

Can we, merely on the basis of the difference in acuteness of the disease, the variability of the position of the parasite in the red corpuscles, and the variable dimension of the parasitic elements themselves, stick to the four kinds of anaplasms, i.e. marginal, central, Argentinian, and Rossicum?

Paper No. 18.

CONTAGIOUS PLEURO-PNEUMONIA OF GOATS IN EAST AFRICA.

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CONTAGIOUS pleuro-pneumonia is without doubt the most serious and most prevalent of goat diseases in Eastern Africa. It ravages most of the native herds every year and causes immense loss. Unfortunately, it does not spare imported breeds, and many settlers who have experimented with imported goats as a dairy proposition have experienced heavy losses.

The disease has been diagnosed throughout the various parts of Kenya. It also exists in the Belgian Congo, where native breeds are said to be immune (van Saceghem); in Uganda, and in Tanganyika. It has also been investigated in India where it ravages the native herds in the Kangra district of the Himalayas. Reference to any text book will show that the disease has been observed in most of the countries forming the Mediterranean littoral. In the past much confusion has existed as regards the identity of contagious pleuro-pneumonia with the so-called "boufrida" of Algeria and with the infectious pneumonia observed in septicaemia haemorrhagica. From recent research it has been conclusively shown that there are only two infectious caprine pneumonias, viz.: (a) the pneumonia of acute caprine haemorrhagic septicaemia, and (b) contagious pleuro-pneumonia, and with the latter must be finally identified the pneumonia studied by Leclainche, Mori, Pusch, Storch, Holzendorf, Polger, and Krusche in France, Spain, Thuringia, and Austria respectively.

The specificity of caprine contagious pleuro-pneumonia may be proved by the impossibility of infecting other animals than goats with pathological material while in the infectious pneumonia of caprine septicaemia haemorrhagica, sheep, rabbits, and mice may be successfully inoculated with pneumonic tissue.

From time to time sporadic outbreaks occur in this Colony of a disease which clinically and pathologically resembles the condition described in the United States by Mohler and Washburn as "Takosis." A simple broncho-pneumonia is found at post-mortem, but there is no difficulty in distinguishing it from the pulmonary lesions of contagious pleuro-pneumonia. Another type of pneumonia observed at the laboratory recently was found in goats used for the production of rinderpest virus. As is well known, in sheep and goats rinderpest is manifested by pathological changes in the lungs and chest. This fact has also been noticed by Edwards in India. Sheep and goats are not very susceptible to rinderpest, but is is not precisely

known how extensive they are affected by this disease under natural conditions. In any case, the type of pneumonia observed in goats used for the production of rinderpest virus cannot be confused with the characteristic lesions of contagious caprine pleuro-pneumonia.

SUSCEPTIBILITY.

The disease is quite specific for goats. Every attempt to transmit the disease to cattle, sheep, and the usual laboratory animals always failed. Goats of all ages and of both sex are equally susceptible, while native animals do not appear to be any more resistant than imported animals.

EPIZOOTOLOGY.

Very little is known about the epizootology of the disease. It is certain that in Kenya the virulence of the disease varies at different seasons and in some years causes far more loss than in other years. It is always at its worst during the wet months of the year when the animals are exposed to continual inclement weather by day and subsequently to the smoky, choking atmosphere of the kraals by night.

Two other well known and prevalent virus diseases of the Tropics, e.g. bluetongue and horsesickness are also prevalent during and shortly after the rains, and there is no little similarity between the epizootology of these two diseases and goat contagious pleuro-pneumonia.

It is generally very difficult to obtain native goats suffering from this disease during the dry seasons, but chronic cases have been observed in imported animals at this time, and in every instance there was evidence from the history that infection was incurred during the wet season.

The disease is said to be most prevalent in mountainous country, e.g. Pyrenees, Kangra District of the Himalayas, etc., but there is evidence that in Kenya the disease occurs from sea level to 10,000 feet and higher. However, in such countries as Greece and Italy the disease also occurs at no very marked altitude.

The immunity possessed by native goats in the Belgian Congo is a very interesting fact when it is remembered that native animals in Uganda and Kenya are exceedingly susceptible to the disease. It is possible that, as the result of the opening up of Central Africa and the consequent more ready inter-communication between all parts of the heart of the continent, the disease has only recently been introduced east of the Great Lakes and the Mountains of the Moon.

PATHOLOGICAL ANATOMY.

Pathologically there are two clearly defined forms of the disease, viz. : (a) the acute and (b) the chronic form. (a) In the acute form the pneumonia changes are very characteristic. All the phases of a fibrinous pneumonia are present from the initial congestion to red and grey hepatisation. The lungs are much enlarged, solid, sink in water, and vary in colour from reddish purple to a pinkish grey. Sections are moist, present a regular mosaic, and break with a granular fracture. From them exudes a bloody, watery fluid, while in the bronchi one observes a hyaline-looking material which readily coagulates forming casts or plugs. There are soft thrombi in the larger and visible bloodvessels. There may be no pleurisy, but this is exceptional.

