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Japanese Encephalitis Activity in the Republic of Korea, 1972-1982.(A Eleven Summary)

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最近 우리나라의 日本腦炎 發生 樣相에 關한 考察

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국 문 초 록

모기 매개 질병에 관한 자료 수집결과 뇌염에 관하여 발병상황을 요약하면 다음과 같다.

1. 1972 년부터 1982 년사이에 뇌염 발병 환자수의 78.5%가 전라남도, 충청남도, 경기도 지방으로 국한 된다.

2. 치사율은 최저 2.3%에서 최고 17.6%이고 평균 3.8%로 나타났다.

3. 작은 빨간 집모기가 뇌염 매개에 중요한 역할을 하고 있으나 그의 낮은 인체 選好性에 대한 이유는 아직 밝혀지지 않고 있다.

빨간 집모기와 금빛 숲모기의 뇌염 매개種으로서의 의미는 뇌염 매개에 있어서 그들의 역할에 따라 좀더 연구 되어야 할 필요가 있으며 돼지에 대한 면역을 통하여 뇌염 유행의 가능성을 줄일 수 있는 효과를 규명하는 연구가 필요 되어 진다.

Introduction

This report is a summary of Japanese Encephalitis (JE) activity in the Republic of Korea between 1972 and 1982. JE activity varied greatly throughout the Republic during this period with the lowest number of confirmed cases (18) in 1979 and the highest number (1197) in 1982 (Table 1). Japanese Encephalitis is the most medically significant and epidemiologically active mosquito-borne disease occurring in Korea. The transmission cycle of JE is not thoroughly understood as the natural reservoir is not known and the primary vector, *Culex tritaeniorhynchus* Giles, apparently only attacks and feeds on man when its population occurs in very large numbers. However, transmission still occurs when this mosquito is present at low population levels. This may indicate that other mosquito species could be very important in the transmission of this disease to man.

Table 1. Distribution of Japanese Encephalitis Cases Throughout the Republic of Korea by Province, 1972-1982.

Year \ Province	Kyongki	Kyongsangnam	Kyongsangbuk	Kangwon	Chungchongbuk	Chungchongnam	Chollabuk	Chollanam	Cheju	TOTAL
1972										
Confirmed Cases	39	7	1	2	1	7	12	4	0	73
Mortalities	0	0	0	0	0	0	1	0	0	1
1973										
Confirmed Cases	97	17	41	0	5	55	55	16	0	286
Mortalities	4	3	2	0	1	5	3	0	0	18
1974										
Confirmed Cases	82	2	5	3	6	12	6	5	5	126
Mortalities	6	1	0	1	0	0	0	2	0	10
1975										
Confirmed Cases	48	0	0	0	2	191	21	27	0	289
Mortalities	0	0	0	0	0	0	1	2	0	3
1976										
Confirmed Cases	9	1	0	0	0	5	10	3	2	30
Mortalities	0	0	0	0	0	0	0	0	0	0
1977										
Confirmed Cases	30	4	6	3	5	23	18	10	2	101
Mortalities	1	0	0	0	1	2	0	2	1	7
1978										
Confirmed Cases	3	12	4	1	0	3	2	6	6	41
Mortalities	0	0	0	1	0	1	0	0	0	2
1979										
Confirmed Cases	1	2	0	0	1	6	2	5	1	18
Mortalities	0	0	0	0	0	0	0	0	0	0
1980										
Confirmed cases	27	13	2	4	3	22	14	17	1	103
Mortalities	2	1	0	0	0	0	1	0	0	4
1981										
Confirmed Cases	49	5	5	9	2	52	14	61	6	194
Mortalities	3	0	0	0	0	3	1	2	0	9
1982										
Confirmed cases	335	120	102	4	103	196	129	198	10	1197
Mortalities	17	5	3	1	1	6	3	4	0	40
TOTAL										
Confirmed Cases	72	183	166	17	128	572	283	352	33	2458
Mortalities	33	10	5	3	3	17	10	12	1	94

Japanese Encephalitis Distribution in Korea

Japanese encephalitis occurs throughout the Republic, but not in equal proportions. The majority (78.5%) of the confirmed cases of JE that occurred between 1972 and 1982, were confined to the 4 western provinces: Chollabuk, Chungchongnam, and Kyongki. These provinces all showed similar trends in that all of these provinces reported increases or decreases in JE cases during the same year. This possible relationship may prove useful in trying to predict whether a year will be an increase or decrease from the previous year. The peak period of virus transmission generally occurs in the August-September time frame when *Culex tritaeniorhynchus* populations are at their highest.

