

The Distribution of Hemagglutination Inhibition Antibodies for Japanese Encephalitis Virus Against the Koreans 1976*

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=국문초록=

한국인의 일본뇌염바이러스에 대한 면역체 (HI) 보유율

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자세한 원인은 잘 모르나 1969년 이후 한국의 일본뇌염 발생율은 과거에 비하여 현저하게 감소되었다. 따라서 본 연구는 최근 한국 자연계에 있어서의 한국인의 일본뇌염 바이러스에 대한 감염빈도를 알아보고자 실시된 실험이다.

검사물은 1976년 1월부터 동년 12월까지 성모병원에 태원한 환자의 일반 검사용혈청(총 1,204명중 남자 574명, 여자 630명)을 대상으로 하여 일본뇌염 바이러스에 대한 혈구응집저지(Clarke & Casals 법) 항체의 분포를 조사한 실험결과이다.

1. 총 1,204명을 검사한 바 10배 이상의 일본뇌염바이러스에 대한 항체보유율은 57.6%이고, 이 중 남자가 58.1%이고 여자는 57.1%였다.

2. 월별 항체보유율은 10월이 91.2%로 가장 높았고 12월이 32.9%로 낮았다. 기타는 그 중간이었다.

3. 연령별 항체보유율은 대체로 연령이 증가함에 따라 항체보유율이 높았다.

본 실험에서 한국인에게 나타난 일본뇌염에 대한 항체의 보유율은 아직도 많은 사람들이 일본뇌염 바이러스에 대한 계속 불현성감염을 받고 있다는 사실을 알 수 있었다.

INTRODUCTION

For many years a disease which is called as

summer encephalitis, has been recognized in Korea by many workers (Yoshihara, 1932; Takaki, 1933; Shiiba & Chun, 1936) and it is now clear that it is the same disease as the Japanese encephalitis. The

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Japanese encephalitis virus (JEV) was isolated for the first time from an American soldier in 1947 by Sabin et al., and was also rediscovered from Korean patients who died of the epidemic in 1949 by Lee & Kim (1951; Ministry of Health and Social Affairs, Republic of Korea, 1963), when 2,729 deaths out of 5,616 cases were reported. Epidemiological data have been available since then, because the disease was registered at that time as one of the notifiable communicable diseases of prime importance in Korea.

Thus, the epidemiological record shows that Japanese encephalitis has been an annually recurring public health problem in Korea as in the other Western Pacific countries, as in Japan and Taiwan, Republic of China, however, since 1969 it has been markedly decreased by the unknown factors (Chun, 1975), but some of that supposed relating to the vaccination, mosquito control with insecticide, used of the agricultural agents, education of the public health and so on.

However, Japanese encephalitis still occurs in some areas and it mostly concerns to the public as an annual endemic disease in Korea. For these reasons, we wanted to survey how many Korean people have HI antibodies against Japanese encephalitis virus in this time.

MATERIALS AND METHODS

1. Serum specimens

The total of 1,204 of human sera have been collected from the out-patients of the St. Mary's Hospital from January to December 1976, who were without any characteristic symptom of encephalitis.

After clotting, all the sera were separated and stored at -20°C until they were used. The sera, before being used, were inactivated at 56°C for 30 minutes and treated with acetone and then with adult goose red cells for the removal of interfering materials.

2. Antigen preparation & HI test

The hemagglutination inhibiting antigen of Japanese encephalitis virus was obtained from the Research Institute for Microbial Diseases, Osaka Univer-

sity in Japan.

The antigen had been prepared according to the Clarke and Cassals methods (1958) of the acetone-ether extraction of suckling mouse brain to which the virus of Japanese encephalitis were infected.

The HI test was done with plastic plates according to the methods by Clarke and Cassals.

Tests were performed with a constant amount of antigen, 8 units, against 2 times of serial dilutions of serum starting at 1 : 10.

RESULTS

In the table 1 showed the rate of distribution of Japanese encephalitis HI antibody titers by the sex. In this table, we can see that 694 positive cases (57.6%) out of 1,204 sera were examined; the rates are 58.1% in 574 male cases and 57.1% in 630 female cases.

