Decline in the Positive Rate of Human T-Lymphotropic Virus Type-1 (HTLV-1) Antibodies among Blood Donors in Nagasaki

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Abstract

Objective The aim of this study was to clarify the trend of the HTLV-1 seroprevalence rate among blood donors.

Methods Samples were screened by the particle agglutination test for HTLV-1 antibodies.

Materials Serum from blood donors was screened.

Results The positive rate of HTLV-1 antibodies among blood donors decreased from 13.14 to 0.81% over the years from 1928 to 1983.

Conclusion A decline over the years in the positive rate of HTLV-1 antibodies among blood donors was revealed. (Internal Medicine 40: 14–17, 2001)

Key words: breast feeding, adult T-cell leukemia

Sasebo Red Cross Blood Center from June 1990 to September 1999 (Table 1).

Test for antibody to HTLV-1

Samples were screened by the gelatin particle agglutination (PA) test (Serodia-HTLV-1: second generation PA kit, Fujirebio, Tokyo) for HTLV-1 antibodies in a primary screening assay.

A final serum dilution of 1:8 or higher that caused agglutination of the antigen coated particle was considered positive.

Analysis

The positivity rate of HTLV-1 antibodies was calculated on the basis of the actual number of donors and is expressed for every age by year of birth. The decrease in the positivity rate was evaluated using the trend test.

Results

The results of the screening test are summarized in Table 1. The results in Table 1 are the data of donors at their first visit to Nagasaki or Sasebo blood center. The positivity rate of HTLV-1 antibodies among blood donors decreased from 13.14 to 0.81% over the years from 1928 to 1983 (test of trend: $p < 0.01$). The total positivity rate did not differ significantly between males and females. The positivity rates of HTLV-1 antibodies are shown by age group in Table 2. The data in Table 2 are the data of donors at their first visit in each year (1990–1999).

Discussion

Blood centers test all the donated blood and report the results to the donors. These tests include those that ensure the safety of the blood units that will be used medically. At the time of this study, the results of tests had not been reported to donors, although HTLV-1 antibodies test is one of these tests. PA method is used for assay of HTLV-1 antibody and the titer of agglutination determines the positivity in the final serum dilution of 1:8 or higher. This criteria is one that does not include false-negative, therefore there is a possibility that false-positive results may be included. Samples that were proved positive by PA method and negative by immunofluorescence

Introduction

Human T-lymphotropic virus type-1 (HTLV-1) is highly endemic in Nagasaki prefecture. Anti-HTLV-1 screening of donated blood was instituted in Japan, because HTLV-1 is known to be an etiologic agent for various diseases such as adult T-cell leukemia (ATL) (1, 2), HTLV-1 associated myelopathy/tropical spastic paraparesis (3, 4), uveitis (5), and Sjogrens syndrome (6). On August 1987, the ATL prevention program (APP) was started in Nagasaki prefecture and it has continued for more than ten years (7, 8). It is important to clarify the trend in the HTLV-1 seroprevalence rate among residents in Nagasaki prefecture for evaluation of this program.

For editorial comments, see p 1.

Materials and Methods

Subjects

We have screened 798, 971 serum samples representing voluntary blood donors (142, 174 male and 111, 650 female) between 16 and 64 years of age who have visited Nagasaki and

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Positive Rate of HTLV-1 Antibodies

Table 1. Positive Rate (%) of HTLV-1 Antibodies among Blood Donors in Nagasaki Prefecture