Kangwon, the extreme northeastern province, has the lowest incidence of JE in Korea (Fig. 1). This may be the direct result of low *Culex tritaeniorhynchus* population levels in this province as indicated by mosquito surveillance data collected in this province around Weonju and Chuncheon between 1979-1982 (Wildie et al., 1983). Even though JE Activity and *Culex tritaeniorhynchus* population levels reached record levels during 1980-1982, there was only 1 confirmed case from this province during this period.

JE activity in Kyongsangbuk and Kyongsangnam provinces does not always appear to be concentrated around the larger population centers (Table 2). Daegu (Kyongsangbuk Province) had only 12% of the total confirmed cases reported from this province between 1972-1982. Similiarly, Busan (Kyongsangnam Province) accounted for only 22.4% of cases confirmed in that province. However, the Seoul-Incheon areas composed 51.7% of the areas diagnosed in Kyongki Province from 1982 to 1982.

Japanese Encephalitis in Man

Japanese Encephalitis is a disease that produces symptoms in man raning from a mild systemic illness in which the victim may not even seek medical attention, this is especially true in developing countries, to a

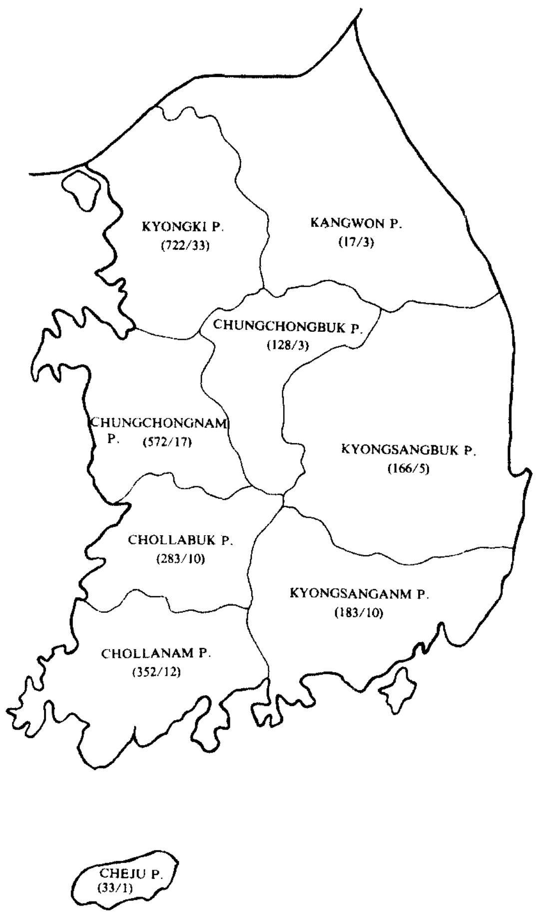

Figure 1. Distribution of Confirmed Cases/ Mortalities of Japanese Encephalitis in the Republic of Korea, 1972-1982.

Table 2. Relationship of Japanese Encephalitis Incidence in Selected Large Cities and Associated Province during 1972-1982.

Case/Percentage / City/Province	Cases	% of Total Cases
Seoul/Incheon	411	57.1
Other Kyongki	309	42.9
Total Kyongki	720	100.0
Busan	41	22.4
Other Kyongsangnam	142	77.6
Total Kyongsangnam	183	100.0
Daegue	20	12.0
Other Kyongsangbuk	146	88.0
Total Kyongsangbuk	166	100.0

life threatening condition. Clinical manifestations begin with an onset of severe headaches and vomiting with high fever. Cerebral and meningeal involvement usually occur and are characteristic of an encephalitic disease. There frequently are transient ocular aberrations associated with JE disease. Mortality usually will occur within 10 days and is associated with comma. The mortality associated with JE is reported to be 30% (Harwood and James, 1979); however, between 1972-1982, it ranged from 2.3%-17.6% with an average of 3.8%. With early detection and treatment, the prognosis is very good. After a recovery from the disease, a prolonged convalescence period is typical with accompanied weakness, tremors, nervousness, and uncoordination. Permanent mental impairment and personality changes have been observed.

