

**Antibody Levels to Japanese Encephalitis Virus in Swine in an Area  
of a Human Epidemic**

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**OBJECTIVE :** To determine and evaluate antibody titers to Japanese Encephalitis Virus (JEV) in swine in the area of a human epidemic.

**BACKGROUND :** In July 1972 an outbreak of Japanese encephalitis occurred in American military personnel at the Nham Phong Marine Air Base, Thailand. From previous studies performed by our laboratory in the Chiangmai area and from studies performed in Japan by other laboratories, swine can be considered an amplifying host for JEV and a potential source of infection for humans through mosquito transmission. Swine can also be used as a sentinel species in following the course of a human epidemic. The villages in the immediate area of the Marine base raise a substantial number of hogs.

**PROCEDURE :** Three nearby villages and one pig farm were visited. No clinical cases of encephalitis had been reported in either humans or swine in these locations. One hundred twenty four swine were bled and the fresh whole blood inoculated within 5 minutes into weanling mice in an attempt to isolate the virus of Japanese encephalitis. Sera from the same hogs were tested for hemagglutination inhibition (HI) activity against JEV.

**RESULTS :** No isolates of JEV were obtained from the specimens taken; however, swine in all four areas showed serologic evidence of previous infection with JEV, with serum antibody titers as high as 1:1280 by the HI method. Table 1 shows the number of animals with positive titers (greater than 1:20) to JEV. In areas 3 and 4, pigs of all ages had a high incidence of positive titers to JEV, but in areas 1 and 2 most animals over 5 months of age showed positive titers while most animals under 5 months of age were negative. Because a few of the young pigs in area 1 exhibited positive antibody titers but most remained susceptible, it was possible that active infection with JEV was present in this area at the time of bleeding. On 30 August 1972, one month after the original sera were collected, areas 1 and 2 were visited again. No clinical cases of JEV had been reported in humans or animals. Sera were drawn from 49 hogs and titers for JEV antibody were determined by the HI method. These results are compared with titers of the earlier sampling in Table 2. Because identification of individual animals was not possible in all cases, sera were not paired but were processed as a group. The incidence of positive JEV titers has not shown any significant change, remaining high (100%) in older animals and low (13%) in the young animals. The epidemic of encephalitis in humans was over; there had been no new cases in the 2 weeks immediately preceding this second visit.

**DISCUSSION :** The epidemic of JEV infection in humans was at its peak before the first serum sampling in hogs was done. The high incidence of positive antibody titers exhibited by very young animals in areas 3 and 4 on 30 July 1972 indicates that these animals were actively infected with JEV only 1 to 2 months earlier and could have served as a reservoir of infection. Passive immunity from the mother might account for some antibody in very young pigs, but does not account for the high incidence of positive titers among the younger group in areas 2 and 4 as compared to the low incidence of positive titers among the younger

group in areas 1 and 2. At the nearby air base were a group of individuals new to Southeast Asia and not previously exposed to JEV. The people at the air base began showing clinical signs of Japanese encephalitis in early July 1972. Villagers who had been in the area a long time had undoubtedly been previously exposed to JEV, probably had a substantial immunity to the infection, and did not develop clinical signs. By the time of our visit on 30 July 1972, the viremic stage in the hogs had already passed, and virus could no longer be isolated from the specimens collected. With this reservoir of virus no longer available, we would expect to see a decrease in clinical cases of JEV in the humans and termination of the epidemic. This is exactly what did happen. From these observations and data, it appears that that active infection with JEV occurred first in the hogs in areas 3 and 4, and followed shortly thereafter in the susceptible human population at Nham Phong Air Base. No evidence for active infection with JEV was found in the animals in areas 1 and 2 during the study period. Table 2 indicates that young susceptible hogs in these villages remained susceptible on 30 August 1972, and did not become infected as had the animals in the other villages and the people at the air base. The high incidence of positive JEV titers in animals over 5 months of age confirms the prevalence of JEV in this area. Virtually all individuals had become infected by the fifth month of life. Because hogs are clinically silent when infected, they can exist as an undetected reservoir of JEV.

Table 1.  
JEV Titers in Swine from Nham Phong Area

| Area | Distance from runway | Approx. Number of Hogs | Hogs Bled    | % Positive for JEV Antibody |                      |
|------|----------------------|------------------------|--------------|-----------------------------|----------------------|
|      |                      |                        |              | <5 Months of Age            | 5 - 18 Months of Age |
| I    | 1.5 miles North      | 70                     | 46<br>(66 %) | 25 % (28)*                  | 89 % (18)            |
| II   | 1.5 miles West       | 25                     | 15<br>(60 %) | 0 % (4)                     | 100 % (11)           |
| III  | 2 miles South        | 60                     | 37<br>(62 %) | 81 % (27)                   | 100 % (10)           |
| IV   | 5 miles West         | 190                    | 26<br>(14 %) | 42 % (26)                   |                      |

\* Total number of animals bled in this group.

Areas :

- I Ban Nong Krung Kli Kuang
- II Ban Kok Sanga
- III Ban Bua Yai
- IV Pig Farm, Nai Koon Punthong

Table 2.  
Pre and Post Epidemic Titers to JEV in Hogs

| Areas | Percent Positive For JEV Antibody |           |                    |           |
|-------|-----------------------------------|-----------|--------------------|-----------|
|       | <5 months of age                  |           | 5-12 months of age |           |
|       | 30 Jul 72                         | 30 Aug 72 | 30 Jul 72          | 30 Aug 72 |
| I     | 25% (28)*                         | 10% (20)  | 89% (18)           | 100% (18) |
| II    | 0% (4)                            | 33% (3)   | 100% (11)          | 100% (8)  |
| Total | 22% (32)                          | 13% (23)  | 93% (29)           | 100% (26) |

\* Total number of animals bled in this age group.

Areas :

- I Ban Nong Krung Kli Kuang
- II Ban Kok Sanga