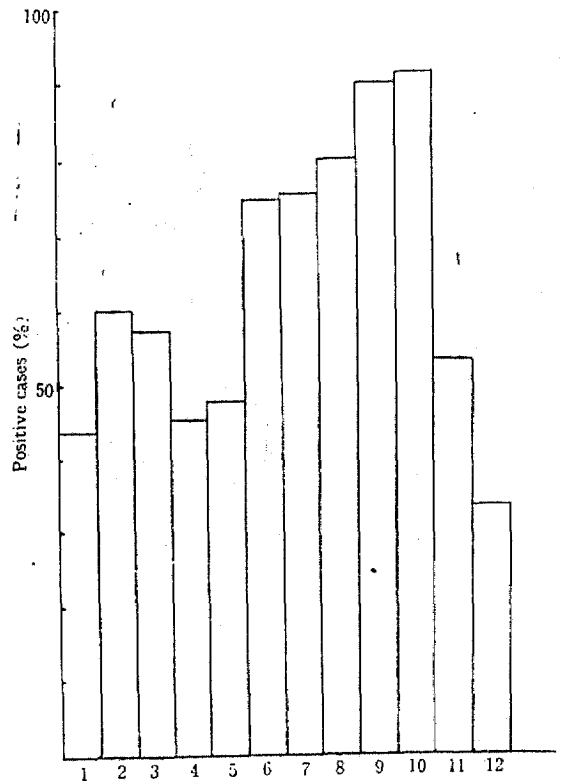


Fig. 1. Monthly distribution of HI antibody titer in person 1976.

Table 1. Sex distribution of HI antibody titers in persons 1976

Sex	No. of examine	HI antibody titers against JEV						Total
		1:10	1:20	1:40	1:80	1:160	1:320	
M	574	92	92	90	44	11	5	334 (58.1)
F	630	92	102	111	33	15	7	360 (57.1)
Total	1,204	184 (26.5)	194 (27.9)	201 (28.9)	77 (11.0)	26 (3.7)	12 (1.7)	694 (57.6)

() : percent

This result is not a significant difference between

male and female.

The seasonal HI antibodies, table 2 and figure 1, have been distributed mostly in August (80.3%), September (90.1%) and October (91.2%), but October was the highest month through the year. In October is the highest month with 91.2% in 34 cases and rate in other seasons showed to be comparatively low.

In the table 3 and figure 2 showed that the Japanese encephalitis antibodies were distributed in all age groups. All the age groups who underwent the examination have about 50% of antibodies, but the group who had the most antibodies were the people whose age were from 51 to 60.

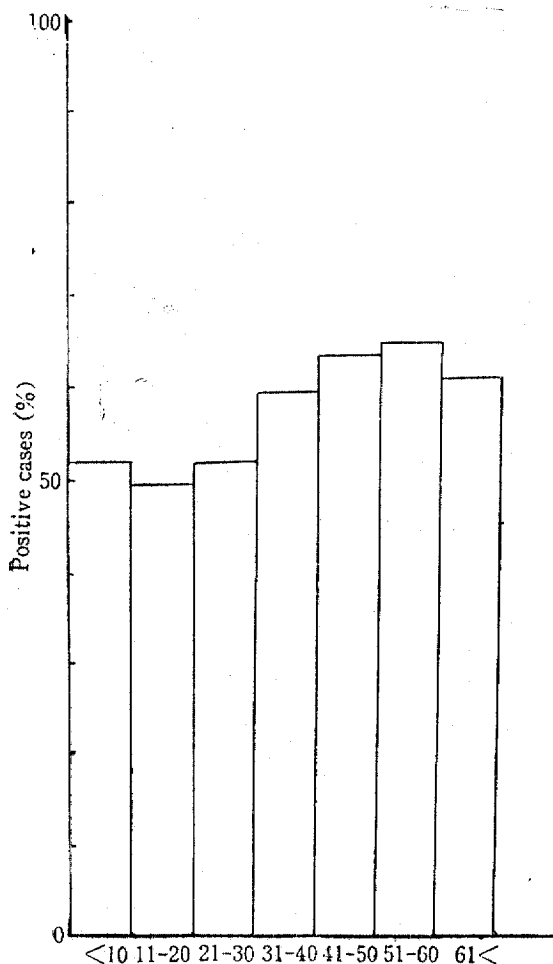


Fig. 2. The distribution of HI antibody for Japanese encephalitis among Koreans of several age groups in 1976.

