On the Classification of Bovine Tuberculosis due to Stage and Type

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I. Introduction

The classification of human tuberculosis due to stage has hitherto been attempted from the immunological and allergical standpoints by many investigators. Firstly, Ranke (1916) classified it into 3 kinds: the 1st primary complex stage, the 2nd allergic stage and the 3rd immune stage. Afterwards, some subsequent investigators as for example Ogata, Takeda in Japan recently, improved Ranke's classification with their own opinions. Such works should be believed to be of great value to form a basis for a more extensive study on the development of tuberculosis process. However, with regard to bovine tuberculosis Nieberle (1933) is the only author who divided it into 3 stages in imitation of Ranke's theory, so far as I am aware.

Meanwhile, I have also studied on bovine tuberculosis pathologically and tried to classify it due to stage and type from immunologic and allergic points of view. I therefore will report the results of the classification.

II. Materials and methods

On my former post, Korea Government-general Institute for Veterinary Hygene, I once investigated morphologically on the changes due to immunity and allergy against the various kinds of bacilli including the tubercle bacillus as a member of employed materials. At that time Koch's phenomenon, the tuberculin allergy etc. were investigated under the employment of many experiment calves. Moreover, many cases of the spontaneous, tuberculous cattle were collected from the immune cattle against Rinderpest suffering from tuberculosis and were examined pathologically. These specimens were totally 38 cases in number, consisting of both naturally died and artificially killed cases. Since I retired from Korea, I have continued the same investigation at the present post. I now have classified spontaneous bovine tuberculosis into 5 kinds due to stage and type from the immune and allergic standpoints.

III. Patho-anatomical findings

The above mentioned materials were examined patho-histologically in detail, especially the morbid period and type having been observed minutely. The results obtained are exhibited in the following schedule.

Distribution of lesions, stage and type of each case

Number of case	Mode of death	Course of disease (Year)	Distribution of lesions				Type	Stage
			Lungs	Pulmonic lymph-nodes	Mesenteric lymphnodes	The others		
1	Killed	1	+	−	−		Productive	1
2	Died	5	+++	++	+	Trachea +	Exudative	5
3	Killed	more than 2	+	++	+		Productive	3
4	〃	3	+	±	+		〃	1
5	〃	more than 2	+	+	+	Pharyngeal lymphnodes ++	〃	3
6	〃	1	++	±	−		〃	4
7	〃	more than 2	++	++	+	Liver +	〃	3
8	〃	〃	+	+	+	Kidneys +	〃	〃
9	〃	〃	+	+	−		〃	〃
10	〃	〃	+++	+	+	Lymphnodes of neck +	〃	〃
11	Died	〃	+++	+	+		Exudative	5
12	〃	1	+++	+	+	Kidneys + Pleura + Peritoneum +	〃	5
13	〃	5	+++	+	+	Pleura +	〃	〃
14	〃	4	++	+	+	Liver +	Productive	3
15	〃	1	+	+	+		Exudative	5
16	〃	2	+	+	+		Productive	3
17	〃	3	+++	+	+	Tonsils +	Exudative	5
18	〃	2	++	+++	++	Tonsils + Pharyngeal lymphnodes +	Productive	4
19	〃	1	+++	+	+		Exudative	5
20	〃	1	+++	+	++		Productive	3
21	Killed	2	+	+	+	Pharyngeal lymphnodes +	〃	〃
22	〃	2	++	+++	++	Tonsils + Pharyngeal lymphnodes +	〃	〃
23	〃	2	−	−	−	〃	〃	1
24	〃	3	+	+	−		〃	〃
25	〃	1	+	+	+	Tongue + Skin +	〃	3

Number of case	Mode of death	Course of disease (Year)	Distribution of lesions				Type	Stage
			Lungs	Pulmonic lymph-nodes	Mesenteric lymphnodes	The others		
26	Died	2	+	+++	+	Tonsils + Pharyngeal lymphnodes + Pleura +	Productive	4
27	〃	1	++	++	+	Tonsils + Pharyngeal lymphnodes +	〃	〃
28	Killed	less than 1	+	+	+		〃	2
29	Die '	3	+++	+	+	Pharyngeal lymphnodes +	Exudative	5
30	〃	2.5	++	+	++	Tonsils + Pharyngeal lymphnodes +	〃	〃
31	Killed	1	++	+	+		Productive	3
32	〃	2	+	+	+	Pharyngeal lymphnodes + Liver +	〃	3
33	Killed	1	+	+	−		Productive	1
34	Died	1	+	+	−		〃	〃
35	〃	2	+	+	++		〃	3
36	〃	1	+	+	+		〃	4
37	〃	3	+	+	−		〃	3
38	Killed	2	+	+	+		〃	1

