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CONTAGIOUS PLEURO-PNEUMONIA,

OR

LUNG PLAGUE IN CATTLE.

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CONTAGIOUS PLEURO-PNEUMONIA, OR LUNG PLAGUE.

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THE prevalence of contagious pleuro-pneumonia among cattle at different points in the Middle Atlantic States at the present time, and the danger of its extension by the natural course of the cattle traffic to districts that are now free from it, afford sufficient reason for directing the attention of physicians to the great injury that may result to the interests of agricultural communities from its spread, and for indicating the prominent characteristics by which the disease can be recognized, and the means that may be adopted for its restriction. Scientific veterinary medicine has received so little encouragement in this country, and so few individuals have been properly trained in this specialty, that the services of a qualified veterinary surgeon cannot be readily obtained in the smaller towns and villages, where the disease is most likely to show itself under circumstances favoring its spread; and it seems proper that physicians practicing in such districts should familiarize themselves with the subject to an extent sufficient to enable them to give such advice and direction as may save their communities from great financial loss, and prevent, possibly, the ruin and distress of many families. So far from the observation and study of disease in animals detracting in any way from the dignity of the medical calling, it is presumed that every physician of liberal training will recognize how greatly such observations have contributed in the past, and will probably contribute in the future, to the progress of medical science, especially in relation to the essential characteristics of the contagious principle in many affections, and the manner in which disease is communicated from one individual to another. Of the various names by which this disease has been designated, *pulmonary murrain*, *contagious pleuro-pneumonia*, and *lung plague* are those which are best known in this country. The term epidemic or epizoötic is frequently applied in this connection, but is objectionable, as it tends to suggest to the popular mind some determining influence in the atmosphere as the cause of the affection, and diverts attention from its true infectious character. As the contagious disease is often confounded with sporadic, non-contagious affections of the chest, I agree with Professor Gamgee in his preference for the term "lung plague" as the most distinctive, although contagious pleuro-pneumonia is

most clearly indicative of the prevailing pathological conditions. The disease is indigenous in Asia and the steppes of Eastern Russia, and first appeared in Europe, into which it was introduced through the latter country, at the end of the seventeenth century, and during the succeeding hundred years it gradually spread westward, until at the beginning of the present century outbreaks were occurring every few years over all parts of the continent. As the disease was extinguished in one place it would reappear in another, owing to the movements of cattle in trade. It was imported into the British Isles from Holland in 1840, and committed great ravages there, the average loss from destruction of cattle for many years being from ten to twenty millions of dollars. From Great Britain the disease was introduced into this country by various importations of cattle. Between 1843 and 1850 slight outbreaks occurred in the vicinity of New York and Brooklyn, which have been so frequently renewed as to warrant the belief that the disease has never been wholly extinguished there. It has appeared at different points along the Northern Atlantic States, but its most serious manifestation was at Belmont, Mass., 1859, where three cows imported from Holland died a few days after their arrival, and the disease extended to the other animals on the estate. A calf purchased from this farm showed signs of illness on its way to Brookfield, fifty miles distant; it was placed in a barn with fifty head of previously healthy stock, most of which sickened in succession, and a large number died. The disease spread from farm to farm, as animals were interchanged in trade, the numerous deaths of cattle threatening financial ruin to many farmers, and the true character of the affection and the immense damage threatened to the agricultural interests of the State were soon recognized. The state authorities took prompt action by convening the legislature in special session, securing the necessary appropriations, and appointing commissioners with power to kill cattle actually diseased, as well as those that had been exposed to contagion and were suspected, the owners being compensated in part. Arrangements were made for the isolation and quarantining of diseased or suspected animals; the sale or the transportation of any cattle from the infected to the healthy districts, without permission of the commissioners, was made punishable by fine and imprisonment. In spite of these energetic measures the disease was not completely exterminated in the State until after a hard seven-years' fight and the slaughter of some twelve hundred cattle, in addition to those which died of the disease. The history of the Massachusetts outbreak illustrates the advantage of prompt coöperative measures for preventing the disastrous consequences that are likely to ensue from failure to recognize the disease in its early prevalence. In treating of the lung plague it is well to insist upon the recognition of the essential fact that it is a specific contagious affection, which does not arise spontaneously,

