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Author(s)	YAMAGIWA, Saburo; FUJIMOTO, Yutaka; OHBAYASHI, Masashi; ONO, Takeshi; OHSHIMA, Kan-ichi
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CLINICO-PATHOLOGICAL STUDIES ON EPIDEMIOLOGY OF EQUINE INFECTIOUS ANEMIA. I.

Saburo YAMAGIWA, Yutaka FUJIMOTO, Masashi OHBAYASHI,
Takeshi ONO and Kan-ichi OHSHIMA

*Laboratory of Veterinary Pathology, Faculty of
Veterinary Medicine, Hokkaido University,
Sapporo, Japan*

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INTRODUCTION

The authors consider that the people concerned with equine infectious anemia in this country believe generally as follows:

“Occurrence of the disease experienced in Japan has become sporadic and the greater part of the patients have come to manifest a chronic course.”

Moreover in Japan, cases of epidemic diseases which had close relation to equine infectious anemia have repeatedly attracted the attention of the veterinary world. Also cases of equine infectious anemia in Hokkaido, which were assumed to be scattered by injection-syringes, have been discussed.

Needless to say, the authors consider that it is absolutely necessary from the viewpoint of prevention and scientific study to carry out sufficient critical analyses and examinations about the various phases of occurrence of equine infectious anemia. As to the practical circumstances, however, it is difficult to secure clinical data on the affection and contraction of the disease in every case and, besides, at the present stage of study, simple or sure diagnostic methods have not yet been found.

Thus, by reason of the above facts, investigators are placed in a difficult situation to collect comprehensive data which answer to their purpose.

At the beginning of the paper the authors wish to express their gratitude to Dr. Shizuma SUGANO, Dr. Masanori TAJIMA, Dr. Akira UEDA, Messrs. Masatomo GOTOH, Ruizo ISHITANI, Noboru SASAKI, Satoru KONNO, Mutsumi INCUE, Yojiro OHMURA and Shoji MORIMOTO for their cooperation in and out of the laboratory. The authors also wish to express their thanks to the persons concerned of the Animal Industry Section, Hokkaido Prefectural Office for their kind help.

The authors, however, have had chances to investigate thousands of cases of equine infectious anemia, records of which were collected in order to study the nature of histological changes. They could also critically examine these materials according to their source and types. In the present paper, the authors propose to inquire into the true facts regarding the epidemiology of the disease by way of analysis, fundamentally, of the results already deduced from the materials and also through more sufficient investigations upon certain cases whose detailed clinical history had been examined.

RELATIONSHIP BETWEEN THE TYPE OF LESIONS AND
COURSE OF EQUINE INFECTIOUS ANEMIA

Detailed descriptions on the types of pathological changes of the disease have been published under the subject "Pathological Studies on Equine Infectious Anemia. I~III. (In Japanese)" in the *Jûi Chikusan Shimpô* (*Journal of Veterinary Medicine*, Tokyo; papers I~VIII have already been published). To begin with, the authors wish to introduce a table on the analysis of types from the report at "The Symposium on Equine Infectious Anemia" of the 34th Meeting of the

TABLE 1. *Types of Pathological Changes of Equine Infectious Anemia*

TYPE	ACUTE	SUBACUTE	CHRONIC	RELAPSED
Pathology	Parenchymatous degeneration	Parenchymatous degeneration	—	Parenchymatous degeneration
	Dynamic activities of endothelial system	Dynamic activities of endothelial system	Static activities of endothelial system	Dynamic activities of endothelial system
	—	Increase of L-cells in lympho-reticular tissue	Increase of lymphocytes in lympho-reticular tissue	Increase of lymphocytes in lympho-reticular tissue
	—	—	—	Static activities of endothelial system
Clinic	<i>Febris continua</i> at high degree	<i>Febris recurrens</i>	Abrupt pyrexia or <i>Febris remittens</i>	Abrupt pyrexia or Apyrexia
	Death	Death	Chronic course	Death
Association	Frequent	Frequent	Observable	Frequent

Japanese Society of Veterinary Science (Saburo YAMAGIWA: On Pathology of Equine Infectious Anemia, *Jap. J. Vet. Sc.*, 14, 523 (1952) (In Japanese)).

It needs some care to read the present paper in connection with the authors' division of the disease into four types as above listed. These classifications were established from only the viewpoint of pathological changes. However, the course of the acute and subacute type is respectively 2~3 weeks and 1~2 months, as is concluded from the data of experimental cases. The chronic type needs special caution, because some cases of equine infectious anemia progress mildly from the beginning of affection, that is, in most of the chronic type elapsed time is considerable but in a part of the cases not always so.

