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# Sero-epizootiological study on swine influenza in a prefecture of Japan

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SUMMARY

A total of 1799 swine sera collected in Toyama prefecture in the central part of Japan during the years 1978–82 were tested for antibody against swine influenza virus (SIV), A/New Jersey/8/76 (H1N1). A high prevalence of antibody was observed in the years after the severe epizootic of SI, 34·5% in 1979 and 51·7% in 1982. In other years, the percentages of positive sera were low and ranged from 1·7 to 12·4%. Regional variations were seen in relation to a small scale epizootic. No antibody to SIV was detected in any of the sera collected during the warm season. In the following dry and cold winter, however, a severe epizootic occurred among the swine populations.

The first occurrence of swine influenza (SI) in Japan was recognized in Niigata prefecture, in 1977 (Shibata *et al.* 1978). Further outbreaks of SI and a high prevalence of antibody to SI virus (SIV) in other prefectures were reported by several workers (Yamane *et al.* 1978; Onta *et al.* 1978; Sugimura *et al.* 1980; Sugimura *et al.* 1981). Moreover, in the eastern area of the Toyama prefecture adjacent to the Niigata prefecture, a severe epizootic and a high prevalence of SIV antibody were observed in 1978 (Ohno *et al.* 1980). Since then we have performed serological surveillance of SIV infection among swine populations in this area, to evaluate seasonal variation and the mechanisms of virus transmission (Easterday, 1975). The purpose of this study was to elucidate the epizootiological features of the antibody response to SIV in swine.

Serum samples were obtained from 1799 swine approximately 7 months of age during the years 1978 to 1982 at two abattoirs located in the Toyama prefecture. During the period November 1980 to February 1982, sera were collected from about six swine on each farm and from a total of 60 swine per month, except for

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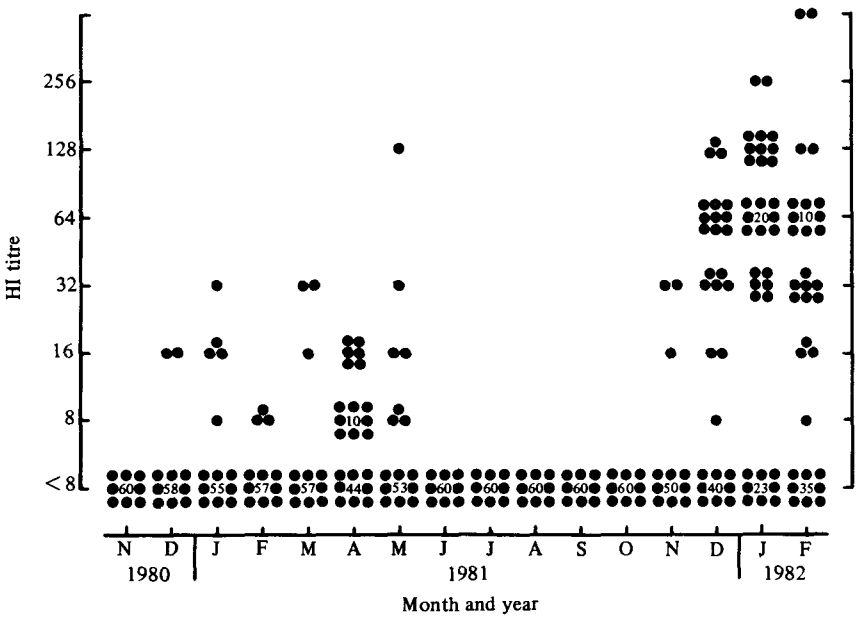


Fig. 1. Results of monthly testing for HI antibodies among swine.

November 1981. These sera were stored at −30 °C until tested. Serum antibody to SIV, A/New Jersey/8/76 (H1N1), was examined by the hemagglutination-inhibition (HI) test using a microtitre method after treatment with both potassium periodate and a commercial receptor-destroying enzyme (Takeda Chemical Industries, Ltd., Osaka, Japan). Details of the test have been described elsewhere (Goto & Shimizu, 1977; Goto *et al.* 1978), excluding the use of ethyl ether-treated virus antigen. An HI titre of $\geqslant 8$ was recorded as positive. A known positive SIV antiserum prepared in chickens served as a control throughout the experiments.