as was long supposed, from any combination of influences, like overcrowding, bad or swill feeding, exposure to severe weather, etc., and that wherever the disease has prevailed in Europe or America it has been introduced by some animal suffering from the specific affection. Its contagious character has been amply demonstrated not only by the difficulty of checking the disease when it has once gained a foot-hold among cattle, but by the experiments that have been made under the direction of the Swiss and French governments, where diseased animals were introduced among others, notably healthy, in districts where the affection had never prevailed, with the result of communicating it to nearly all the animals exposed. The greater portion of those which survived the disease were not again susceptible on repetition of the exposure. These observations also demonstrated that the contagion could be communicated by the clothes worn by the attendants or the blankets used for the animals, by the vessels and troughs from which they took their water and food, by the excretions, and by contact with the flesh of cattle that had died of the disease, and that these various substances retained the power of infection for many months. The pathological features exhibited by the disease are those of a specific and contagious general affection of a low typhus character, with special manifestations in the lungs, where extensive inflammation, with an excessive exudation into the pleural cavity, into the bronchi, and directly into the lung substance itself, occurs, — conditions which may proceed to such an extent as directly to destroy life by interfering with respiration, or may be succeeded by disorganization, formation of abscesses, gangrene, and more or less complete destruction of the lung tissue, accompanied by purulent infection and blood poisoning. The morbid anatomy of the disease bears considerable resemblance to that of acute phthisis in the human subject; but in many of its features the lung plague has a pathological analogy with small-pox, as it is eminently contagious, may be reproduced in other animals by inoculation with the exuded matter, when it causes a modified disease which secures immunity from its recurrence for a time, as does also an attack of the original affection. The special manifestations of this disease are displayed in the lungs, and the exudation into those organs contains the contagious principle, just as in small-pox the same conditions are manifested on the skin. The period of incubation attending the development of this affection is not well marked, as it may extend from one week to three or four months; and even after this long incubative stage only a latent form of the affection, with but few characteristic symptoms, may be developed. The cattle which conveyed the disease from England to Australia were three months on the voyage, and had no symptoms of the affection until landed, but there was no doubt that the infection of the animals had occurred before their departure from England. These insid-

ious characteristics, which frequently mask its existence, add greatly to the difficulties connected with the disease. Many animals die during the first or second week, in the suffocative stage of the disease. If this period be survived, life may be prolonged five or six weeks. In the cases where recovery takes place the affected animal is capable of communicating the disease to exposed healthy cattle during the whole period of convalescence. The disease varies greatly in intensity and in its rate of mortality. Animals on one farm may exhibit a mortality of seventy-five per cent., while on one adjoining nearly all may be sick, and but few die. The average death-rate is about forty per cent. of those affected. The observation of a few cases of the lung plague will enable any one with a medical training and a correct knowledge of the pathology of the affection to recognize its appearance among cattle. In a herd where the disease has gained a foot-hold, among the first symptoms shown by the affected animals will be the listlessness and irregularity of appetite and of rumination, distinguishing them from their healthy fellows, who are steadily browsing around them ; and it has been noted as a curious fact that, despite the failure of appetite, the sick animals have a fuller appearance than natural. Another early symptom is the change occurring in the animal's hide, which loses whatever softness or sleekness it may have possessed, and becomes rough, stiff, and staring, the hair tending to stand outright, and the whole coat assumes a marked scraggy character. Slight shiverings generally attend the development of the disease, and expert dairy-maids, in some of the districts of Europe where the plague has prevailed for a long time, recognize its existence at an early stage by the stiffness of the teats, the difficulty in milking, and the gradually lessening amount of the secretion. An irregular, slight cough, harsh and dry in character, but not painful, develops daily ; it is attended by a short, regular moan or grunt, which accompanies each expiration, and forms one of the most constant and characteristic symptoms of the disease. Both symptoms are aggravated by movement, and if suspected cattle are forced into active motion the affected animals will generally give these signs. Pressure on intercostals causes wincing and signs of tenderness ; the respirations are quickened, and very shallow in character. The urine is scanty and high colored, constipation exists, and the excrement discharged is unnaturally dry. Many cases of the disease undoubtedly do not proceed beyond the stage manifested by these symptoms, resolution of the affection taking place, the poison being eliminated before essential change in the lung is produced. Although the physical examination of the chest in cattle is much less satisfactory than in man, on account of the greater thickness of the chest wall, the interposition of the broad scapulæ, and the restlessness of the animals interfering considerably with auscultation and percussion, yet it is of great value in the diagnosis of the disease, and for correct observation of its progress.