EPIDEMIOLOGY OF EQUINE INFECTIOUS ANEMIA IN HOKKAIDO

1. Cases Examined as Standard

The standard cases are described by the authors under the following grouping:

Autopsied cases consulted in the Veterinary Hospital of Hokkaido University (Group-A)

Autopsied cases which required diagnosis (Group-B)

Autopsied cases at Sapporo Slaughter House (Group-C)

Autopsied cases of race horses (Group-D)

Autopsied cases of military horses transferred to Hokkaido University (Group-E)

Liver puncture cases which required diagnosis (Group-F)

Group-A One hundred eighty-six cases were histologically diagnosed as equine infectious anemia among numerous horses which were brought for consultation to the Veterinary Hospital of Hokkaido University (Hokkaido Imperial Univ.) and autopsied at the authors' laboratory during the past 30 years. Most of these horses were raised in Sapporo and neighbouring districts as farming horses.

The cases comprised 112 acute and subacute, 58 chronic and 16 relapsed type. As most cases of the acute, subacute and relapsed type died or were urgently slaughtered, it is comprehensible that pathological changes of equine infectious anemia observable in the most cases which progress to lethal termination belong to these three types. About a half of the chronic type cases died in the hospital and among them many cases showed no other lesion which could be ascribed the *causa mortis*.

It must also be emphasized about the chronic type that on the one hand some cases had been transferred to the laboratory under the ordinance of slaughter after periodical examination according to law and on the other hand considerably many cases could not be clinically diagnosed as equine infectious anemia.

Among the four types, the most worthy of attention is the relapsed which was presumably first introduced to the veterinary world by the authors. The

authors consider that it is unreasonable to dismiss the relapsed type summarily as lesions as a result of a fit during the course of chronic equine infectious anemia, because the examinations of numerous cases of the chronic type resulted in the finding that the characteristic changes visible in the relapsed type could not be identified in slaughtered cases as connected with the fit. It is also to be emphasized that 14 cases out of 16 relapsed type were analyzed at least with special attention to complicated hepatic changes, because they were the autopsied dead cases and before death equine infectious anemia of the chronic type was confirmed by liver puncture in the hospital (note table 12).

As descriptions of lesions of the relapsed type have already been published, no details are offered in the present paper (vide *Jûi Chikusan Shimpô*, No. 95, 813 (1952). (In Japanese)).

Group-B This group consists of such cases as those collected during the recent several years as the materials sent to the laboratory from various areas in Hokkaido and field cases autopsied by members of the laboratory staff. Most of them are farming horses; 53 cases are the acute or subacute type, 108 chronic and 4 relapsed. Most of the chronic were slaughtered by law after periodical examination.

Fifty-three cases of the acute or subacute type attract attention, because most of them required examination by reason of unknown cause of death. About one-third of these 53 include cases which required differential diagnosis with Japanese equine encephalitis and cases which died abruptly after vaccination for the encephalitis.

Group-C During 5 years, from 1948 to 1952, 308 cases of infectious anemia horses were examined in the Sapporo Slaughter House. Classified by type, the acute or subacute number 96, chronic 210 and relapsed 2. The abundance of chronic type is influenced by the fact, it must be considered, that horses ordered to be slaughtered by law were collected at the slaughter house.

The fact that the acute or subacute type was about one-half of the chronic is also important. As it is easily conjectured that many horses hopeless to cure or superannuated are collected at the slaughter house, it may be said that, when such horses are not utilized as meat, they will die at any time in various areas of Hokkaido.

Group-D The authors could find 18 cases of race horses among numerous autopsied cases; they were 8 acute or subacute, 9 chronic and 1 relapsed. It is clarified that these cases had been raised in Hokkaido, but little was known about where they became affected.

However, 3 cases, of which the race-careers were ascertained, were undoubtedly attacked by the disease in stables of race clubs and another 3 cases were supposed to have played races with chronic-type lesions in the course of their travels to participate in various race meetings.

Group-E Sixteen cases of equine infectious anemia were detected among horses which had been raised in some certain place chiefly in the late Asahikawa

Army Division.

There were no reports that cases of equine infectious anemia occurred in large number during mass-raising as military horses. As, with one exception, all cases were conjectured to be affected and to manifest symptoms in the division, it may be considered that the disease had occurred among the army horses without great difference from cases out of the division in Hokkaido where the occurrence of the disease had become constant.

Group-F During the past 4 years, diagnoses of equine infectious anemia were required of about 55 punctured liver materials which were sent from interested persons in various areas of Hokkaido. With all materials the data were received in which the chronic course of patients were described. Through microscopy it was clarified that 30 cases were of the chronic type of equine infectious anemia while 25 showed no sign of the disease.

Results obtained from the above 6 groups have been summarized in the following table 2.