Generally the pneumonic areas are covered by a lemon-coloured fibrinous deposit which is saturated with a similar coloured fluid. This deposit may be as much as 3cms. thick; it is soft, slimy, and full of lacunae, which contain the characteristic pleural exudate. In peracute cases it is easily removed from the lungs; in older cases it is much more firmly attached. This deposit, in bad cases, may cover the entire lung and extend on to the pericardium. If the pneumonia is bilateral then the deposit and exudate are also generally bilateral, but not constantly so. The pleural exudate may measure as much as 500c.c.s. It is clear citron-yellow in colour, odourless, and free from blood. It may be unilateral or present in both mediastinal cavities. In cases that run a course of 10 days or longer there are adhesions between the parietal and visceral pleurae. These are of a soft, gelatinous nature and are easily broken down. In older cases they tend to become more and more dense and fibrous. The parietal pleura may appear quite normal or it may be very injected, somewhat thickened, moist, and covered with adhesions whose nature depends on the type and course of the disease.

The bronchial glands are usually enlarged and on section somewhat swollen and moist. The only other changes noticed are found in connection with the spleen and heart. The former is usually in a condition known as acute "tumor splenis"; while the heart muscle may appear flabby and soft with the cavities much dilated. As a rule, however, cardiac lesions are associated with the chronic type of pneumonia.

The right lung only was affected in 40.5 per cent. of cases; the left lung only in 23 per cent. of cases, and in the remaining 36.5 per cent. the pneumonia was bilateral. As regards the position of the pneumonia the lesions were most frequently found in the base of the main and cardiac lobes.

(b) In the chronic form there may be no pleurisy, but in the majority of cases the lungs are firmly attached to the chest wall by dense, tough, fibrinous adhesions, which generally arise from the visceral pleura covering a pneumonia zone, but in a few cases it has been observed that the adhesions may spring from the visceral pleura covering a normal lung. In chronic cases no exudate has ever been noticed. In a small percentage of cases a bilateral fibrous pleurisy has existed independently of any concomitant pneumonia. Generally, however, pleurisy and pneumonia are present in the same case at the same time.

The fate of an acute pneumonia in this goat disease, if the animal survives, is a chronic fibrous pneumonia. Suppuration, necrosis, or gangrene have never been noticed. But in a few cases there is evidence that almost complete resolution occurs so that the respiratory function of the diseased lung is restored. The recuperative powers of the goat lung are very great, and it may be impossible to find pneumonia foci at all in the lungs of an animal that some months previously was a typical clinical acute case of the disease.

When resolution is not complete, fibrosis follows red hepatisation, and the anatomical picture superficially resembles the lung in bovine pleuro-pneumonia, but there is no difficulty pathologically in differentiating between the bovine and caprine diseases. Sequestra and cavitation are not observed in goat contagious pleuro-pneumonia. As is well known, these lesions are regarded as pathognomonic of bovine pleuro-pneumonia.

ETIOLOGY.

The disease is due to an ultra-microscopic and filtrable virus, which is present in the pneumonic areas of the affected lungs and in the pleural exudate. Every attempt to cultivate the etiological agent has always failed. In acute cases cultures from the lungs and pleural fluid are negative. It is only in chronic cases that cultures may be positive, and then the nature of the organisms present indicate extraneous contamination. Mori, an Italian worker, believes the cause to be an aspergillus, but local experiments have entirely failed to substantiate this claim. Similarly, numerous workers, e.g. Lanfranchi and Pacchiono in Italy, Langhorn and Van Saceghem in the Belgian Congo, etc., have isolated various organisms which they believe to be the cause, but local investigation confirms the general consensus of opinion that this disease must be classified as being due to an ultra-visible virus.

Mori has observed in various phagocytic cells of the lung and pleural exudate peculiar bodies which he describes as conidia. These structures have also been observed by Scheillhase in Tanganyika and by the writer in Kenya. A closer examination of them leaves no doubt but that they are "cell inclusion bodies," structures which are so characteristic and specific of many virus diseases.

NATURAL INFECTION.

It is not exactly known how the disease is spread under natural conditions. Some workers, like Van Saceghem, believe that infection takes place *per os*, but the majority are of the opinion that it is essentially aerogenic in origin. It is most probable that the etiological agent of all the specific pneumonias primarily reach the lungs through the bronchial tubes. The experimental transmission of the disease carried out at Kabete support the view that infection is bronchogenic.

TRANSMISSION EXPERIMENTS CONDUCTED AT KABETE.

The disease has been artificially transmitted to healthy goats as follows, viz:—

- (a) In five cases by actual contact; (b) in one case tried by intrabronchial insufflation of 4 c.c. pleural exudate, and (c) by intrathoracic inoculation of filtrate passed through a Seitz filter in one of two cases tried. In each of these experiments extraneous infection can be ruled out as experimental animals were always kept rigidly isolated.

Subcutaneous inoculation of the juice expressed from pneumonic tissue caused a febrile reaction but no pneumonia, while intravenously similar material caused no reactions.

