Original Communications.

BACILLUS AERTRYCKE—THE POSSIBLE CAUSATIVE BACILLUS OF CANINE TYPHUS (STUTTGART DOG DISEASE).

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The high mortality among dogs in India is always a source of anxiety to dog lovers, and probably no part of the population is more affected in this respect than the military officer. The mortality appears to be higher among dogs bred and born in England. The cause of death seems nearly always to be ascribed by the owner to "tick fever," but, if careful inquiries are made, it will be found that in many cases the symptoms do not correspond with the textbook descriptions of that disease, and no examinations of the blood have been carried out by a competent observer. The diagnosis has often been made on the advice of some unqualified person in the station "who knows something about dogs."

It is not the intention of the writer to decry the "unqualified dog practitioner," as many such take up this line of work owing to their natural liking for dogs quite apart from any financial considerations; but it stands to reason that the differential diagnosis in such cases must frequently be unscientific and of a rough-and-ready description. Really skilled, up-to-date scientific advice on dog diseases can only be available in very few stations in India at the present day.

In Poona, as in other stations, the mortality among dogs is always high, and popular opinion seemed perfectly contented with a diagnosis of tick fever. In 1926 the writer examined several blood-films of dogs which were declared by their owners to be suffering from tick fever, but was unable to discover any sign of a piroplasma. In fact, the microscopic results were so consistently negative, and the opinion of the owners of the dogs that the disease was tick fever so positive, that one began to fear that any little skill formerly possessed with a microscope was departing with the onset of old age. Finally, however, a stained blood-film, said to be swarming with piroplasma, was brought to the laboratory, and the granules of deposit in a particularly badly-stained Leishman film were demonstrated as the elusive protozoa. This was heartening in view of previous failures to discover piroplasmas in blood-films.

On going carefully into the symptoms of the majority of the cases these seemed to be divisible into two groups:

(a) Pyrexia, loss of appetite, thirst, vomiting, often not marked, great wasting and weakness. These symptoms lasted ten to fourteen days, and if improvement occurred there was left behind a prolonged debility during which the animal usually became covered with sores, etc., and eventually
died of septicemia. Ulcers in the mouth during the illness might, or might not, be a prominent feature.

(b) A type similar to the above, but with gastric and intestinal symptoms very marked. Distressing vomiting, great abdominal pain and ulceration of the mucous membrane of the mouth being the main features. Death usually occurred in seven to ten days.

One of the writer's own dogs developed the disease of the latter type, and was nursed for ten days through what closely resembled an attack of enteric fever in the human being, except that vomiting was a somewhat prominent symptom. The abdominal pains then became so agonizing, peritonitis being obviously present, that one gave up the unequal contest and put the poor creature out of his pain.

Type (b) cases are obviously canine typhus or Stuttgart dog disease, and present no difficulty in diagnosis, if one has read the textbook descriptions of this disease. But one of the objects of this paper is to put forward the view that in all parts of India there are probably large numbers of Type (a) cases which are simply a milder, or less acute form of the Stuttgart dog disease, and which in the absence of skilled scientific veterinary advice are usually diagnosed as tick fever, and treated as such. As will be seen later, there appears to be reason to believe that this disease is caused by infection with organisms of the Salmonella group, and the appropriate treatment would therefore appear to be by salines, etc., as in treating human infections of food poisoning, in lieu of the trypan-blue injections so empirically administered to most cases.

From a study of the symptoms it seemed obvious that the infective agent would most probably be discovered by examination of the intestinal contents. The local pack of hounds was known to be attacked, usually in the autumn, with a disease causing pyrexia, wasting and death, and arrangements were made to have any such hounds carefully watched, and any stool passed sent at once to the laboratory. Only two stools were examined, as orders for transfer of station arrived within a few days. In one case an almost pure culture of pure B. aertrycke (Mutton) was found on the litmus lactose agar plate.

The bacteriological findings appeared therefore to agree with the clinical symptoms, and arrangements were made at once for the transmission of further specimens from sick dogs to the laboratory, and also for the examination of serum from as many pariah dogs as possible, as these animals might be carriers. Two such dogs were shot outside the laboratory and the serum obtained was tested against the bacillus. In both cases the organism was agglutinated to a reasonable titre; one in a dilution of 1 in 125, and the other in a dilution of 1 in 50, to the best of my recollection.