TABLE 2. *Classified Distribution of the Types of Equine Infectious Anemia in Standard Cases*

CASES EXAMINED	ACUTE & SUBACUTE	CHRONIC	RELAPSED	TOTAL
Group-A: Autopsied Cases in the Laboratory	112	58	16	186
Group-B: Autopsied Cases Diagnosis Required	53	108	4	165
Group-C: Cases of Sapporo Slaughter House	96	210	2	308
Group-D: Race Horse Cases	8	9	1	18
Group-E: Military Horse Cases	6	10	0	16
Group-F: Liver Puncture Cases Diagnosis Required	0	30	0	30

Although the authors consider that the data are not entirely perfect so as to be entirely acceptable as the standard examination, yet the table may be useful as an outline of the occurrence of equine infectious anemia in Hokkaido.

2. Examined Cases of Municipalities in Hokkaido

The data for this discussion were obtained by examination of the cases from 10 districts, viz., liver punctured cases in Kamifurano (Group-Fu), autopsied cases respectively in Tokachi-shimizu (Group-Ts), in Rikumbetsu (Group-Ri), in Shimokawa (Group-Sk), in Otaru (Group-Ot), in Shiroishi (Group-Sh), in Aibetsu (Group-Ai), in Hokuryu (Group-Ho), in Mori (Group-Mo) and in Shintotsukawa (Group-St).

Group-Fu In July 1950, 10 horses out of about 1,500 in the town of Kami-furano were slaughtered after the periodical examination required by law as cases of equine infectious anemia. From that time, for the purpose of self-protection, the Agricultural Mutual Association of the town carried out liver puncture on 144 horses which manifested decrease of erythrocytes, increase of lymphocytes and, through the general clinical test, other possible symptoms of the disease; then the punctured materials were sent to the authors' laboratory for pathological examination. Microscopically 25 cases of equine infectious anemia were confirmed among them all of which were the chronic.

Not only in this town but in all of Japan to detect the siderocytes in peripheral blood, ISHII's method, is highly valued, however, this method showed negative results in these cases of group-Fu with a few exceptions. The town seemed as if purified by the periodical examination, but, from the results by liver puncture, survival of infectious anemia horses was confirmed in the town to a number exceeding that of the slaughtered.

To put it briefly, in 1950, at any rate, more than 30 cases of the chronic type were undoubtedly in hiding in the town.

Group-Ts In the town of Tokachi-shimizu, 33 cases of equine infectious anemia were autopsied in the two years 1950 and 1951; these cases numbered 7 acute or subacute, 24 chronic and 2 relapsed. Periodical examinations were carried out on all horses of the town by means of application of siderocytes test in those years. The authors also made pathological examinations of dead cases in the town with the cooperation of the Agricultural Mutual Association. Thus the authors consider that the circumstances of occurrence of equine infectious anemia in that town were clarified in regard to those years.

It is easily possible to agree that if the liver puncture had been applied, a greater number of the chronic type cases would have been detected similar to the findings in group-Fu.

Group-Ri From June to August 1950, one liver punctured material, 6 autopsied dead cases and 4 autopsied slaughtered were received at the authors' laboratory from the village of Rikumbetsu; the village had raised 897 horses in 1950 according to statistics. All cases were diagnosed as equine infectious anemia and classified as 7 acute or subacute and 4 chronic.

It may, however, be noted that, according to the clinical data, material from two affected horses of the same owner were twice observed and classified among the former type.

Group-Sk According to statistics of 1949, 982 horses had been raised in the village of Shimokawa; the Animal Industry Section of the Hokkaido Prefectural Office received report of the occurrence of pyretic horses of unknown cause and that 4 of them had died in the village in July, 1949. Officials in charge rushed to the village, diagnosed 3 cases as acute equine infectious anemia and slaughtered them.

One of the died was examined histopathologically by the authors and the case

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was diagnosed as the subacute type of equine infectious anemia.

It was stated in the data that the description "unknown cause" was recorded because of the negative result of application of ISHII's method; the 3 slaughtered cases also showed negative results for siderocytes.

Group-Ot In the city of Otaru, it was recorded, lethal cases suspected as equine infectious anemia had occurred successively from July of 1939 to the next year. The authors examined material from 2 dead cases which had come to the hospital from Otaru in May with the result that they were diagnosed as the subacute type.

Group-Sh In the last decade of April 1942 in the village of Shiroishi, 1,007 horses were raised according to statistics of 1949, patients sick of unknown cause were observed and early in May the Animal Industry Section of the Hokkaido Prefectural Office carried out the examination for equine infectious anemia on 793 cases. That examination resulted in finding 13 cases of equine infectious anemia. The cases examined by the authors were 2 out of 5 which had been slaughtered in the last of April after decision of the positive case. The 2 cases were diagnosed as the chronic type.

According to contemporary information at that time, in regard to the successive occurrence of the cases of unknown cause, the suspicions of persons concerned were excited about preventive injections against osteomalacia performed at the last of April that year. However, the authors consider, by reason of the type, that the time of affection of autopsied cases had no relation to those preventive injections.

Group-Ai From March to May 1947 in the village of Aibetsu, 864 horses were raised according to statistics of 1951; more than 20 cases of unknown cause died successively. Then in the village, the Animal Industry Section of the Hokkaido Prefectural Office carried out twice at the beginning and middle of July the simultaneous examination for equine infectious anemia. It was recorded that 27 and 6 true cases respectively were discovered, however, all cases manifested no definite clinical symptoms.