Severe epizootics of SI in the area were recognized twice, in October 1978 and in December 1981, and these were confirmed by virological and serological examinations. In the 1978 outbreak, swine on 27 (69·2 %) of the 39 farms developed serum antibody and this was found in all six animals from each affected farm. In the 1981 epizootic swine from 13 (62 %) of the 21 farms were antibody positive. All the viruses isolated in both epizootics were identified as SIV (H1N1) through the courtesy of the National Institute of Animal Health, Ibaraki, Japan. In the year following each epizootic a high positive rate of antibody was found; 34·5 % (178/516) in 1979 and 51·7 % (62/120) in 1982, respectively. By contrast the values were as low as 12·4 % (41/330) in 1978, 1·7 % (2/120) in 1980 and 8·0 % (57/713) in 1981. However, swine with HI antibody to SIV were found from December 1980 to May 1981 (Fig. 1). This result clearly indicates an epizootic of inapparent SIV infection in the swine. The titres of HI antibody and the number of swine involved were low compared to the severe epizootic which occurred in December 1981. On the other hand, none of the swine were positive for SIV antibodies from June to October 1981. Some of the positive sera tested showed a significant reduction of HI titres after the treatment with 0·2 M 2-mercaptoethanol. These results indicate a striking contrast between the cold and warm seasons with respect to SIV infection among the swine.

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Table 1. *Distribution of swine with HI antibody to A/NJ/76 virus in 13 districts*

| District (No. of swine raised in 1981) | No. of swine HI positive/ No. tested (percentage) | | |
|---|---|---|---|
| | Jan.–May 1981 | Nov.–Dec. 1981 | Jan.–Feb. 1982 |
| KB (9896) | 20/54 (37·0) | 9/39 (23·1) | 16/29 (55·2) |
| TY (4943) | 5/71 (7·0) | 12/20 (60·0) | 29/41 (70·7) |
| UZ (7132) | 4/58 (6·9) | 1/36 (2·8) | NT* |
| TO (2996) | 1/39 (2·6) | NT | 6/24 (25·0) |
| Other 9 districts (10,868) | 4/78 (5·1) | 1/18 (5·6) | 11/26 (42·3) |

* Not tested.

Table 1 represents the distribution of the swine with SIV antibody by district. There are thirteen districts in the study area and, for the purposes of analysis, these were divided into five groups consisting of each of the four districts raising more than 3000 animals and the remaining nine districts raising less than 3000 in each. A relatively high incidence of antibody positive swine was observed in KB district from January to May 1981. From November to December 1981, many positive reactors were distributed among the swine raised in both TY and KB districts, and in all the districts from January to February 1982. A considerable difference in the regional distribution of antibody-positive swine was observed during the small scale epizootic and early in the severe epizootic, but not in the late stage of the severe outbreak. It has been suggested previously that SI outbreaks occur almost simultaneously in many swine farms because of the wide distribution of SIV among herds (Easterday, 1975). In the present study, however, a certain regional variation of occurrence was observed in the mild epizootic.

The relationship between climatic conditions and severity of SI epizootics in the area was studied. During the period November 1980 to May 1981, there were no farms with antibody-positive swine among the six animals tested, whereas from November 1981 to February 1982 all six swine from 13 (62·0 %) out of the 21 farms showed positive antibodies. For the former period, average humidity was as high as 80 to 100 % from the middle of December 1980 to the next January. Average temperatures also remained relatively high ranging from 5 to 15 °C through early November to middle December 1980. For the latter period, average humidity has ranged between 60 and 90 % from late December 1981 to the next January, except on a few days. Average temperature was consistently lower, ranging from 0 to 10 °C from early November to middle December 1981, as compared with the average temperature of 5 to 15 °C in the past 30 years.

It is well known that SI epizootics occurred coincidentally with the onset of autumn rains and marked fluctuations of temperature (Easterday, 1975). Over a period of 14 months, Hinshaw *et al.* (1978) conducted comparative studies on virological and serological surveillance of SI between the north central and south central United States of America. They showed that the northern central states showed the peak of virus activity in swine from October to December, whereas the southern states did not have a marked peak other than a slight increase in the spring months. Moreover, Nakamura (1972) observed the presence of SIV antibody in Hawaiian swine. These findings suggest that the climatic condition is not the

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single definitive factor determining the dissemination of SIV. In the present study, the severe epizootic occurred in a relatively dry climate (in contrast to Easterday's finding) and during a cold winter. In addition, the spread of the disease seemed to depend on the accumulation of susceptible swine during the warm period of June to October 1981.

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