Work on this subject then had to cease, owing to transfer of station, but the strain has been kept in the hope that time would become available to go further into the matter. This unfortunately has been impossible, and...
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these notes are published in the hope that some other D.A.D.P. will go into this question fully. The writer will be glad to forward a subculture of the strain in question to anyone interested. Major R. F. Bridges, R.A.M.C., was recently kind enough to test it against specific sera of the Salmonella group, and found also that it agglutinated with specific serum of \textit{B. aertrycke} (Mutton) only. If this bacillus can be proved to be the cause of the disease, hundreds of valuable dog lives might be saved by the use of a prophylactic vaccine in the future, and a vaccine might also be tried in treatment. If the writer is correct in his assumption that the disease is widespread among dogs in India, and that the milder type is usually undiagnosed, the cause is worth investigation, even though the above results are not confirmed.

It is in the hope of encouraging such research that the following ideas which were in the writer's mind two years ago are recorded:—

(1) Taking India as a whole, and particularly those stations in which skilled scientific veterinary advice on dog disease is absent, a high percentage of the cases diagnosed and treated as tick fever are not suffering from that disease.

(2) The greater proportion of these cases, if examined bacteriologically with the same attention to detail as is given in human cases of enteric fever (e.g. early examination of blood and faeces, freshness of specimens, etc.) might prove to be infections by an organism of the Salmonella group, most probably \textit{B. aertrycke}.

(3) The cause of canine typhus, or "Stuttgart dog disease," appears to be \textit{B. aertrycke}, and this bacillus may also be responsible for the milder or more typhoid-like disease which is frequently diagnosed as tick fever. The cause of canine typhus appears to be a complete misnomer, and gastro-enteritis (\textit{B. aertrycke}) is probably the correct term to use.

(4) Pariah dogs may prove on examination to be heavily infected, and to be the probable carriers, although mice as carriers would also have to be considered.

(5) If the above presumptions prove correct, the infection is almost certainly carried by flies, and this would account for the sporadic way in which dogs are infected. Fleas and dog lice in the rôle of carriers might also be investigated.

(6) If pariah dogs' faeces are the source of infection, and flies the carriers, might not some of the curious little outbreaks of food poisoning which occur among the troops be due to the same cause? Flies and pariah dogs' excreta are never far from barracks in this country.

(7) Lastly, if \textit{B. aertrycke} can cause a ten-day pyrexia of a typhoid nature in dogs, might not some of our ten-day enteric group pyrexias among troops be due to the same cause?

These ideas may only have been vain imaginings, but at the same time it is thought that an investigation on the above lines may prove of some interest to a D.A.D.P. looking for a subject for research, and that the results may be well worth the trouble and time entailed.
I am greatly indebted to Major H. C. Brown, C.I.E., I.M.S. (Retd.), of the Wellcome Bureau of Scientific Research, for providing me with the following references to the literature concerning the occurrence of aertrycke infections in dogs. Apparently no such finding has previously been reported from India, and only once in England.

In the Medical Research Council's Report, No. 91 (Savage and Bruce White) [1], a case is quoted of B. aertrycke (Newport) having been once isolated from a dog suffering from enteritis.

In an investigation undertaken at the Wellcome Bureau of Scientific Research [2] no members of the Salmonella group, pathogenic to mice, were found in an investigation of 100 random samples of faeces from dogs.

In an article, “Domesticated Animals as Sources of Bacilli Pathogenic to Men,” by W. G. Savage [3], there is no record of any member of the Salmonella group being found in the dog.

Recently also I have come across, in Huytra and Marek's “Special Pathology and Therapeutics of the Diseases of Domestic Animals” [11], the statement, in the discussion of the etiology of the disease, that Huytra in all cases succeeded in isolating a colon bacillus and a virulent proteus strain from the contents of the severely inflamed and haemorrhagic intestines.

It is also stated that Scheibel and Zschokke found in the blood bacilli resembling those of chicken cholera and swine plague.

These results apparently have not been confirmed, as Professor Wooldridge states in vol. i of the “Encyclopaedia of Veterinary Medicine, Surgery and Obstetrics” (1923) [12]: “The actual cause of canine typhus is not definitely known, but the lesions of the stomach and intestine usually contain an enormous number of the organisms of the Bacillus coli type, which may however be due to a secondary invasion. On the other hand, B. coli may possibly be the cause of the infection, and this view is somewhat supported by the results which frequently follow treatment of the disease by means of vaccines prepared from a canine strain of that organism.”

