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PREVALENCE OF TUBERCULOSIS IN THE DOMESTICATED ANIMALS.

Abstract of an Address delivered before the Lancashire Veterinary Association, by Sheridan Delépine, Professor of Pathology, The Owens College.

THE more do we learn about tuberculosis the more are we bound to consider it as, perhaps, the most universal disease, both with regard to its pandemic and its panzootic character.

Not only does it affect man and a very large number of other mammals, but numerous observations and experiments have proved that, when external conditions are favourable, the lower vertebrata may also become infected. From a public health point of view, the prevalence of tuberculosis among the animals which man has associated by domestication with his every-day life, has the greatest possible interest.

The flesh and milk of several of them constitute the most important elements of the food of a large proportion of mankind. Their hides, bones, blood, excrements, are used for various purposes, and must come in contact with a number of people. We mix with these beings in our thoroughfares, and even in our houses; and in certain parts it might almost be said that they are the bedfellows of men, women, and children.

If it be remembered that tuberculosis has abundantly been proved to be transmissible from the lower animals to man, and from man to the lower animals, either through the air or food passages, and also, but more rarely, through the abraded skin, or the genito-urinary passages, this promiscuity cannot fail to convey an impression of insecurity.

It is not my object here to speak of tuberculosis in such animals as monkeys, camels, giraffes, antelopes, llamas, lions, tigers, foxes, tapirs, zebras, etc., all of which have, when kept in menageries, been found to be liable to tuberculosis. My remarks will be limited to those domesticated animals that are most constantly associated with man in this country.

Several of them have, for a long time, been supposed to be immune against tuberculosis, and many are still believed, not only by medical men, but also by veterinary surgeons, to be refractory. I need only mention the horse, the goat, and the dog, in support of my contention. Many attempts of serum treatment of tuberculosis have been and are still based on such belief, so that nobody can deny the tenacity with which the notion has been retained.

In the last few years I have often in private argument combatted this erroneous view, and this I have been able to do on the basis of personal experience, for I have had many opportunities of investigating cases of tuberculosis in nearly all the domesticated animals, with the exception of the sheep, and but few of these cases have been brought to me under the impression that they were instances of tuberculosis.

It must be admitted that the disease is much rarer in some kinds, such as the goat and the sheep, than in others, among which I may mention the ox and the pig, but even this relative immunity may be more apparent than real, for,

(1) *Some animals are, by their mode of life, less exposed to infection than others.*—Thus, cows, kept in the ill-ventilated, insanitary byres or dairies of large towns, are exceptionally liable to the disease, whilst sheep and goats, which are usually kept in the open, run hardly any risk of infection. Swine, fed on uncooked tuberculous offal or milk, are undoubtedly more exposed to infection than horses kept on fodder, which by its nature can under ordinary conditions be considered free from tubercle bacilli. (Foals, calves, goats, and kittens, fed on uncooked tuberculous milk, become tuberculous, just as the pig would under the same circumstances.)

(2) *The lesions produced by tuberculosis do not present the same appearances in all animals.*—Their distribution, being determined by the channel by which the bacillus penetrates the body, is different in animals which are usually infected through the alimentary canal, and in those which are attacked through the air passages. The pulmonary and peritoneal lesions in cattle have long been known under the names of grapes, pearl disease, perlsucht, etc., and have early been attributed to tuberculosis, whilst in the horse the extensive lesions produced in the spleen, though long known under the name of lymphadenoma, have only been lately correctly interpreted. In fact, in the horse large masses of lymphoid tissue, growing in connection with mesenteric and retroperitoneal glands, are often still supposed to be sarcomatous, though, by careful examination, it can be shown that they are inflammatory, and harbour an immense number of tubercle bacilli. The same difficulty may occur in man, but I must own that in some cases of human lymphadenoma, which, from a naked eye and microscopical examination, I believed to be tuberculous, I have been unable to prove the presence of tubercle bacilli. In other cases, however, I have shown that lesions which seemed at the post-mortem examination to be lymphadenomatous were actually tuberculous.*

* There is, in the St. George's Hospital Museum, London, a spleen showing how difficult the diagnosis is when a naked eye examination is the only guide. This spleen, which I examined about eight years ago, and which I found to be tuberculous, has more than once been re-examined by others under the impression that it had been wrongly labelled.

