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A Human Ecological Study on Epidemics of HBV and HTLV-1 among Islands in Western Japan

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INTRODUCTION

The prevalence of oncogenic viral infections, such as human T-lymphotropic virus type-1 (HTLV-1) related with adult T-cell leukemia/lymphoma (ATLL) and hepatitis B virus (HBV) related with hepatoma, has been reported to be high in the southwestern part of Japan including Nagasaki prefecture¹⁾. Epidemics of these viral infections, especially of HTLV-1, have been reported to be variant among local communities,²⁾³⁾⁴⁾ and socio-biological backgrounds of each community i. e., missionary work of Christianity and international trade³⁾, epidemics of filariasis and other parasites, marriage distance, nutritional level⁴⁾, etc. have been speculated to contribute to the variations. Nagasaki have unique points for the epidemiological study of these viral infections because it had been only a port opened to foreign countries during the Edo era and Christianity also introduced in that period. Moreover, there are rather isolated communities in many islands where filariasis had prevailed until several decades ago. The aim of this study based on field studies in the islands of Nagasaki Prefecture is to examine the variations of these viral infections among and within communities on islands with reference to human ecological settings, such as socio-cultural background of each community.

SUBJECTS AND METHODS

Subjects :

As the subjects of this study, we selected two islands ; one is a coastal island named Oshima located 60km north of Nagasaki city and the other is the town of Narao located in the upper part of Gotoh islands (Fig. 1). These two towns have different backgrounds of human ecological settings ; Oshima (population of about 7,000 in the 1985 census) is a rather industrialized island which had a coal mine from 1936 to 1965 and is now developing a ship building industry. Through the transition of the main industry, the socioeconomic characteristics of

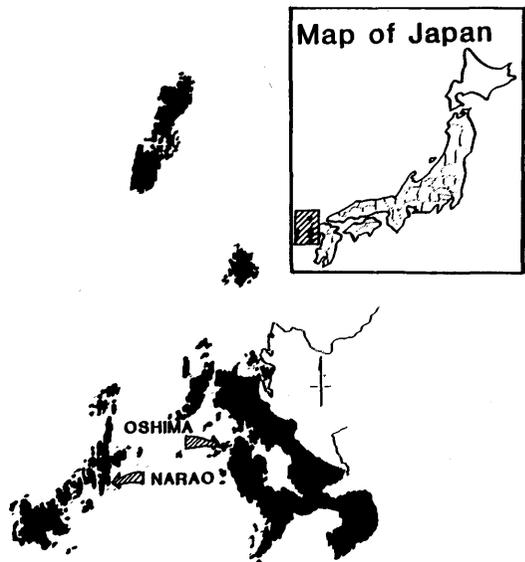


Fig. 1. Location of islands

local communities have diversified from a traditional farmers' community to semiurbanized residential districts. In this island, we selected three communities ; one is a new community where retired coal mine workers are mainly living. The others are traditional ones in which most of the dwellers are engaged in agriculture and/or fishing. Narao (population of about 4,700 in the 1985 census) has been a fishing village since the pre-Edo era and local communities are separately located along the seashore because of the mountaineous island. In these communities on the two islands health surveyes for dwellers aged over 40 years were carried out in 1986 and '87.

Detection of markers for viral infections :

Sera were stored at -20°C until use. The passive hemagglutination (PHA) method and the reversed PHA (RPHA) methods were used for detecting antibody (HBsAb) against hepatitis B surface antigen (HBsAg) and HBsAg, respectively. With regard to HTLV-1, antibodies to HTLV-specific antigens, called anti-HTLV-1 antibody (ATLA), was detected by the gelatin agglutination assay (Serodia-ATLA). To confirm the specificity of the antibody, the indirect immunofluorescence method using MT1 and MT2 cells as target for 1/10 dilution of test sera⁵⁾ was used.

