsorters' disease) thirty-six hours previously. The blood was still fluid and of natural colour, its corpuscles were natural, and it contained the characteristic bacilli, but no spores. Rodents inoculated with it speedily died. The heifer D, which had been successfully inoculated three months previously, suffered from no ill-effects after this severe test, beyond a slight rise of temperature the following day, and a small phlegmon. In E, however, very severe symptoms set in in twelve hours, and for some time life was threatened; but on the fifth day improvement set in, although the swelling was so considerable as to call for incisions to be made into it. The same two animals were submitted to another comparative test two months later, D being inoculated with the spleen, and E with the pericardial serum from a cow dying of splenic fever on a sewage farm near Bradford. No symptoms followed in either case.

It had been objected that, although such inoculation conferred protection against further inoculation, the animal might still be susceptible of the epidemic or epizootic disease. But there is ample evidence to show that animals insusceptible of inoculation do not spontaneously suffer from the disease, and that the disease in its epidemic form is really inoculated in some part of the mucous membrane. Striking confirmation of the protection by inoculation has recently occurred. Near Bradford the sewage of a mill and the adjoining village is carried almost directly to a small farm about a mile distant, and there distributed to some meadows on one side of a valley and stream, the fields on the other side not receiving any of the sewage. This sewage (containing as much as 26 per cent. of organic matter) is largely composed of the washings of wool from the mill, and that the wool contained anthrax poison was shown by the occurrence of four cases in the men washing the raw wool in April, one in May, and one in June. On May 1st the proprietor of the farm, who had procured twelve cows from Scotland, placed five cows (lot 1) upon the sewage farm, and the rest (lot 2) on the other field. On May 27th one of the lot 1 was found dead and two others ill. All the animals were now removed to the non-sewage fields, but on June 8th the eight were put on the sewage farm, and on the 30th the cow which had been ill was found dead. The rest were again taken off these infected meadows, but on July 2nd one of the second lot died suddenly from anthrax. Two sheep grazing on the sewage field also died. On July 13th the three animals above called A, D, and E were placed on these fields, and remained there, two of them till October 19th, and one till November 16th, quite free from disease. Meanwhile two

more sheep died from anthrax, and although the mills had been stopped the contagion still remained in these fields, for on November 23rd the proprietor placed some fresh cattle on them, having kept them on the other fields from the end of September. On December 2nd one of these animals died of splenic fever.

These facts are, of course, not absolutely conclusive, for it is difficult to obtain any absolute proof of the power of resistance acquired by any exposure to contagion; but there are few conditions which could have been more satisfactory in proof of the protection afforded by inoculation.

Professor Greenfield then described at length the researches arrived at in the same direction, and with similar results, by Pasteur, Chauveau, and Toussaint; and remarked that, to be of practical value, a method must be found to confer the maximum of protection with the minimum of risk to the inoculated animal. He had, therefore, instituted a series of experiments, on the modification of the anthrax poison, which he proposed to describe in the next lecture (and a note of which was read at the Royal Society on June 17th, some time before M. Toussaint made his method public at the Académie des Sciences).

Passing to the phenomena following inoculation, he remarked upon the constancy with which a local gelatinous œdema and rise in temperature (whether of fixed duration and degree observations were too few to decide) occur in the non-fatal cases; whilst in the fatal cases such symptoms were absent. They were also absent in the subsequent inoculations, so that the conclusion is that the swelling is not a mere inflammatory reaction caused by injection of irritant material, but as specific as the vesicle of vaccinia or the chancre of syphilis. It varies also with the intensity of the virus, and not with the material containing it, and its appearance may be looked upon as a favourable omen. He had failed to find bacilli in this gelatinous exudation in bovine animals as in rodents; and inoculations from the blood during the high temperature were inert, so that if bacilli were absorbed they must be destroyed. There was no definite information as to recurrence after mild attacks, nor on the question of individual proclivity and susceptibility. The resistance after inoculation is not complete, for it may be increased by further inoculations, and Chauveau has shown it may be overcome by enormous intra-venous injections. It cannot be that the pabulum for the maintenance of the life of the virus is exhausted, but it would seem as if the power of destroying the virus were intensified, and that a certain property innate in the system acquired increased activity by use. Chauveau shows that Algerian sheep, which have great natural power of resistance to the virus, have this increased by inoculation, and that if ewes are inoculated in the last months of gestation the lambs are insusceptible. The observations of Brauell and others, and in one case by Professor Greenfield himself—the blood and tissues of the fœtus of an animal dying of anthrax were found not to contain bacilli, whilst those of the mother may swarm with them. So that immunity may be transmitted without contagion; and possibly this is due to a product of the virus, and not the virus itself being the factor capable of protecting by inoculation. If this be so, a new law of vast importance in contagious disease would be opened up. The fact of non-recurrence adds one more link between anthrax and the specific contagious diseases as distinguished from simple blood-poisoning; and gives encouragement to the investigation of its laws, in the hope of applying them in future to the less understood but more important and fatal human diseases.