(3) *Different animals react differently to the experimental inoculation of tuberculous products.*—Observers who have used only one method of artificial infection have been led to attribute undue weight to the differences which they have observed. The rabbit and the guinea-pig are both very liable to tuberculosis, and do not show much difference when infected through the lungs, but subcutaneous inoculation gives rise in the guinea-pig to a much more extensive and regular infection of the lymphatics than it does in the rabbit.

These sources of error have become less important of late, for it is now easy, by the inoculation method, by the demonstration of tubercle bacilli, or by the application of the tuberculin test during life, to determine whether an animal is or was suffering from tuberculosis.

Statistics collected during the last few years by such men as Jöhne, Bang, Lydtin, Ostertag, Arloing, Nocard, MacFadyean, and others, can, therefore, be taken as a good basis for estimating the prevalence of tuberculosis. It is chiefly on the work of these observers that I have relied for the figures given in the following lines; my own experience, being of a fragmentary character, has only served me as a guide in the interpretation of the statements made by others.

CATTLE are, with man, the mammals the most liable to tuberculosis.

By putting together a few of the figures collected in England, France, Germany, Denmark, and Holland, and giving the number of tuberculous animals in over 600,000 heads of cattle, it is found that more than 16 per cent were affected. One is certainly not far wrong in saying that out of every 10 cows one or two are certainly tuberculous. Yet this statement must be qualified, for there are districts in which tuberculosis is almost absent, whilst in others it is so very prevalent that a non-tuberculous cow is the exception. This is specially true of large towns, where milch cows are often kept in infected dairies. In such dairies, three to six, seven, or even eight cows out of ten are tuberculous, statistics to that effect having been collected not only in France and Germany, but also in England and Scotland.

The ways in which these cows become infected are evident enough if the distribution of the tuberculous lesions is kept in mind. The air passages and the alimentary canal are undoubtedly the paths through which the bacilli generally penetrate into the organism, either with contaminated air or with contaminated food. Infection through the genito-urinary tracts, the udder, the skin, though possible, is undoubtedly of rare occurrence.

It is evident that infection in most cases takes place after birth, the supposed great share of heredity is now more than doubtful, at least in the old sense. Nothing is more convincing in this respect than the

statistics relating to the prevalence of tuberculosis in calves. From returns obtained chiefly in Germany, Denmark, and France, and based on the examination of more than $2\frac{1}{2}$ millions of calves, it may be said that not more than 0.03 per cent are affected, *i.e.*, that not more than 3 calves out of 10,000, or roughly speaking 1 in 3,300, are tuberculous. From certain statistics collected in Saxony it would seem that however small the number of tuberculous calves is, that number is gradually increasing.

SWINE are not generally supposed to be very liable to tuberculosis, but we have more and more evidence to show that this is not a correct impression. Most German returns show that at least one pig out of every 100 is affected with tuberculosis, and in some cases one pig out of 60. In Saxony the percentages were in 1891: 1.07, in 1892, 1.37, and in 1893, 1.64, a gradual increase similar to that which has already been noticed in connection with cattle. By putting together statistics collected in Germany, Holland and France, and relating to nearly one million pigs, one gets a general percentage of 0.85, but some of the percentages given, especially in France, are suspiciously low. By adding to these figures some German and some unusually high Danish returns, quoted in the recently issued Report of the Royal Commission on the effect of food derived from tuberculous animals, a higher percentage is obtained, *viz.*, 2.75, based on the examination of nearly one and a half million pigs. From this it would appear that one pig out of every 36 might be tuberculous. If it is remembered that in certain countries much pork is eaten, salted, or smoked, but uncooked, the importance of tuberculosis in swine will become apparent, for neither smoking or salting can be relied on for killing the tubercle bacillus.