IV. Classification of tuberculosis due to stage and type

Firstly, I examined the general nature of the tubercular changes. There are both productive and exudative lesions in the lungs. By means of this fact bovine tuberculosis can be divided clearly into the productive and exudative types. The extra-pulmonary lesions always are productive alone and are of little importance. Next, examining the infecting routes of the tubercle bacillus, I can understand that a limitative existence of all lesions within the lungs and its regional lymphnodes signifies without doubt an infection through the lungs, and that within the tonsils and their regional lymphnodes also signifies certainly that through the oral or pharyngeal route.

Besides, from the observation of the process of lesions it is comprehended that a forcus containing the abundant bacilli means the activity of the disease, on the contrary, a forcus containing few or no bacilli and showing the marked calcification and the intensive growth of the connective tissue means the stop of the disease. Accordingly, a case

which has both active and stopping forci in the same body can be recognized as secondary tuberculosis due to a relapse after the disease took once a healing tendency. For this reason it is always possible to differentiate the primary tuberculosis from the sencondary one. The disease due to the primary attack by the tubercle bacillus has only the lesions of the same oldness.

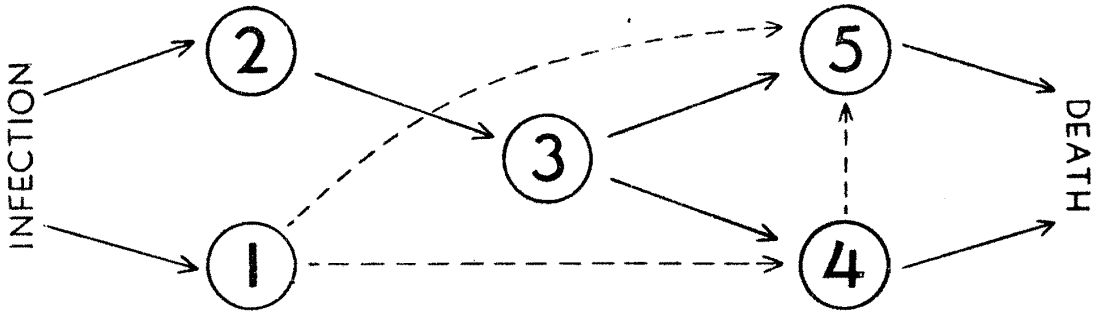
In short, on the basis of the above stated considerations, bovine tuberculosis has been classified into 5 kinds due to the period and type from the immune and allergic respects. The results are illustrated as following schudele and chart.

Kinds of tuberculosis and their number

Kinds of tuberculosis due to stage and type	Killed cases 19	Died cases	
		Death due to other disease 8	Death due to this disease 11
1 Stopping tuberculosis of primary complex	6	1	0
2 Primary spreading active productive tuberculosis	1	0	0
3 Primary stopping productive tuberculosis after spreading	11	4	0
4 Secondary active productive tuberculosis	1	3	1
5 Secondary active exudative tuberculosis	0	0	10

Key: 1. "Spreading" indicates specially the haematogen spreading.
2. Other disease indicates the non-tuberculous diseases, a death due to which is of same significance as that due to being killed.

Connection among each stage and type



Key: 1. The numerial in the ring reveals the kind of tuberculosis.
2. Dotted line indicates the imaginary connection, suggesting the possibility in spite of the absence of the specimen examined.

Next, explaining the nature of tuberculosis of each stage and type, I will interpret the reason of classification as follows.

1. Stopping tuberculosis of primary complex: Tuberculosis of this kind indicates slight tuberculosis which has the lesions at the infected site and its regional lymphnodes alone without the haematogen spreading yet, showing a healing tendency.