The authors examined 2 slaughtered cases out of the former 27 and result was positive for the chronic type. Circumstances about the dead cases are unknown.

Group-Ho In January 1949 in the village of Hokuryu, statistically the number of horses was 614 in 1952, one pyretic horse of unknown cause was found and 18 cases with similar symptoms were observed before the middle of June. Among them 4 died under such clinical diagnoses as pleuropneumonia, strangles and unknown cause while were 3 slaughtered as cases of equine infectious anemia.

Three cases from among the remainder were examined by the authors and were diagnosed as the chronic type of equine infectious anemia.

Thereafter at the last of June, the Animal Industry Section of the Hokkaido Prefectural Office exposed 9 suspected cases of equine infectious anemia by the simultaneous examination.

Group-Mo From January 1949 to March 1950 in the town of Mori, where

819 horses were raised according to statistics of 1952, more than 40 patients of unknown cause were reported and a half of them died; one case which occurred early in March was identified as the subacute type of equine infectious anemia through the authors' examination.

The Animal Industry Section of the Hokkaido Prefectural Office carried out a simultaneous examination at the beginning of April and exposed 33 true and suspected cases. The authors examined 29 cases, one of which was died, and classified them as 3 subacute, 24 chronic and 2 negative cases.

In regard to this group, some persons considered that the successive occurrence of the sickness was caused by preventive injections for strangles. Although the authors could not obtain the materials at the time of that successive occurrence, it was clarified that the chronic type cases of equine infectious anemia at 5 per cent of all horses had been hidden in the town and 4 subacute type cases were confirmed absolutely without relation to the time of preventive injections.

Group-St In January 1947 in the village of Shintotsukawa, where the statistics recorded 1647 horses as total population in 1952, successive occurrences of horse deaths by unknown cause was reported. At the end of January the simultaneous examination was carried out by the Animal Industry Section of the Hokkaido Prefectural Office at N-settlement of the village and 32 cases were exposed, among which 14 died, 2 slaughtered, 14 cured and 2 removed.

Among these cases the authors examined 5 dead cases and diagnosed them as 3 subacute, 1 chronic (died of colic) and 1 relapsed.

According to the bacteriological examination by the Laboratory of Veterinary Hygiene and Microbiology of Hokkaido University, association of *Salmonella abortus-equi* as the mortal cause could be absolutely denied.

Results of examination of the above groups are tabulated as follows:

TABLE 3. *Distribution of the Type of Equine Infectious Anemia in the Cases of Municipalities*

CASES EXAMINED	ACUTE OR SUBACUTE	CHRONIC	RELAPSED
Group-Fu : Liver Punctured Cases in Kamifurano	—	25	—
Group-Ts : Autopsied Cases in Tokachi-shimizu	7	24	2
Group-Ri : Autopsied Cases in Rikumbetsu	7	4	—
Group-Sk : Autopsied Cases in Shimokawa	1	—	—
Group-Ot : Autopsied Cases in Otaru	2	—	—
Group-Sh : Autopsied Cases in Siroishi	—	2	—
Group-Ai : Autopsied Cases in Aibetsu	—	2	—
Group-Ho : Autopsied Cases in Hokuryu	—	3	—
Group-Mo : Autopsied Cases in Mori	3	24	—
Group-St : Autopsied Cases in Shintotsukawa	3	1	1

It may be said that the first five of the above groups, Fu, Ts, Ri, Sk and Ot, depict a phase of the actual state of equine infectious anemia in municipalities of Hokkaido; the chronic type is hidden constantly and the acute, subacute and relapsed type come to the fore at any time, just as has been clearly pointed out above in the standard cases.

The authors have described the examined results of group-Sh and four additional municipalities, in which deaths by the acute or subacute type lesions had been become a subject of discussion by reason of various circumstances by persons concerned. Especially in groups Sh, Ai, Mo and St question was raised as to a possible connection between certain preventive injections and the prevalence of the equine infectious anemia. About such problem the authors have already published some discussion under the subject of "Pathological Studies on Equine Infectious Anemia. XIV & XXII", but it may said that no definite conclusion is obtainable in so far as examinations to date are concerned.

3. Cases Examined from Stockfarms

There were examined autopsied cases obtained from 12 stockfarms in Hokkaido including agricultural institutions in which numbers of work horses were raised.

Group-Ku K Prefectural Stockfarm is an old breeding farm. In June 1948 at the clinical examination for equine infectious anemia 13 out of 76 horses being raised there were diagnosed as suspected cases of the disease. One farm horse, which had not been suspected of equine infectious anemia from clinical and other conditions, was slaughtered and the case was diagnosed pathologically as definitely having the chronic type of equine infectious anemia.