In the pig the infection generally takes place through the alimentary canal. Young pigs fed on tuberculous milk or other tuberculous products are extremely readily affected, as proved by several experimenters since Chauveau in 1868. Hence the danger of throwing to the pigs uncooked tuberculous milk or offal, as is not unusually done. Nocard believes that nine out of ten cases become infected through the alimentary canal. This is supported by the distribution of the tubercular lesions, which affect chiefly the whole of the lymphatic ganglia connected with the alimentary canal from the mouth to the large intestine. The liver and spleen are generally involved, but the serous membranes are much less affected than in cattle. The lungs are often riddled with miliary tubercles, a result of general infection.

Calcification of tubercle is much less frequent in swine than in cattle. Chronic affection of the glands of the neck and of the bones give rise to what has been described under the name of pig's scrofula.

In the HORSE numerous instances of tuberculosis have been put on record, yet the animal, as I have already said, is still often thought to possess a special immunity against tuberculosis. There is no sufficient basis for any estimation of the percentage of horses affected. From the way in which the thoracic and the abdominal organs are affected it seems certain that infection may take place either through the air or the food passages. But the bacillus must generally enter the body through the alimentary canal. What is specially remarkable about tuberculous lesions in the horse is the extraordinary proliferation of lymphoid tissue which is associated with them. The appearance of the spleen is characteristic, and has already been alluded to, the mesenteric and sublumbar ganglia not uncommonly reach a considerable size, and may be cheesy or fleshy, resembling in the latter case sarcomatous masses. Several cases of this kind have been referred to me as instances of tumours occurring in the horse. The liver may be affected like the spleen, and is usually the seat of cirrhosis. The lungs are often the seat of miliary tuberculosis. In these lesions the number of tubercle bacilli is at times extremely large. There is ground to believe that tuberculosis is more frequent in the horse than it used to be, and this is probably connected with the custom which has become prevalent in some districts of bringing up foals on cows' milk.

In the SHEEP tuberculosis is undoubtedly rare. Taking the Danish and German statistics as guides, it would appear that not more than 11 sheep in 10,000 can be expected to be tuberculous under ordinary circumstances; in fact, this figure is too high, owing to the probable errors caused by various pseudo-tubercloses. The proportion attacked is possibly much smaller than the one just given, being probably seldom above three in 10,000, and often much less.

The GOAT, the supposed special refractoriness of which is taken as the basis for a method of serum-therapie for tuberculosis, has also been found not to be immune. Not only can it be infected experimentally, but several instances of non-experimental tuberculosis have been described by several observers; one case examined by McFadyean has been on record for several years now. In several instances the tuberculosis has been acquired by cohabitation with tuberculous cows or feeding on cows' milk.

Instances of tuberculosis in the DOG and CAT are becoming more and more frequent in our pathological records, and several instances of mesenteric or pulmonary tuberculosis in these animals have fallen under my own notice. These animals undoubtedly often become

infected owing to their living in the houses of tuberculous human beings, but in their turn they become dangerous to those who make pets of them, and specially to children.

Regarding tuberculosis in BIRDS, it is important not to be too much impressed by the differences between avian and human tuberculosis. We have to deal here only with varieties of the same bacillus, and as we know little of the conditions under which the tubercle bacillus lives saprophytically, it is impossible to tell at present whether the avian tubercle bacillus may not at times become a source of danger to man. The facts that in some poultry yards tuberculosis spreads rapidly, and that when the disease has occurred once it is difficult to eradicate, show that avian tuberculosis is a very contagious disease.

In conclusion, I would like to point out that domesticated animals constitute a breeding ground for a bacillus which is one of the most dangerous enemies of man.

Recent observations have shown that there is a tendency towards an increased prevalence of tuberculosis amongst these animals. It is evident that considerations of mere economy cannot much longer prevent the State from dealing actively with such a glaring danger. It is fortunate under those circumstances that veterinary surgeons should in some places have been called upon to assist medical officers of health in the inspection of animals used for food. The special knowledge which a veterinary man can bring to bear on such questions should make it possible for us to arrive before long at a correct estimate of the magnitude of the danger to which we are exposed through tuberculosis. This should be known *not only in a general way but accurately in each district*, and to the veterinary profession, which has already done so much in the past, we are now looking for the information still wanted.