RESULTS AND DISCUSSIONS

Sex and age differences of carrier rates of HBV markers (Table 1) :

Table 1. Age and sex distributions of HBV markers carriers

Age class	OSHIMA			NARAO		
	Male	Female	Both sexes	Male	Female	Both sexes
40-49	6/ 27(22.2)	18/ 52(34.6)	24/ 79(30.4)	5/ 10(50.0)	24/ 83(28.9)	29/ 93(31.2)
50-59	19/ 72(26.4)	40/118(33.9)	59/190(31.1)	11/ 30(36.7)	38/130(29.2)	49/160(30.6)
60-69	30/ 75(40.0)	45/123(36.6)	75/198(37.9)	28/ 64(43.8)	51/137(37.2)	79/201(39.3)
70-79	13/ 47(27.7)	33/ 74(44.6)	46/121(38.0)	15/ 54(27.8)	26/ 60(43.3)	41/114(36.0)
80-	6/ 13(46.2)	7/ 17(41.2)	13/ 30(43.3)	6/ 10(60.0)	2/ 3(66.7)	8/ 13(61.5)
Total	74/234(31.6)	143/384(37.2)	217/618(35.1)	65/168(38.7)	141/413(34.1)	206/581(35.5)
χ^2 -values						
on ages	6.06($p=0.19$)	2.56($p=0.63$)	7.32($p=0.12$)	5.96($p=0.21$)	6.65($p=0.16$)	7.55($p=0.11$)
on sex	1.83 ($p=0.18$)			1.14 ($p=0.29$)		

Numerals in parenthesis are rates (%)

The carrier rates of HBsAg and HBsAb were 2.1% and 33.4% in 623 dwellers of Oshima, and 3.7% and 31.4% in 595 dwellers of Narao, respectively. There was no significant difference between the islands in the prevalence of either HBsAg or HBsAb. When the positive case in HBsAg or HBsAb was collectively defined as HBV markers carrier, the rates of both sexes were quite similar between the two islands ; 35.1% in Oshima and 35.5% in Narao. The carrier rate of the male seemed to be higher than that of the female in both islands. No statistically significant difference was found among ages of either sex in both islands. But the rate seemed to be higher with aging, particularly in the 80's.

Epidemics of HTLV-1 carrier (Table 2) :

ATLA carrier rate in Oshima, 10.2%, was significantly lower than that in Narao, 28.6% ($\chi^2=9.99, p<0.001$). Moreover, the age-related pattern of the carrier rate was characteristic on each island ; the rate in Narao slightly increased until the 60's and thereafter it seemed to be plateau, but that in Oshima increased until the 60's and greatly decreased after the 70's. Such age related patterns of ATLA carriers may indicate the difference of epidemics of HTLV-1 in the past between the islands ; Oshima might have been a virgin land for HTLV-1 until several decades ago, but Narao has been continuously contaminated.

Variations of carrier rates among local communities (Table 3) :

Table 2. Age and sex distributions of ATLA carriers

Age class	OSHIMA			NARAO		
	Male	Female	Both sexes	Male	Female	Both sexes
40-49	3/ 27(11.1)	5/ 50(10.0)	8/ 77(10.4)	2/ 10(20.0)	14/ 83(16.9)	16/ 93(17.2)
50-59	6/ 71(8.5)	17/118(14.4)	23/189(12.2)	6/ 30(20.0)	40/130(30.8)	46/160(28.8)
60-69	6/ 75(8.0)	19/123(15.4)	25/198(12.6)	18/ 64(28.1)	47/137(34.3)	65/201(32.3)
70-79	1/ 47(2.1)	4/ 74(5.4)	5/121(4.1)	16/ 54(29.6)	19/ 60(31.7)	35/114(30.7)
80-	1/ 13(7.7)	1/ 17(5.9)	2/ 30(6.7)	4/ 10(40.0)	0/ 3(0.0)	4/ 13(30.8)
Total	17/233(7.3)	46/382(12.0)	63/615(10.2)	46/168(27.4)	120/413(29.1)	166/581(28.6)
χ^2 -values						
on ages	2.63($p=0.62$)	5.85($p=0.21$)	7.32($p=0.12$)	2.05($p=0.73$)	9.43($p=0.05$)	7.57($p=0.11$)
on sex	3.05 ($p=0.08$)			0.09 ($p=0.77$)		

Numerals in parenthesis are rates (%).