In the summer of 1951 another clinical examination was carried out on 120 horses and thereafter 19 cases were slaughtered, among which 7 were suspected cases and 17 showed positive reaction according to ISHII's method. Only one case was diagnosed as the chronic type of equine infectious anemia by the authors through histopathological investigations of 15 cases among the above. Liver puncture material from 15 not slaughtered horses with negative result to ISHII's method were also examined. They were all negative.

In the summer of 1952 the third clinical examination was executed on all horses and liver punctured materials were microscopied on 14 horses which showed some suspicion of equine infectious anemia in their clinical history or other conditions of sickness. The examination, however, resulted in negative conclusions.

In the data preserved in K-Stockfarm it was recorded that 30 true cases of equine infectious anemia were exposed and slaughtered after the simultaneous examination in 1942 when 3 horses had died of equine infectious anemia; about those cases the authors could not know anything clinico-pathologically.

Although serious affection of equine paratyphoid among *the horses of that* stockfarm has been suspected, there has been no report of the successive occurrence of equine infectious anemia or of equine infectious anemia in association

with equine paratyphoid.

Concluding finally, many horses were sacrificed which manifested positive reaction for ISHII's method. Disregarding the cause of such sacrifices, in actual fact only two cases of chronic type equine infectious anemia were confirmed in a long time.

Group-Si S Prefectural Stockfarm is the original farm of the above K Stockfarm; S was transferred from Makomanai after World War II.

In June 1950 12 horses were tested by ISHII's method; they all showed negative result; two among them were liver-punctured and the result was also negative.

Thereafter in 1951, 5 horses out of 18 examined by ISHII's method showed positive result and two of which were slaughtered without pathological investigations.

Furthermore in the summer of the next year, 1952, examination for equine infectious anemia was carried out on 15 horses including 14 which had shown positive reaction in the previous year. There were exposed 3 true and 5 suspected cases and then those 8 cases were killed in slaughter house; the authors could not find any lesions of equine infectious anemia in any of the cases. Two horses among 7 cases not disposed showed positive reaction for ISHII's method, but on microscopical sections of liver punctures from these 7 cases no sign of equine infectious anemia was observed.

Finally, it was ascertained that the S-Stockfarm had been quite free from equine infectious anemia constantly.

Group-To Nine materials of liver puncture were sent from Tokachi National Stockfarm and 3 cases were confirmed as the chronic type of equine infectious anemia. Those 8 cases out of 9 showed positive result for ISHII's method.

Group-Ma This group consisted of 5 autopsied cases of equine infectious anemia sent from Makomanai Prefectural Stockfarm during 14 years from 1926 to 1939. Pathologically 4 were acute or subacute and 1 was chronic type.

Group-Hd During 15 years from 1937 to 1951, 6 cases of equine infectious anemia were autopsied at the First Farm of Hokkaido University; among them 1 was acute and 5 chronic type cases.

Group-Ko This group contained cases from the Kotoni Agricultural Experiment Station. During 9 years from 1942 to 1950, four cases of equine infectious anemia were offered and among them the number of acute or subacute type was 3 and chronic 1.

Group-Ta In 1937 materials of one subacute type case of equine infectious anemia was sent from Takikawa Prefectural Sheep Station.

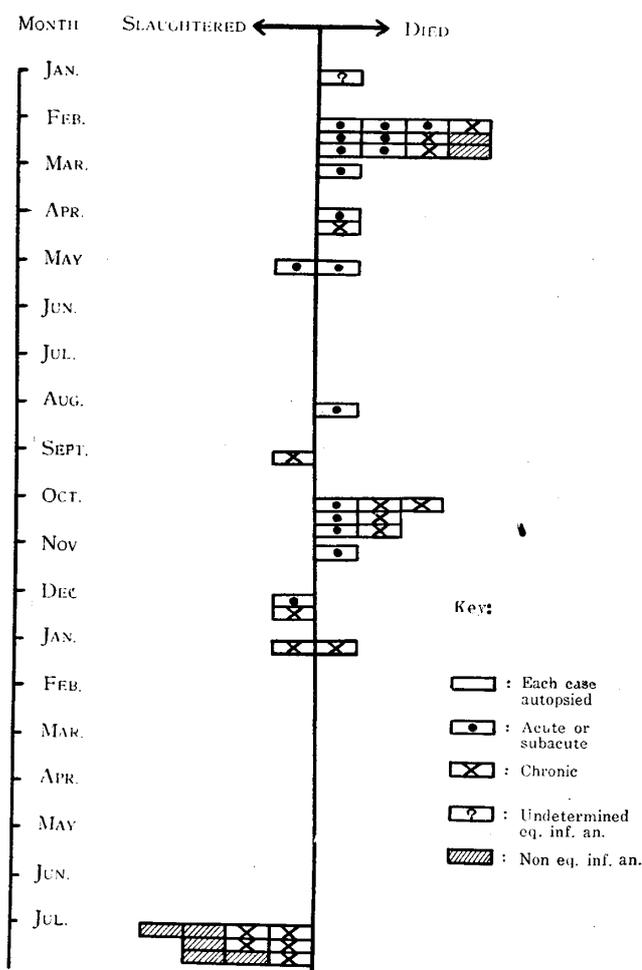
Group-Tu One case was autopsied at Tsukisappu Sheep Station in 1946 and was found to have chronic type lesions of equine infectious anemia.