A very brief account of the symptoms, etc., of canine typhus and tick fever is given below, as possibly other medical officers may be interested and may not have seen any literature on the subject. The notes on canine typhus are partly extracted from the two volumes on diseases of animals quoted above, but are mainly from the “Encyclopaedia of Veterinary Medicine” [12].

**Canine Typhus.**

*Epizootic Gangrenous Stomatitis and Gastro-enteritis; Stuttgart Dog Disease.*

*History:* Described by Hofer under the name “typhus” in 1850. The disease appeared in Germany in 1898, and in the following years in other countries as a severe plague. In this outbreak Klett, who observed it in the autumn in and around Stuttgart (hence the name Stuttgart dog disease),
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gave the first clinical description. Various observers in other countries described the disease. There was a widespread epizootic extension in middle Europe, 1898-1900, since when the disease has largely disappeared from these countries.

**Aetiology.**—Unknown; organisms of coli group suspected. Some cases are recorded in which experimental feeding of healthy dogs with discharges of affected animals has produced the disease, but there were many failures. Possibly dog lice or fleas may act as carriers.

**Symptoms.**—In Europe old dogs appear more susceptible than young dogs. (This does not appear to be the case in India.) Four types of the disease are recorded: Acute, subacute, mild, and chronic or atypical:

1. **Acute.**—Severe vomiting, dullness and depression. Great thirst. Constipation followed by diarrhoea. Both vomit and faeces may contain blood; weakness; rapid loss of flesh; eyes dull and sunken; mouth cold and clammy. Temperature at first raised, in later stages becomes subnormal. If the case last several days, there is extensive ulceration of the mucous membrane of the mouth, particularly along gums and cheeks. Fatal in eighty to ninety per cent of cases.

2. **Subacute.**—First symptom often cough due to pharyngitis (this was marked in the case of the writer's dog referred to above, and was present several days before acute symptoms supervened). Occasional vomiting, dullness, thirst, constipation followed by diarrhoea, later tenesmus, which may be mistaken for constipation, ulcers on gums, cheeks and tongue. Vomiting gradually becomes more frequent. Pyrexia 2° to 3° F. In later stages temperature subnormal. Emaciation and weakness, death in about ten days in at least fifty per cent of cases.

3. **Mild.**—Dullness, anorexia, thirst, vomiting. Temperature may be normal or elevated 1° or 2°—ulceration of mouth may occur. Irregular action of bowels, possibly slight diarrhoea.

4. **Chronic or Atypical.**—Persistent vomiting, irregular action of bowels, great thirst, progressive emaciation, mucous membranes anaemic, temperature normal, or later subnormal. After ten to fourteen days symptoms may become very acute and such cases are usually fatal.

The cases discussed by the writer appear to have resembled, in the main, the mild or subacute type as described by Professor Wooldridge, but diarrhoea was not always a marked feature, and vomit was not necessarily blood-stained, even in the later stages.

Death seemed to be the ultimate end, whatever the type of case. Variations in the clinical symptoms appear to have occurred in different outbreaks, and sometimes ulceration of the mouth appears to have been absent, even in fatal cases (Albrecht). Pyrexia, vomiting, wasting, thirst, dullness, constipation followed by diarrhoea, and ulceration of the mouth would appear to be the main symptoms, but all may vary in intensity in individual cases.

**Anatomical Changes.**—Mainly confined to alimentary tract; ulcers and
sloughs in mouth; mucous membrane of stomach inflamed, haemorrhagic and possibly ulcerated. Bowels in some cases inflamed and haemorrhagic, particularly the small intestines, but at other times little enteritis. Abdominal lymph glands swollen and possibly haemorrhagic. In the chronic forms lesions may be entirely absent. At other times ulceration of the buccal mucous membrane is present.

Very brief notes on tick fever, extracted from C. M. Wenyon's "Protozoology" vol. ii [10], and from Major General T. H. Symons' article in the Indian Journal of Medical Research, vol. xiv, 1926, p. 293, are given below.

These publications should be read by any medical officers interested in the matter.

**Tick Fever or Babesia of Dogs**

The above term, as used in India, probably includes two diseases with different symptoms and causation.

(a) Due to *Babesia canis*, the cause of malignant jaundice in dogs.

(b) Due to *Babesia gibsoni*, the cause of a progressive anaemia.

In both diseases pyrexia and anaemia occur.