Table 3. Variations of epidemic of viral infections and social characters among communities

District	Viral infections		Social characters		
	HBV markers	ATLA	Origin	Religion	Occupation
OSHIMA					
A	78/237 (32.9)	21/237 (8.9)	88.0	0	40.3
B	40/ 91 (44.0)	20/ 91 (22.0)	68.1	26.6	25.7
C	102/295 (47.4)	22/292 (7.5)	23.3	-	4.4
χ^2 -values	3.05 ($p=0.08$)	16.57 ($p=0.00$)			
NARAO					
A	20/ 55 (36.4)	14/ 55 (25.5)	-	-	-
B	13/ 53 (24.5)	19/ 53 (35.8)	-	-	-
C	32/ 88 (36.4)	22/ 88 (25.0)	72.3	4.2	26.9
D	29/ 83 (34.9)	28/ 83 (33.7)	60.0	0	50.0
E	33/ 99 (33.3)	33/ 99 (33.3)	70.5	2.9	75.0
F	21/ 49 (42.9)	13/ 49 (26.5)	76.9	92.3	87.5
G	11/ 20 (55.0)	4/ 20 (20.0)	85.7	100.0	75.0
H	21/ 52 (40.4)	8/ 52 (15.4)	55.6	88.9	75.0
I	19/ 60 (31.7)	17/ 60 (28.3)	62.9	0	50.0
J	5/ 24 (20.8)	7/ 24 (29.2)	63.6	0	80.0
K	4/ 11 (36.4)	4/ 11 (36.4)	80.0	0	66.7
χ^2 -values	10.71 ($p=0.38$)	9.99 ($p=0.44$)			

Viral infections : numerals are the same in Tables 1 and 2.

Social characters

Origin : percentage of persons who were born in each town.

Religion : percentage of Christians.

Occupation : percentage of farmers and/or fishermen

- : no data

There were considerable variations of both viral infections among local communities of both islands. Especially in Oshima, the variation of the ATLA carrier rate was statistically significant ($\chi^2=16.57$, $p=0.000$). The variations of the HBV markers carrier rate seemed to be less varied in either island. No significant correlation ($\chi^2=2.21$, $d.f.=1$) between the

HBV markers and the ATLA rates indicated that life style and/or the environment which have been contributed to epidemics may be different between these two viral infections. Referring to the carrier rates to human ecological setting of each community, the contribution of social characters to the viral infestations seemed to be dominant in Oshima ; the Chris-

tian community (district B) showed the highest rate of ATL carriers.

Moreover, examination of ATLA carrier rates relating to migration history, the native population who were born in the island showed the lowest rate (9.8%) and the immigrants from neighbouring areas of the mainland showed the highest (18.8%). The rate of the immigrants from out of Nagasaki prefecture (11.0%), most of them were living in district C, was intermediate (10.0%).

Human movements in accordance with industrialization and/or marriage within the same religious group seem to affect the variation of HTLV-1 among local communities of Oshima. Similar findings have been reported on Carribeans in London⁶⁾ and Japanese in Bolivia⁷⁾.

On the contrary to Oshima, the relationship of viral infections with social characters was not clear in Narao. For example, Christian communities (district F,G and H) showed a higher rate in HBV markers, but not in ATLA which does not support Gallo's hypothesis.⁸⁾ Narao is rather a traditional and sedentive community as a whole and the marriage distance has been limited with Gotoh islands. The small amount of human movement seems to cause a high frequency of viral infections and a less extent of variation among local communities. As a conclusion, human ecological settings which are particular in each island may act as an important role on viral infections.

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