Group-Oh One subacute type of equine infectious anemia occurred in Otofuke Stockfarm in 1948.

Group-Ns One chronic type case of equine infectious anemia was observed in Nishishumbetsu Stockfarm.

Group-Se Beginning from November 1937, pyretic cases had occurred successively among young horses aged 2 to 3 years in the Tokachi Detachment of the Military Horse Supply Depot and the number of patients amounted to 474. Clinically many cases among them manifested symptoms such as strangles and catarrh of upper trachea and the first dead case was found in January of the next year. The group was made up of cases from two source, viz., 13 dead cases autopsied thereafter at the detachment and autopsied cases of 13 died and 15 slaughtered which were transferred to Hokkaido University at two times, April and July, for the purpose of study on equine infectious anemia. According to the available data, it was recorded that 40 horses which could be diagnosed as equine infectious anemia still remained in the detachment in July. Classified by type, acute or subacute were 17 and chronic 17, as shown in figure 1.

FIG. 1. Distribution of the Type of Equine Infectious Anemia by Month in the Tokachi Detachment of Military Horse Supply Depot



Group-Mu From the autumn of 1947 to January of the next year, 70 cases of abortion caused by *Salmonella abortus-equi* were confirmed in the public pasture of M-city and the patients amounted to about a half of the total number of pregnant mares. The cases examined were 13 autopsied horses died during the time of prevalence in the pasture.

It was confirmed pathologically that each one case slaughtered in December 1947 and August 1948 had chronic type equine infectious anemia. Further, 2 cases in January 1947 and one case each in May, June and October were acute or subacute type of equine infectious anemia.

From the above described results using material from various stockfarms table 4 was obtained: —

TABLE 4. *Distribution of the Type of Equine Infectious Anemia in the Cases of Stockfarms*

CASES EXAMINED	ACUTE OR SUBACUTE	CHRONIC
Group-Ku : K Prefectural Stockfarm	—	2
Group-Si : S Prefectural Stockfarm	0	0
Group-To : Tokachi National Stockfarm	—	3
Group-Ma : Makomanai Prefectural Stockfarm	4	1
Group-Hd : The First Farm of Hokkaido University	1	6
Group-Ko : Kotoni Agricultural Experiment Station	3	1
Group-Ta : Takikawa Prefectural Sheep Station	1	—
Group-Tu : Tsukisappu Sheep Station	—	1
Group-Oh : Otofuke Stockfarm	1	—
Group-Ns : Nishishumbetsu Stockfarm	—	1
Group-Se : Tokachi Detach. Mil. Horse Supply Depot	17	16
Group-Mu : Public Pasture of M-City	5	2

In groups Ku, Si and Se the cases were carefully examined with participation of persons connected with Hokkaido University, but the other groups were dealt with by persons connected with the stockfarms and only the materials were sent to the authors' laboratory with requests for examination. Therefore data about the latter groups were extremely imperfect.

From the above described results, the following two conclusions may be reached.

Firstly, it can be stated that all of the famous government and public stockfarms are included as the sources of the materials examined and that, although not examined for the purpose, all stockfarms experienced the occurrence of equine infectious anemia with the sole exception of S-Stockfarm which has been recently established.

That comment may be a matter of course, because these farms are situated in Hokkaido in which equine infectious anemia constantly occurs, but, except in the groups Se and Mu, it must be accepted that there is no evidence of observance of successive occurrences of many cases of equine infectious anemia. About these circumstances, the authors can conclude with confidence about such cases as those of the groups Ku and To where it was clearly stated horses had been carefully examined by ISHII's method repeatedly.

Classified by the type of lesions, not only the chronic type but also the acute

The authors wish to express their cordial thanks to the Laboratory of Veterinary Hygiene & Microbiology and the Laboratory of Veterinary Internal Medicine, Hokkaido University for their kind permission to cite the data.

or subacute were observed. However in the present paper, the numerical relation between the two types is not discussed, because it is influenced according to the difference of interest of the persons concerned at the stackfarms.

Secondly, it can be concluded about groups Se and Mu as follows. In group-Se, cases of death by acute or subacute type of equine infectious anemia occurred successively in the coldest season as an aftermath of prevalence of strangles among young horses. In group-Mu, cases of death by equine infectious anemia were sporadically experienced when abortion caused by *Salmonella abortus-equi* was prevalent among mares in the pasture.