Though a primary forcus in the lungs of human tuberculosis is exudative, the forci detected in the lungs here are productive. After all, I think that perhaps the true primary forcus which could not be detected must exist somewhere and the secondary forci alone which spread from the near primary forci must be seen here by me.

2. Primary spreading active productive tuberculosis: This indicates active tuberculosis which is haematogenously spreading. The lesions are productive. This kind is met with rarely among the specimens employed here, but it is considered that this kind of tuberculosis must be looked commonly among experimental tuberculosis infecting with the large quantity of tubercle bacillius.

3. Primary stopping productive tuberculosis after spreading: This kind indicates stopping tuberculosis which occurs after primary haematogen spreading, showing now a healing tendency. This tuberculosis is numerous and is looked commonly among the killed cases.

4. Secondary active productive tuberculosis: This indicates active tuberculosis which invites the multiplication of bacillus in the forci owing to a relapse after stopping tendency. This kind is often met with and is frequently so severe that a cattle may die.

5. Secondary active exudative tuberculosis: This indicates active tuberculosis which has been transformed from other kinds because of an alteration of constitution, physical nature of cattle. The fact that the lesions are clearly exudative is the most noteworthy characteristic. That every forcus invites the wonderfully remarkable multiplication of bacillus is an other important characteristic. These tuberculosis are always so serious that a cattle takes the termination of death relatively rapidly.

Generally speaking, almost all of general tuberculosis which act as the cause of death consist of this kind. Tuberculosis which are ordinally seen among the died cases are this kind.

V. Cause of occurrence of each kind

According to the above mentioned investigations a cattle essentially seems to have the unexpectedly strong natural resistance against tuber-

culosis. Namely, when the cattle is infected with the tubercle bacilli, a part of them become stopping tuberculosis of primary complex on account of the relatively strong natural resistance, surviving long. In that time, the remaining cattle become primary spreading active productive tuberculosis on account of relatively weak natural resistance, dying cattle are extremely rare or zero, and almost all of them become primary stopping productive tuberculosis after spreading, surviving long because of the appearance of immunity. But a small number of them become sometimes secondary active productive tuberculosis owing to a relapse and die rarely because of the decrease of immunity. Out of all kinds of tuberculosis the most fearful one is secondary active exudative tuberculosis.

Its cause of occurrence can not be seen to be the simple disappearance of immunity. An essential alteration of constitution of cattle is considered to be a true cause, because the fact that the change (normergic change) in the lungs of tuberculosis of this kind differs fundamentaly from those of tuberculosis of all other kinds lends good support to prove this. Namely, the tubercular changes of this kind alone are exudative and invite the wonderfully exceedingly multiplication of bacillus in every forcus. These two characteristics can not be observed at all among the tubercular changes of all other kinds. Such an alteration of the constitution which means a decrease of resistance may be understood as an allergy. This allergy is established against the living bacilli and can not be given experimentally to the animals, in spite of happening accidentally, notwithstanding the cause of occurrence is unknown, this allergy seems to be closely related to the acquired (not congenital) idiosyncrasy.

However, the tuberculin allergy is established against the dead bacilli or toxin and can be given experimentally and expectedly to the animals. This allergy seems to be closely related to the local anaphyraxis. Therefore, it allows that above 2 kinds of allergy differ essentially each other.

VI. Summary

1. 38 cases of bovine tuberculosis, consisting of 19 died cases and 19 killed cases have been pathologically examined from immune and allergic respects.

2. Tuberculosis can be classified into 5 kinds according to stage aud type.

That is:

(1) Stopping tuberculosis of primary complex.
(2) Primary spreading active productive tuberculosis.
(3) Primary stopping productive tuberculosis after spreading.
(4) Secondary active productive tuberculosis.
(5) Secondary active exudative tuberculosis.

3. Tuberculosis which become a cause of death is mainly (5). This tuberculosis alone is exudative and is the most fearful kind among all kinds of tuberculosis. Tuberculosis looked in the died cases is this kind, on the contrary, tuberculosis looked in the killed cases are mainly (3).

4. It is considered that the cause of occurrence of (1)-(4) have relation to the strength of natural resistance and acquired immunity and that of (5) has relation to an allergy. This allergy differs from the allergy like the tuberculin reaction, being recognized rather to be closely allied to the acquired idiosyncrasy.

Literatures

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