It does not require a veterinary expert to recognize another certain and constant symptom in connection with the development of the disease, — the elevation of the temperature of the body, which is increased from its normal standard, 100°–101°, to 102°–104°, and may rise to 106°. This increase of temperature is almost invariably marked, and the use of the clinical thermometer by its insertion in the rectum or vagina of suspected animals furnishes us one of the most reliable diagnostic marks that we possess, and one that will often give indications of the existence of the disease before the appearance of any other symptoms. Animals in whom a temperature of more than 102° is recognized should be at once isolated and placed under observation. The flattened and motionless ribs on the affected side, the dullness on percussion, and the presence of the healthy respiratory murmur in a normal lung, or its absence in the consolidated organ, where it may be replaced by the râles produced by the varying conditions of the inflamed bronchial tubes, or by the hollow cavernous and gurgling sounds attending destruction of the lung tissue, are pathognomonic signs of the disease. Early in the disease, the foundation of inflammatory products on the surface of the pleura is indicated by the leathery friction sounds produced by the inflamed surfaces rubbing over each other, and as the exudation into the pleural cavity increases the respiratory sounds disappear. If the disease progresses, the symptoms increase with more or less rapidity, the cough becoming more constant and severe, the respiration more difficult, as is shown by its quickened and spasmodic character, by the dilated nostrils, the arched back, and the efforts made by the animal to relieve the affected chest by breathing with the abdomen, drawing up the hind legs, throwing the body forward, the chest, owing to its peculiar construction, being thus expanded. If lying, the animal rests on the affected side, leaving the other as free as possible. Each expiration is accompanied with the characteristic moan or grunt which is present from the first stages, or, if absent, may be elicited by pressure on the intercostals. The dyspnœa becomes intense, and there is a free discharge from the widely dilated nostrils and eyes, thin and serous at first, which gradually becomes thick, yellow, and purulent. If in the open field, the sick animals separate themselves from the unaffected members of the herd, stand persistently with widely distended legs, and present a physiognomy that is very characteristic of the disease.

While the general temperature of the body as shown by the thermometer is greatly increased, the extremities and horns may be quite cold ; frequently the peculiarity being exhibited of a single horn or foot only being thus affected. The skin increases in harshness and dryness, and instead of slipping over the subcutaneous tissue as in health seems to become adherent to it. The pulse, which may be felt in the submaxillary artery of the jaw, or in the brachial at the inner side of the

fore leg, is increased from its normal rate of 40 or 50 to 80 or 90, and is small and wiry in character. Even in health, the pulse of cattle is accelerated by confinement in close sheds or barns, and in disease there will be a corresponding increase under like circumstances. The respirations, usually 10 to 15 per minute, are increased to 35 or 40, and the normal relation between the pulse and respirations of 4 to 1 disappears. The signs elicited by auscultation and percussion are here of great value in indicating the progress of the disease. The dry friction sound at first produced by the inflamed pleura is modified as the membrane becomes roughened from the deposit of lymph on its surface, and still further by the filling of the cavity by the enormous exudation. The presence of crepitation soon indicates that not only the surface membrane is involved, but that the lung substance itself has also been invaded, and the advent of râles and sibili demonstrate that the bronchial passages participate in the general affection. Even when the consolidation is extended, it does not wholly mask the sounds produced by the affected pleura and bronchi. It is a disputed point whether the disease primarily extends from the pleura or from the bronchi to the lung substance, but it is certain that both surfaces are seriously involved in all fatal cases. The dullness and tenderness elicited by percussion will be in proportion to the amount of the disease. If but one lung is affected, the resonance is markedly increased and the respiration louder than natural in the other. The invasion of both lungs warrants an unfavorable prognosis. The preceding symptoms are those which accompany the active inflammatory stage, when free exudation into all parts of the lung is going on, which may be checked within such limits as to permit of resolution or recovery in a limited number of cases, or may proceed to such an extent as to destroy the animal by suffocation from compression of the lung by the amount of pleural effusion, or from occlusion of the air cells, or even of the bronchi, by the exudation which is so freely poured into them, as well as by the inflammatory products of their own surfaces. In some cases where the consolidation is limited to the central portions of the lung, the ordinary physical signs are not observable, and the principal symptom manifested is that of excessive coughing when the animal attempts to swallow. If the affection proceeds beyond this stage, a new train of symptoms will arise from the disintegration that must almost necessarily ensue. The formation of abscesses, gangrene, and the general breaking down of the pulmonary tissue are attended with symptoms of purulent infection that are unmistakable. The temperature, which during the inflammatory stage was persistently high, becomes variable, the breath and the discharges from the nostrils are intolerably fetid, and portions of gangrenous lung may be coughed up ; the animals become very weak, colliquative diarrhœa replaces the constipation that existed, and death is induced by exhaustion. The post-mortem ap-