Therefore, the authors consider that strangles in group-Se and equine paratyphoid in group-Mu became a forerunner and thereafter, horses with latent chronic type infectious anemia playing a role as the source of infection, provoked the successive occurrence of fatal cases of the disease.

4. Cases Examined for Embryonic Affection

The authors describe according to the three groups; autopsied cases of infectious anemia mares and their foals (Group-G), autopsied cases of infectious anemia mares and their embryos (Group-H) and autopsied cases of embryos in abortion or premature birth (Group-I).

Group-G Seventeen pairs were obtained as material, therefore, 17 mares of equine infectious anemia were autopsied at the same time as the autopsy of the foals. Following the examination of 34 autopsied cases table 5 was made.

TABLE 5. *Distribution of the Type of Equine Infectious Anemia in the Cases Examined for Embryonic Affection (Group-G)*

MATERIALS		EQUINE INFECTIOUS ANEMIA CASES OF MARE	
		Acute or Subacute	Chronic
Foals	Non Equine Inf. An.	5	5
	Acute or Subacute	4*	0
	Chronic	0	3

* One mare of a pair out of 4 diagnosed as the relapsed type.

As shown in the table 7 pairs, both mare and foal, were diagnosed as having equine infectious anemia out of 17. However, there being no absolute certainty as to the time of contraction of the disease, affection in embryonic stage could be denied in the 4 pairs where both mare and foal showed the acute or subacute type lesion of equine infectious anemia. In one pair out of 3 in which both had the chronic type of equine infectious anemia, embryonic affection was supposed, but in the other 2 pairs circumstances of affection and contraction are not known with certainty.

Group-H Ten pairs, that is 10 embryos were autopsied at the same time as the autopsy of 10 mares which were diagnosed as equine infectious anemia. Data in table 6 were obtained by the examination of these 20 cases.

TABLE 6. *Distribution of the Type of Equine Infectious Anemia in the Cases Examined for Embryonic Affection (Group-H)*

MATERIALS	EQUINE INFECTIOUS ANEMIA CASES OF MARE		
	Acute or Subacute	Chronic	
Embryos	Non Equine Inf. An.	5	5
	Acute or Subacute	0	0
	Chronic	0	0

No embryo showed any lesion of equine infectious anemia, as indicated in the table.

Group-I Two cases of 3 aborted (without data concerning the mares) and one case of premature birth (the mare without anamnesis) showed the subacute type lesions. One other aborted embryo showed no sign of the disease, although the mare had chronic type equine infectious anemia.

It is concluded that the frequency of embryonic affection of equine infectious anemia does not reach a very high ratio, so far as is indicated by data from examination of groups G, H and I.

EPIDEMIOLOGY OF EQUINE INFECTIOUS ANEMIA AMONG SERUM HORSES IN THEIR STABLES

In the following the authors describe the experience at the Institute for Infectious Diseases of Tokyo University (Denken) and the Kitasato Institute for Infectious Diseases (Hokken) in Tokyo.

Group-Denken All cases of died and wholly bled were autopsied during years from April 1941 to March 1943. The number of cases of equine infectious anemia are listed in the following table (Table 7).

With the progress of technique, the immunization period has been remarkably shortened but on the other hand the burden of serum horse has become extraordinarily heavy. About this group, attention must be also paid to the circumstances that the period studied extended into that of World War II when the selection of horses used for the purpose of immunization was unsatisfactory and that horses were frequently purchased from areas where equine infectious anemia was of constant occurrence.

Altogether, as shown in the table, the lethal cases may be considered numerous; the important causes of death were exhaustion, pneumonia, thrombosis in pulmonary arteries, etc in addition to equine infectious anemia. Under these

TABLE 7. *Distribution of the Types of Equine Infectious Anemia in Group-Denken by Month (April 1941~March 1943)*

MONTH	NUMBER OF CASES OF EQUINE INFECTIOUS ANEMIA				NUMBER OF CASES AUTOPSIED		
	Acute or Subacute	Chronic	Undeter- mined	Total	Died	Slaugh- tered	Total
Jan.	1	1	2	4	30	0	30
Feb.	1	2	0	3	25	0	25
Mar.	5	10	3	18	26	3	29
Apr.	0	2	1	3	12	1	13
May	0	4	0	4	11	38	49
Jun.	1	5	2	8	12	23	35
Jul.	0	4	3	7	30	21	51
Aug.	1	6	1	8	34	1	35
Sept.	0	9	0	9	15	12	27
Oct.	4	6	1	11	14	15	29
Nov.	0	5	0	5	15	6	21
Dec.	1	5	1	7	25	0	25
Total.	14	59	14	87	249	120	369

circumstances, it is rather no wonder that a large amount of equine infectious anemia occurred and on average 23.6 per cent cases were found, with differences between 50 to 4.8 per cent dependent upon the kind of immunization.