GUY'S HOSPITAL.—The following is the reply of Dr. S. O. Habershon and Mr. Cooper Forster to the resolution sent them by the members of the Brixton Medical Book Society, a notice of which appeared in our last week's issue:—

“Dec. 6th, 1880.

“GENTLEMEN,—We sincerely thank the members of the Brixton Medical Book Society for the resolution passed at their meeting on Dec. 3rd. We highly appreciate the sympathy of our professional friends in the painful and difficult position in which we have been placed as seniors on the staff of Guy's Hospital. We could no longer remain in office without sacrificing the honour and the just claims of our profession.—We are, Gentlemen, yours very faithfully,

S. O. HABERSHON.
J. COOPER FORSTER.”

Clinical Lecture

ON

CARCINOMA OF THE SIGMOID FLEXURE.

Delivered at St. Mary's Hospital,

By ARTHUR T. NORTON, F.R.C.S.

A shilling and a sixpence arrested in the bowel at the seat of the stricture; perforation of bowel and escape of fecal fluid beneath the iliac fascia; pyæmic abscesses and secondary deposit of cancer in the liver.

GENTLEMEN,—R. L—, a healthy-looking woman, aged forty-four, was admitted into the hospital on the 24th of January. She said she had enjoyed good health until the previous month. Owing to the symptoms exhibited at the date of admission the patient was entered as a medical case under the care of one of the physicians.

When first seen she complained of nausea and continual retching, but without vomiting; of great pain in the left lumbar and iliac regions of the abdomen, aggravated by pressure, and also of severe pain referred to a point midway between the tuberosity of the ischium and the great trochanter of the femur. For some days the symptoms remained unchanged. The temperature varied, being always above normal, sometimes 102°, and the variations were not regular, the highest point in the day being from time to time in the morning, occasionally in the afternoon and evening.

On the 13th of February there was detected deeply in the left iliac fossa, and reaching nearly as low as Poupart's ligament, a distinct swelling, excessively tender and somewhat fluctuating in character. This swelling could not be felt on a vaginal examination. On the morning of this day the patient had a distinct rigor lasting about a quarter of an hour. Retching and vomiting were continuous throughout the day, but the vomit was not stercoraceous.

On the 17th of February I examined the case again in consultation, and found what I described as an irregular, fixed, somewhat nodular mass on a level with the last lumbar vertebra three inches from above downwards, and an inch and a half from side to side. In the left iliac fossa was also an abnormal enlargement, tense and elastic, and of doubtful fluctuation.

On the following day the patient was put under chloroform, and the question of exploratory puncture was discussed, but I considered that the tumour with doubtful fluctuation lay so far away, and in itself was so slight in the elevation, that such a puncture would very probably prove a failure; whilst at the same time the necessity of making the puncture in very close proximity to the iliac vessels made the risk of the operation too great in comparison with any good results that might possibly be derived from it.

From day to day the patient suffered from severe rigors, followed by profuse perspirations. The tongue was brown, furred; the pulse 120; the bowels were open regularly, sometimes solid motion, and often diarrhœa.

On the 24th February the physician inserted a trocar, in order to ascertain the character of the fluctuating tumour, but only blood came away.

On the 26th I again saw the patient in consultation, and found the left side of the abdomen emphysematous, commencing around the seat of the puncture and extending some six or eight inches upwards. It was considered advisable to open down upon the tumour at once, and I therefore passed a knife into the point of the former puncture, and made an opening large enough to admit my finger. About ten ounces of frothy, yellow material, resembling typhoid fever stool, came away, and on inserting the finger within the aperture the cavity was traced under the psoas inwards as far as the pelvic cavity, and upwards as high as the last lumbar vertebra. The extremity of the cavity could not be reached by the finger, but as high as the finger could reach a somewhat extensive induration could be made out near the lumbar vertebra, giving to the finger a sensation such as an ulcerated surface. The wall of the cavity was