Vector Relationships

Culex tritaeniorhynchus, the primary vector of JE, breeds in rice fields, ground pools, and marshes which are characterized by open standing water that are somewhat stagnant. This mosquito is very adaptable and has been observed breeding in artificial containers such as barrels and cement tanks. *Culex pipiens pallens* and *Aedes vexans nipponii* have been incriminated as additional vectors of JE (James and Harwood, 1969). These mosquitoes will breed in the same habitats that *Culex tritaenoirhynchus* are found. However, *Culex pipiens pallens* tend to prefer water sources with higher organic content such as sewage ditches. Both *Culex pipiens pallens* and *Aedes vexans nipponi,* like *Culex tritaeniorhynchus,* are widely distributed throughout Korea. However, *Aedes vexans nipponii* are only collected in large numbers in the northern provinces in the Republic, whereas *Culex pipiens pallens* do not show any apparent latitudinal preference.

Japanese Encephalitis Transmission

James and Harwood (1969), reported that transmission of JE virus from infective *Culex tritaeniorhynchus* normally did not occur unless the vector population was very high. Self et al. (1973) reported that JE expressed its highest antibody conversion rates in the host by 1 September after *Culex tritaeniorhynchus* population levels had sharply fallen. This difference between vector density and antibody conversion rates may be due to the result that the virus apparently undergoes a latent or lag period when the virus is undergoing multiplication in the host before the virus causes the clinical disease symptoms. The latent period may very up to 2 weeks or more. Consequently, the predicted outbreak can be misidentified by 2 weeks or more.

Wildie et al. (1983) found *Culex tritaeniorhynchus* populations to reach their peaks in August and sharply decline in September and continue to decline into October. September is considered to be the most important month for JE transmission in Korea; however, most likely the actual transmission has already occurred in August with clinical symptoms not observed until September due to this lag period.

Japanese Encephalitis Reservoirs/ Animal Hosts

A reservoir in nature has not been identified for JE. The mosquito, itself, may act as the reservoir through the process of transovarial transmission. This has not been demonstrated in *Culex tritaeniorhynchus;* however, Hsu et al. (1975) found the virus did develop in ovarian cell cultures of this mosquito indicating that transovarial transmission may be possible.

Culex tritaeniorhynchus prefers large animals such as pigs and cattle or birds to man. Self et al. (1973) found that *Culex tritaeniorhynchus* were more readily attracted to cows than pigs; however, the mosquito more frequently fed on pigs. Pigs as well as birds, like the black-crowned night heron and egrets are considered to be amplifier hosts. An amplifier host serves to provide a pool of infective virus to noninfective mosquitoes. These hosts are very important during epidemics. Harwood and James (1979) cited studies by Ueba et al. (1972) that immunizing pigs could reduce this virus pool and the amplification of JE virus in pigs, thereby, reducing the infection levels of *Culex tritaeniorhynchus.*

An amplifying host is not a reservoir, because the host does not maintain the virus at infection levels at all times. Horses appear to be like man, a dead-end host and have no epidemiological significance because they only develop a low blood viremia that is not at a level of sufficient magnitude to infect mosquitoes.

Summary

The Japanese Encephalitis virus—host—vector transmission cycle is still not very clearly understood in Korea. *Culex tritaeniorhynchus* plays an important role in JE transmission, but it is not known why this mosquito has a low attraction to man. The vector significance of *Culex pipiens pallens, Aedes vexans nipponii* needs further clarification as to their role in JE transmission. Additional study is needed in determining the positive effects of reducing potential epidemics through immunizations of pigs.

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