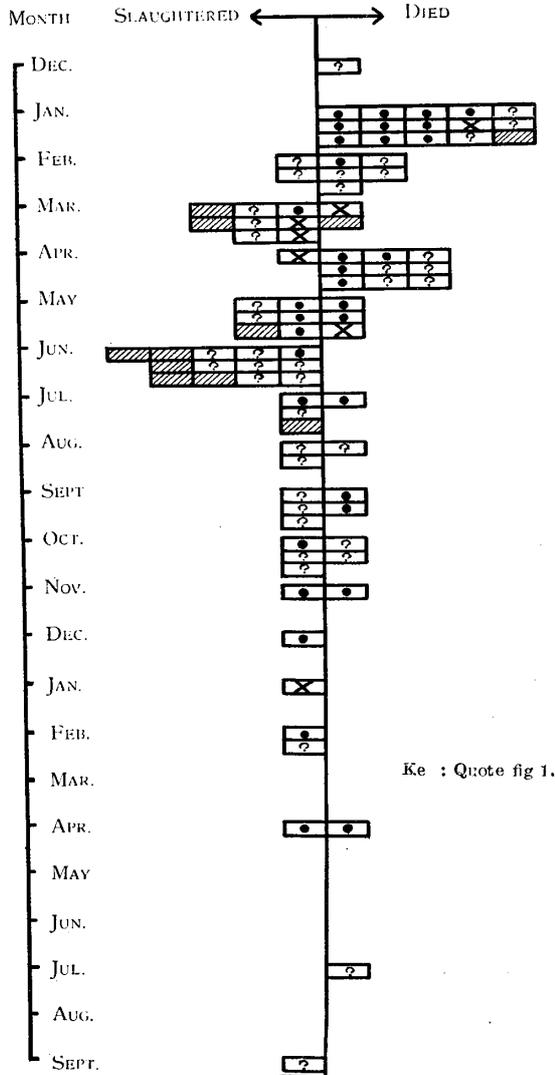
Classification of the cases of equine infectious anemia, showed clearly that the chronic type, 59 cases, was positively predominant over the acute or subacute, 14 cases. As to the distribution by year and month, the rate of autopsied infectious anemia cases was extremely high in March 1942, when 16 out of 25 died and 2 slaughtered were equine infectious anemia cases. However, no special reason was found for the sudden prevalent occurrence at that time, concluding by the types of lesions.

Group-Hokken The occurrence was described of cases which started from two fatal cases in stables of the Hokken at the end of 1940 among 40 serum horses which had been purchased en bloc: 34 horses died successively before the end of January of the next year.

The results described in the present paper were obtained from the pathological findings of dead and slaughtered horses which were examined in the institute by Dr. Shiro MIURA and co-workers clinico-hematologically and bacterio-serologically for two years when the prevalent occurrence was experienced as above noted (Figure 2).

The rate of detection of equine infectious anemia was as high as 95.5% in dead horses (42 out of 44) and 83.3% in slaughtered (40 out of 48).

FIG. 2. *Distribution of the Type of Equine Infectious Anemia by Month in the Group-Hokken (Dec. 1940~Sept. 1942)*



It is regrettable that there was no pathological examination of considerably many cases, but among the dead and slaughtered cases the subacute or acute type amounted to 82.5% (33 out of 40). There were seven chronic cases.

The result of bacteriological examination by MIURA et al. was as follows;

Salmonella abortus-equi was detected from 32 cases of the acute or subacute type (97.0%), 6 cases of the chronic (85.9%) and 16 cases of undetermined type (39.0%). Also the presence of hemolytic streptococci was confirmed in 17 cases out of 40 and *Shigella equirulis* in 3 cases. With the exception of a few cases identified as carriers, most of the cases showed serious infection.

In stables of the Hokken as above described, association of equine infectious anemia with equine paratyphoid and septicemia by hemolytic streptococci was of prevalent occurrence as a temporary phenomenon.

From the above described facts about the occurrence of equine infectious anemia observed in stables of the Denken and Hokken, the following two principal general comments are comprehensible.

As the first, the chronic type of equine infectious anemia was observed from the beginning in both stables and

then the occurrence was experienced continuously with successive deaths and necessary slaughterings. The cases comprised two kinds of patients: those affected in stables and those transferred to stable with the disease.

As the second comment, there was a great difference in mode of occurrence of the acute or subacute type infectious anemia between the two groups. The mode of the Denken-group was similar in outline of occurrence to that shown in the standard cases; the acute or subacute always occurred sporadically where the chronic type of equine infectious anemia had settled permanently. As to the Hokken-group, on the contrary, it showed opposite relation; the detection rate of

the acute or subacute was absolutely high and association with equine paratyphoid and other sickness was remarkably observed.

(continued)

The problem of association was discussed in detail in the following papers;
Saburo YAMAGIWA: Morphological Critical Studies on Association, Especially on Complex Contraction of Equine Infectious Anemia. *Jûi Chikusan Shimpô*, Nos. 39~41 (1950), (In Japanese).