**I.—Babesia canis Infections.**

(1) *Babesia canis* (Piana and Galli-Valerio, 1895) occurs in many countries, and was described in India by James (1905), in Assam, and by Webb (1906), and Christophers (1907). It is a pear-shaped protozoon 4.5 to 5 microns in length, pointed at one end, bulbous at the other. There is usually a vacuole in the cytoplasm. The nucleus, as seen in dry films stained by Romanowsky's method, consists of a deeply-staining granule near the pointed end, while extending from it is a string of fine granules. The pear-shaped form goes through a definite evolution, becoming rounded in form, then budding is seen, after which two pear-shaped parasites are found which remain attached by their pointed extremities until separation occurs. Division into four or more parasites may occur. For full details see Wenyon's "Protozoology."

(2) Transmission in India is due to the bite of *Rhipicephalus sanguineus*, and it was shown by Christophers [9], who also worked out the cycle of the parasite in the tick (1907), that the nymphs and probably the adults which resulted from eggs laid by an infected tick were infective.

(3) Symptoms.—In acute cases pyrexia, progressive anaemia, jaundice and haemoglobinuria, frequently terminating fatally. In more chronic types pyrexia may be only slight, there is a mild anaemia, and jaundice may, or may not, be present. Indigenous dogs, though healthy, may be found to be harbouring the parasite.

(4) Post-mortem Appearances.—Marked jaundice of internal organs, enlargement of spleen, swelling and congestion of kidneys. Smears of the
internal organs may show the parasites to be more numerous than in the peripheral blood. Sections of the kidney show hyperæmia, and degeneration of the epithelium of the tubules, granular and epithelial casts. Parasites are found in red cells as round, irregular or pear-shaped individuals. Budding forms, leading to pairs of pear-shaped forms, are common. In heavy infections fifteen or more parasites may occur in a single cell.

II.—Babesia gibsoni Infections.

Babesia gibsoni (Patton 1910), discovered in dogs in Madras by Patton (1910), and later in jackals. It is smaller than B. canis and pear-shaped forms are absent. It is usually seen as a small ring or oval, occupying not more than an eighth of the diameter of a red cell. A single dot of chromatin, or two dots connected by a thread, may be seen. Occasionally large ovoid forms as long as half the diameter of the cell, or elongate parasites nearly as long as the cell itself, occur. Reproduction is by binary fission and the cell may be crowded with parasites.

Symptoms.

(1) Pyrexia.—(i) Four to five days with relapses of about same period—highest rise as a rule about 104° F. (normal 100°6° F.); (ii) may be only one day's fever, a period of fever, or disease may become chronic without noticeable fever.

(2) Anæmia.—Pallor of ears earliest sign. This pallor is also seen on the inside of the thighs and abdomen and, later, on gums, inside of lips and tongue.

(3) Enlarged spleen and possibly tenderness over spleen, particularly in early stages.

(4) Dry scurfy coat, with loss of hair in patches, particularly over ribs.

(5) Slackness, loss of appetite, bad temper.

Symons and Patton [4] emphasize the importance of clean grease-free slides; needles and scissors dry and free from dust, and thorough cleanliness of the dog's ear when making blood-films. If these details are attended to and the film deeply stained, there is little difficulty in finding the parasite, but if the dog's ear and slide are dirty, the parasite will certainly be missed.

I have to thank Major H. C. Brown, C.I.E., I.M.S.(Retd.), and Lieutenant Colonel E. C. Webb, O.B.E., R.A.V.C., for giving me references to the literature of the above diseases and Salmonella infections in dogs, and also Major R. F. Bridges, R.A.M.C., for his trouble in isolating the specific phase of the bacillus in question, and testing it against specific sera of other members of the Salmonella group in order to confirm the diagnosis.

SUMMARY.

(1) Bacillus aertrycke (Mutton) is reported, apparently for the first time, as having been recovered from a dog (October, 1926).

(2) Agglutinins to this bacillus were found to be present in the serum of two pariah dogs examined.
(3) The suggestion is put forward that *B. aertrycke* may be the cause of canine typhus, and that this disease in its subacute form is common in India, and often diagnosed as tick fever.

(4) An investigation into the question of the occurrence of Salmonella group infections among pariah dogs, and careful bacteriological examinations of dogs suspected to be suffering from canine typhus or tick fever is also suggested with a view to proving or disproving the above.

(5) Short notes from the literature concerning canine typhus and tick fever are given for the information of any medical officers interested.

REFERENCES.

[1] Savage and Bruce White, Medical Research Council's Report, No. 91.