The general conclusions from the experiments conducted locally are, viz.:—

- (1) That the disease may be transmitted in a certain percentage of cases to healthy goats by actual contact, by intrabronchially insufflation of infective material, and by direct intrapulmonary inoculation of pneumonic material. The percentage of all successful experimental transmission is on the low side, about 25 per cent.
- (2) That intravenous and subcutaneous inoculation of pneumonic material causes a temporary febrile reaction without producing clinical pleuro-pneumonia.

- (3) That goats which are treated on the lines noted in the preceding paragraph have no immunity conferred, as they develop the typical disease when placed in contact with natural cases.
- (4) That cattle, sheep, and all the usual laboratory animals are immune.
- (5) That the period of incubation varies from 4 to 16 days, and that the course of the disease may be as short as three days.
- (6) That recovery from one attack does not confer any immunity, as the animal may subsequently contract a second and fatal attack and succumb to the second attack within a couple of months of the first.
- (7) That artificial transmission of the disease is a matter of some difficulty. This has also been the experience of most other workers on this disease, e.g. Mori in Italy, Schellbase in Tanganyika, Leclaiuche in France, Walker in India, Melanidi and Stylianopoulo in Greece, etc. It would appear as if the virus is only present in the lungs and thorax at the very commencement of the disease, and this would explain why in a high percentage of cases which come for autopsy, pleural fluids and tissue extracts are innocuous for experimental healthy goats even when inoculated intrathoracically.

SYMPTOMS OF THE DISEASE.

The symptoms of the acute disease are easily recognized. They are classical of acute pneumonia. In chronic cases, however, no lung symptoms may be manifested, but the animal exists in an unthrifty or emaciated condition and generally suffers from an intermittent enteritis.

Such an animal coughs occasionally, especially on unusual exertion, and this symptom may lead to a suspicion of lung trouble.

Some chronic cases suddenly relapse, develop acute symptoms, and die. The cause of these breakdowns is not always evident, but they have been observed to follow contact with natural acute cases. Possibly some chronic cases relapse when exposed to unsuitable environmental or atmospheric conditions. Cold, dampness, and such agents are generally pneumonic. It is a well-known statistical fact that acute human pneumococcal pneumonia is most prevalent in cold, wet, winter seasons. In bovine and ovine contagious pleuro-pneumonia the chronic "lunger" plays a very important role in the propagation of the disease. Whether the same holds good in this goats' disease is unknown, but the impossibility of transmitting the disease with material from chronic cases is significant and seems to indicate that the virus has disappeared from the pulmonary tissues of chronic cases.

SUMMARY AND CONCLUSIONS.

1. Contagious pleuro-pneumonia of goats is a specific caprine disease which ravages native and imported breeds annually and is responsible for a mortality of 60 to 100 per cent. There appears to be a periodic variation in the potency of the virus of this disease.

2. The disease may be acute or chronic, and is frequently, especially in the chronic form, accompanied by a troublesome enteritis.

3. The disease is due to a filter-passing virus whose nature is unknown, but which is present in the lung lesions and pleural effusions of acute cases. Experimentally, as material from chronic cases has invariably failed to reproduce the disease, it is concluded that the causal virus is not present in the lungs of such cases. The conidia-like bodies described by Mori as being a phase in the life-history of an aspergillus, is not accepted. These structures are "cell-inclusion bodies," and are probably similar in nature and character to similar bodies found in other virus diseases.

4. Pathologically, acute cases are accompanied by an extensive pneumonia affecting one or both lungs, while there is also a sero-fibrinous pleurisy with effusion into the mediastinal cavities. Acute cases either terminate fatally or develop into a chronic pneumonia. Chronic cases either recover by a slow process of resolution or else relapse on further exposure to fresh infection when they invariably succumb.

5. Experimental transmission is very difficult and has only been accomplished in a few instances with material from peracute or early acute cases. It always failed with material from chronic cases. The disease has been successfully reproduced by intrabronchial insufflation, intrapulmonary inoculation, and by actual contact with natural, acute cases.

6. Epizootologically the disease causes highest mortality during the wet season. Both native and imported breeds are very susceptible and the mortality may be as high as 60 to 100 per cent. There is no information as to how the virus of the disease is maintained under natural conditions. It is not considered likely on the basis of experimental work that chronic "lungers" exist.

7. Recovery does not confer any immunity, while relapses are very common. Up to the present no immunological research has been undertaken at Kabete. Isolation of sick animals and the complete segregation of imported animals from native or squatter stock is strongly advocated.

Paper No. 19.

POULTRY DISEASES IN SOUTH AFRICA.

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INTRODUCTION.

In presenting this paper, it is not intended to give a symposium on poultry diseases in South Africa, but rather to impress on my veterinary colleagues the importance of the poultry industry and to discuss a phase of our professional work which has hitherto been sadly neglected. Poultry culture has made phenomenal strides during the last twenty years. This industry is well organized, and the world's poultry congresses have done much to popularize the industry and to stimulate international scientific interest in all branches relative to poultry culture.

The first world's poultry congress was held at the Hague (1921), the second in Barcelona (1924), and the third in Ottawa (1927). The