pearances found in animals that have died of the lung plague vary greatly, but have the common feature of being symptomatic of a low form of inflammation of the pulmonary structure, with more or less free exudation into its substance. In animals slaughtered during the early stages of the disease, the pleura will be found to have lost its natural smooth, glistening character, to be reddened and thickened, with a varying amount of exudation into its cavity, and patches of yellow lymph deposit scattered over its surface. In the lung substance the inflammation exhibits the peculiar characteristic of not spreading by diffusion to contiguous parts, but invades separated groups of lobules at a distance from each other, the intervening parts retaining their normal character until separately attacked in their turn. This feature of the disease presents strong evidence in favor of its specific character, the local change being dependent on some general exciting cause in the blood. In the early stages the normal pink color of the lung is replaced by red, gray, or blue patches, formed by the isolated groups of consolidated lobules, and as the exudation occurred at different periods softening will be in progress in some of these, so that the conditions known as red and gray hepatization may exist at the same time. The affected portions of lung are swollen, increased in density and friability, and the normal resiliency, crepitation, and inflatability are lessened. With a little effort the parenchymatous structure may be detached from the interlobular tissue by which it is normally supported. The air passages are often seriously affected at a comparatively early period, the larger bronchi being lined with flaky deposits of lymph, and the smaller tubes quite or nearly occluded by exudation similar to that found in the pleural cavity, and by new elements formed from the tube-walls. Even the blood-vessels of the affected parts may be found obliterated by coagula of blood or lymph. As the disease progresses, the amount of effusion into the pleural cavity generally increases, but without apparent cause the quantity found will vary in different cases from a few ounces to several gallons. At first clear and serous in character, it soon becomes turbid from admixture of flaky lymph and of pus and fat cells in small amount. It coagulates on cooling, so that in an animal inspected some time after death the pleural effusion may be found of a gelatinous consistency. The entire pleura is thickened, mottled, and rough from the extensive deposits of lymph, and adhesive bands of false membrane are formed between the surfaces. These are sometimes so extensive as to make a sort of net-work, holding in its meshes the thickened flaky exudation. The strength of the adhesions is determined by their age and by the character of the inflammation; generally they are very friable, and break down easily under the hand. Only in old cases, especially in such as have developed a tendency to recovery, do they acquire any tenacity. The pericardium becomes in-

volved in the same manner as the pleura, and the connective tissue of the chest is greatly thickened from inflammatory deposits. The lung becomes greatly increased in bulk, in weight and density, and in friability from the excessive exudation going on in its substance. On section, it presents a marbled appearance, due to the peculiar arrangement of the connective interlobular tissue, which has an excessive development in the lungs of cattle, and distinctly marks the boundaries between the groups of lobules, — a prominence still farther increased in this disease by the participation of the connective tissue in the general inflammation, and the development of new elements in its structure to such an extent as to cause marked thickening with formation of lymph, so that it may be seen traversing the lung in broad yellow striæ, irregularly mapping out the islands of lobules inclosed by it. Not infrequently the inflammatory process in the interlobular tissue is sufficiently active to produce suppuration and the formation of small cavities in its substance. The disease is found in its most advanced stages in the lower portions of the lung, where extensive red and gray hepatization may exist, while the upper portion is only slightly congested or œdematous. On cutting into the lung and suspending it, large quantities of blood-stained serum will drain away. The increased density and weight of the lungs are made apparent by placing them in water, when they quickly sink; or, better still, by weighing them in water, when the normal weight of six or eight pounds will be found increased to twenty, thirty, or even forty pounds.