DISCUSSION

It is since the epidemic in 1949, when 5,616 cases with 2,729 deaths were reported, that Japanese encephalitis (JE) virus was recognized as one of the notifiable communicable diseases of great importance in Korea. But since 1969, the incidence of JE virus in Korea markedly decreased (Chun, 1975).

The most important vector of JE virus transmission was *Culex tritaeniorhynchus*. There are many natural hosts which were bled by this mosquito, but swine has been especially known as the most important amplifying host.

In the past, the main epidemic period of the reported cases of JE in Korea was between mid-August and early September (86.2 per cent of the total number of cases).

Although the mechanism of JE virus hibernation

Table 2. Monthly distribution of HI antibody titer in person 1976

Month	Sex	No. of examine	HI antibody titer against JEV						No. positive (%)	
			1:10	1:20	1:40	1:80	1:160	1:320	No. tested	(%)
Jan	M	25	4	2	2	2	0	0	10/25 (40.0)	24/55 (43.6)
	F	30	4	4	3	1	2	0	14/30 (46.7)	
Feb	M	31	9	5	2	3	0	0	19/31 (61.3)	38/63 (60.3)
	F	32	4	6	5	4	0	0	19/32 (59.4)	
Mar	M	53	9	6	7	7	5	0	34/53 (64.2)	55/97 (56.7)
	F	44	3	6	4	3	4	1	21/44 (47.7)	
Apr	M	87	15	14	5	5	1	3	43/87 (49.4)	70/155(45.2)
	F	68	8	7	4	4	3	1	27/68 (39.7)	
May	M	39	4	3	6	1	3	0	17/39 (43.6)	36/76 (47.4)
	F	37	3	6	9	1	0	0	19/37 (51.4)	
Jun	M	61	11	15	19	3	0	0	48/61 (78.7)	112/149(75.2)
	F	88	13	14	27	7	2	1	64/88 (72.7)	
Jul	M	32	2	7	8	4	0	0	21/32 (65.6)	49/65 (75.4)
	F	33	7	10	7	3	1	0	28/33 (84.8)	
Aug	M	31	5	9	7	5	1	0	27/31 (87.1)	61/76 (80.3)
	F	45	6	10	13	5	0	0	34/45 (75.6)	
Sep	M	37	3	6	17	10	0	1	37/37 (100)	73/81 (90.1)
	F	44	5	11	13	5	0	2	36/44 (81.8)	
Oct	M	12	3	2	4	3	0	0	12/12 (100)	31/34 (91.2)
	F	22	6	6	6	0	1	0	19/22 (86.4)	
Nov	M	59	8	13	9	1	1	1	33/59 (55.9)	77/46 (52.7)
	F	87	12	14	15	0	1	2	44/87 (50.6)	
Dec	M	107	19	10	4	0	0	0	33/107(30.8)	68/207(32.9)
	F	100	21	8	5	0	1	0	35/100(35.0)	

Table 3. Age distribution of HI antibody titer in person 1976

Age	Sex	HI antibody titer against JEV						No. positive (%)	
		1:10	1:20	1:40	1:80	1:160	1:320	No. tested	(%)
<10	M	3	5	4	4	1	1	18/29 (62.0)	32/54 (59.2)
	F	4	1	5	2	1	1	14/25 (56.0)	
11-20	M	7	7	11	3	1	1	30/55 (54.5)	51/104(49.0)
	F	4	10	3	2	2	0	21/49 (42.8)	
21-30	M	21	25	12	10	2	1	71/129(55.0)	169/327(51.6)
	F	26	35	27	4	3	3	98/199(49.2)	
31-40	M	24	30	29	12	3	0	98/164(59.7)	204/341(59.8)
	F	29	28	32	14	2	1	106/177(59.9)	
41-50	M	24	15	17	9	1	1	67/113(59.2)	131/210(62.3)
	F	17	15	27	3	1	1	64/97 (65.9)	
51-60	M	6	9	13	0	0	1	29/46 (63.0)	64/99 (64.6)
	F	6	9	12	4	4	0	35/53 (66.0)	
61<	M	7	1	4	6	3	0	21/37 (56.8)	41/69 (59.4)
	F	6	4	5	4	2	1	22/32 (68.7)	

is not yet clear but by some experimental results it probably related with cold-blooded animals (Lee, is suggested that the hibernation of JE virus was 1972), bat (Miura et al., 1970; Lee & Lee,

1973; Rho, 1975), the hibernation of mosquito (Scherer, et al., 1959) and migratory birds (Chang, 1966; Lee, 1976). Recently it was reported that the incidence of urban areas was higher than that of rural areas (Shin et al., 1973 a, b).

Since 1969 the incidence of JE markedly decreased, but the reason was not clearly clarified. However, with relation of life cycle of JE virus, several hypotheses can be considered. The first hypothesis was the ecological adaptation of mosquito (Shin, et al., 1973 b). The second is the effect of JE virus vaccination to the group under 15 in age, especially to the age-group under 9. Furthermore, health education performed by the authorities concerned and school was reasonable for the decreasing of the incidence by JE virus. The HI test was the most proper serological method for detection of the recent infections, because HI antibodies of JE virus maintain at least 1-2 years (Buescher et al., 1959). The rate of HI titers of JE virus obtained from human bodies, domestic animals and domestic fowls differs according to that annual incidence, age-distribution, geographical distribution, and seasonal distribution. Whang et al., (1965) reported that HI antibodies were 8.6 per cent out of 1,010 normal healthy persons and patients HI titer of JE virus, which was higher than 1:80 dilutions. By the report on geographical distribution (Kim et al. 1961), the rate of HI titer of JE virus showed 64.7 per cent in Nonsan area in Chung-Nam, 38.8 per cent in Seoul area, and 47.5 per cent in Wonjoo area in Kang-Won, respectively. After September, about 80 per cent of HI capacity changed into positive reaction.

In this investigation, the difference of the rate of HI titer according to sex distribution was not significant, but the rate of HI titer from 1,204 healthy persons was 57.69 per cent. This result shows to be similar with that of Kim et al. (1961). Also comparing with HI titers, which is more than 1:80 dilution, it is similar with that of Whang et al. (1965).

By the report of Choy and Kim (1971), the rate of HI titers from 2,111 healthy persons was 45.1 per cent from December 1969 to November 1970,

and Lee & Lee (1976) reported that the rate of HI titers from 594 healthy persons showed 56.4 per cent. With the age increasing, HI titers of JE virus increased from 49.0 per cent to 64.6 per cent, which was similar with that of Kim et al. (1967). Monthly alteration of the rate of HI titers increased from June to October, and the maximal rate showed 91.2 per cent in October, 1976. In spite of the marked decrease of the incidence of JE virus, these high titers of JE virus were probably due to the vaccination to young age-group and inapparent infection. However, it is notifiable that the cases of inapparent infection showed the increasing tendency. This result was similar with that of Lee and Lee (1976).

Comparing the present rate of HI titers of JE virus (after 1969) with that before 1969, which were obtained from human bodies, we may suggest that the incidence of JE virus decreased but that JE virus were still widely distributed in the many natural areas.

SUMMARY

1. The total 1,204 of human sera from January to December, 1976 of the out-patients in St. Mary's Hospital were tested one by one. The total 57.6% of the 1,204 cases were confirmed as a hemagglutination inhibition antibodies, and 58.16% out of 574 male cases and 57.14% of 630 female cases were confirmed to have antibodies, respectively.
2. The monthly distribution of hemagglutination inhibition antibody was shown to be 91.2% out of 34 cases in October, 1976 but other months it was low.
3. In the group whose age was from 51 to 60, it was 64.6% and this shows that the group was markedly higher than others.