Where animals that have died of the disease have been prepared for market, the ordinary evidences of the affection may have been removed by the careful sponging of the effusion from the chest, and trimming off the adhesions and lymph formations, so that a thickened pleura may be the only prominent sign of the disease. The most careful trimming of the chest walls, however, will not remove the adhesions, but the distinction should be noted whether these are recent or old, as a certain number of cases of the disease tend toward resolution, and the animal may have lived in good condition for years after having had the disease. Taking in connection with the weight and density of the lung its degree of resiliency and inflatability, and the appearances presented on section, it is not difficult to decide, even after the intentional removal of the usual formations on the pleura and in its cavity, whether or not an animal has been the recent subject of contagious pleuro-pneumonia. When the disease proceeds to such an extent as to result in empyema, abscess, or gangrene of the lung, the appearances presented differ from those found in the human subject, under like conditions, only in degree, and the attendant phenomena of large collections of fœtid pus in the pleural sac, the formation of purulent cavities in the lung, and the general breaking down of the pulmonary tissue will be sufficiently familiar to medical observers without farther description.

The lung plague possesses some features that distinguish it from the idiopathic pleuro-pneumonia that may prevail among cattle under certain conditions. These are its long periods of latency, its insidious character, its tendency to prevail in epidemic form, and the low asthenic type of the disease, as compared with the sudden onset, rapid development, and acute inflammatory symptoms of the idiopathic affection. In the post-mortem appearances of the latter affection the inflammation is of a plastic rather than of a destructive type, and is regularly diffused instead of assuming the patchy form seen in the contagious disease. These distinctive features, however, are not sufficiently marked to form certain diagnostic signs, and those who are most familiar with the insidious characteristics manifested by the contagious affection are compelled to admit that there are no certain means of distinction, and are disposed to recommend that all suspicious cases, where the origin cannot be properly attributed to extreme conditions of weather, or other exciting causes, should be regarded and treated as cases of the contagious affection. Certainly they should be so considered when there is any epidemic manifestation. Treatment of the disease by medication in any form has been found of little benefit; and as each animal affected becomes a new centre of contagion, from which the disease may be spread during the whole period of its prevalence, early isolation and slaughter of the infected animals, and thorough cleaning and disinfection of their quarters and of all articles that might carry the contagious principle, are the most economical and effective means of dealing with it. Efforts to save the animals by treatment are advisable only when the disease prevails to such an extent as to preclude hopes of stamping it out. The flesh of cattle dying in advanced stages of the disease should be deeply buried, with a free supply of corrosive disinfectants, and if the hides, horns, and hoofs are saved healthy cattle should be carefully protected from exposure to them. The fluid exuded into the lungs and pleural cavity has the property of producing a modified affection with several local symptoms, when healthy animals are inoculated. Inoculation secures immunity from the disease for a period of two to four years. This practice has been extensively pursued in countries where the disease has gained such a foot-hold as to prevent its eradication, and it is only under such conditions that the practice is advisable, as each animal inoculated becomes a new source of contagion, from which others may be infected. The fact of the prevalence of the disease on the Atlantic coast, and the exemption which the Western States have heretofore enjoyed, is explained by the direction taken by the cattle traffic, which is almost wholly from the West toward the East. The ordinary Eastern cattle, among which the disease would naturally prevail, are rarely shipped westward, the limited number of valuable imported animals sent in that direction being selected and guarded with special reference

to securing their exemption from the disease. Should the disease, however, once be allowed to gain a foot-hold among the vast herds of the West, where the conditions are such that no control could be exercised over the animals affected, it would probably be a permanent one, and result in immense injury to the agricultural interests of the country.