REFERENCES

- Buescher, E.L., Scher, W.F., Rosenbarg, K.E., Gresser, I., Hordy, J. L. & Bullock, H.R. : *Ecologic studies of Japanese encephalitis virus in Japan. Am. Trop. Med. 8 : 651, (1959).*

- Chang, Ik-Chin & Kim, Il-Hoon : *Serologic survey of Japanese encephalitic virus infection in wild birds in Korea. Korean J. Internal Med.* 9 : 37-56, (1966).
- Cho, K.S. & Kwon, K.M. : *Studies on epizootiological survey of Japanese encephalitis in swine. I. The survey on HI antibody and abortion and stillbirth of JE virus in swine, Korean J. veterinary research* 10 : 59-66, (1970).
- Choy, S.O., & Kim, C.S. : *Serological studies of Japanese encephalitis in Korean adults. The New Med. Jour. Korea*, 14 : 33-40 (1971).
- Chun, Chong Hwee : *Outline of acute infectious diseases in Korean. Third edition, New, Med. J. Co. Ltd, (1975).*
- Clarke, D.H. and Casals, J. : *Techniques for HA and HI with arthropod-borne viruses. Am. J. Trop. Med. & Hyg.* 7 : 561-573, (1958).
- Kim, K.H. et al : *Report of NIH, Korea*, 4; 38-47, (1961).
- Kim, K.H. et al. : *Epidemiological studies of Japanese encephalitis virus 1967. Report NIH. ROIS.* 4 : 55, (1967).
- Kono R. & Kim, K.H. : *Comparative epidemiological features of Japanese encephalitis in the Republic of Korea. China (Taiwan) and Japan. Bull. Wld. Hlth. Org.* 40 : 263-277, (1969).
- Lee, H.W. Min, B.W. & Lim, Y.W. : *Isolation and serologic studies of Japanese encephalitis virus from snakes in Korea. J. Korean Med. Assoc.* 15 : 69-74, (1972).
- Lee, H.W. & Kang, S.H. : *Occurrence of Neutralizing antibodies to Japanese encephalitis virus in migratory birds, (1976).*
- Lee, Y.K. & Kim, U.R. : *Bull. Nat. Inst. Prev. of Inf. Dis., Korea I (in Korea)*, (1951).
- Lee, Y.T. & Lee, C.H. : *Preliminary studies of Japanese encephalitis virus-Neutralizing antibodies in sera of bats by plaque inhibition method. The Korean Cent. J. Med.* 25 : 345-348, (1973).
- Lee, Y.T. & Lee, C.H. : *Serological study on Japanese encephalitis in Koreans and fowls, 1975. Korean J. Infect. Dis.* 8 : 75-82, (1976).
- Miura, T. Toyokawa, K, Allen, R. & Sulkin, S. E. : *Studies of arthropod-borne virus infections in Chiroptera. VII. Serological evidence of natural Japanese B encephalitis virus infection in bats. Am. J. Trop. Med. & Hyg.* 19 : 88-93, (1970).
- Rho, K.J. & Lee, H.W. : *Occurrence of Neutralizing antibody to Japanese encephalitis virus in bats. Korea University Med. J.* 12 : 293-306, (1975).
- Sabin, A.B., et al. : *Japanese encephalitis in American soldiers in Korea. Amer. J. Hyg.* 4 : 356-375, (1947).
- Scherer, W.F. Buescher, F.L., Fleming, M.B., Neguchi, H. and Scandlon J. : *Ecologic studies of Japanese encephalitis virus in Japan. III. Mosquito factors, zootripism and vertical flight of Culex tritaeniorhynchus with observations on variations in collections from animal field traps in different habitats. Am. J. Trop. Med. & Hyg.* 8 : 644-677. (1959).
- Shiiba, Y. & Chun, C.H. : *Mansen no Ikai No. 180, pp. 1 (in Japanese)*, (1936).
- Shin, H.K., Pari, K.D., Jeong, E.B., Kim, B.Y. and Kim, K.M. : *Case and serological studies on Japanese encephalitis in Republic of Korea, 1973. The Report of NIH, ROK.* 10 : 145-150, (1973a).
- Shin, H.K., Kim, K.H., Beong, E.B., Kim, B.Y. & Lee, H.I. : *Epidemiological studies on Japanese encephalitis in the Republic of Korea, 1967-1973. Report of NIH, Korea,* 10 : 131-144, (1973b).
- Takaki, T. : *Jodai Shonika Zasshi*, 1 : 21, (1933).
- Yoshihara, H. : *Chosen Igaku-Kai Zasshi*, 22 : 1036 (in Japanese), (1932).
- Whang, K.S., Chang, I.C. & Hong, K.W. : *Japanese encephalitis in Korea, 1963 human serology, The Korean Med. J.* 10 : 77-92, (1965).