year of birth	actual number of blood donors			number of positive donors			positive rate of anti-HTLV-1		
	male	female	total	male	female	total	male	female	total
1928	134	102	236	15	16	31	11.19	15.69	13.14
1929	165	139	304	10	18	28	6.06	12.95	9.21
1930	224	190	414	22	16	38	9.82	8.42	9.18
1931	302	219	521	19	30	49	6.29	13.70	9.40
1932	405	313	718	34	35	69	8.40	11.18	9.61
1933	488	355	843	43	49	92	8.81	13.80	10.91
1934	556	430	986	28	30	58	5.04	6.98	5.88
1935	705	513	1,218	50	58	108	7.09	11.31	8.87
1936	761	617	1,378	55	64	119	7.23	10.37	8.64
1937	878	692	1,570	49	66	115	5.58	9.54	7.32
1938	886	724	1,610	70	78	148	7.90	10.77	9.19
1939	1,016	747	1,763	68	79	147	6.69	10.58	8.34
1940	1,216	878	2,094	65	75	140	5.35	8.54	6.69
1941	1,298	1,026	2,324	82	84	166	6.32	8.19	7.14
1942	1,382	991	2,373	93	82	175	6.73	8.27	7.37
1943	1,440	1,037	2,477	91	89	180	6.32	8.58	7.27
1944	1,597	1,096	2,693	118	64	182	7.39	5.84	6.76
1945	1,296	827	2,123	72	72	144	5.56	8.71	6.78
1946	1,651	1,035	2,686	107	86	193	6.48	8.31	7.19
1947	2,764	1,587	4,351	163	101	264	5.90	6.36	6.07
1948	2,803	1,665	4,468	149	115	264	5.32	6.91	5.91
1949	3,176	1,804	4,980	174	108	282	5.48	5.99	5.66
1950	2,932	1,568	4,500	163	94	257	5.56	5.99	5.71
1951	2,944	1,657	4,601	138	87	225	4.69	5.25	4.89
1952	2,928	1,646	4,574	161	89	250	5.50	5.41	5.47
1953	3,037	1,615	4,652	137	89	226	4.51	5.51	4.86
1954	3,158	1,635	4,793	143	79	222	4.53	4.83	4.63
1955	3,088	1,572	4,660	129	56	185	4.18	3.56	3.97
1956	2,978	1,593	4,571	128	56	184	4.30	3.52	4.03
1957	2,949	1,620	4,569	116	64	180	3.93	3.95	3.94
1958	3,171	1,706	4,877	118	64	182	3.72	3.75	3.73
1959	3,204	1,824	5,028	101	60	161	3.15	3.29	3.20
1960	3,268	1,829	5,097	103	56	159	3.15	3.06	3.12
1961	3,258	1,834	5,092	83	59	142	2.55	3.22	2.79
1962	3,301	1,878	5,179	99	46	145	3.00	2.45	2.80
1963	3,191	2,072	5,263	95	51	146	2.98	2.46	2.77
1964	3,254	2,191	5,445	79	44	123	2.43	2.01	2.26
1965	3,371	2,473	5,844	92	47	139	2.73	1.90	2.38
1966	2,593	2,024	4,617	57	48	105	2.20	2.37	2.27
1967	3,685	3,064	6,749	83	63	146	2.25	2.06	2.16
1968	3,523	3,058	6,581	50	44	94	1.42	1.44	1.43
1969	3,829	3,481	7,310	80	58	138	2.09	1.67	1.89
1970	3,820	3,866	7,686	60	58	118	1.57	1.50	1.54
1971	4,108	4,288	8,396	63	64	127	1.53	1.49	1.51
1972	5,621	5,305	10,926	80	85	165	1.42	1.60	1.51
1973	6,336	6,317	12,653	90	81	171	1.42	1.28	1.35
1974	6,559	6,210	12,769	89	95	184	1.36	1.53	1.44
1975	5,819	5,495	11,314	71	78	149	1.22	1.42	1.32
1976	4,752	5,067	9,819	65	68	133	1.37	1.34	1.35
1977	4,273	4,479	8,752	65	68	133	1.52	1.52	1.52
1978	3,938	4,329	8,267	52	50	102	1.32	1.16	1.23
1979	3,309	3,446	6,755	41	47	88	1.24	1.36	1.30
1980	2,657	2,817	5,474	27	27	54	1.02	0.96	0.99
1981	1,442	1,718	3,160	19	25	44	1.32	1.46	1.39
1982	630	843	1,473	9	9	18	1.43	1.07	1.22
1983	105	143	248	1	1	2	0.95	0.70	0.81
Total	142,174	111,650	253,824	4,464	3,425	7,889	3.14	3.07	3.11

Table 2. Positive Rate (%) of HTLV-1 Antibodies by Age Group among Blood Donors in Nagasaki Prefecture

Sex	Age	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Test of trend
Male	16~20	1.53	1.44	1.17	1.12	1.35	1.24	0.97	1.07	0.94	1.19	S
	21~25	1.66	1.95	1.50	1.51	1.48	1.27	1.35	1.02	1.08	0.76	S
	26~30	2.08	2.55	2.53	2.39	2.29	2.15	1.97	1.83	2.04	1.20	S
	31~35	3.70	3.59	3.51	3.00	2.78	2.56	2.33	2.42	2.75	2.71	S
	36~40	5.35	4.82	3.62	3.71	3.95	3.32	3.33	2.96	2.58	2.85	S
	41~45	4.83	5.35	4.66	4.90	4.89	4.65	4.63	4.52	4.34	3.94	S
	46~50	6.38	6.56	5.15	4.71	5.41	5.31	5.65	5.51	4.94	4.94	S
	51~55	5.92	4.38	5.77	5.62	5.29	5.68	5.65	5.91	6.57	5.81	S
	56~	7.52	8.19	7.69	7.10	6.23	6.60	7.45	6.13	6.63	6.50	S
Total		3.13	3.22	3.09	3.07	3.18	2.97	3.09	3.01	3.02	2.91	—
Female	16~20	1.44	1.28	1.45	1.14	1.12	1.05	0.91	0.97	0.90	0.89	S
	21~25	2.06	1.99	1.66	1.77	1.11	1.01	1.25	1.00	1.14	1.22	S
	26~30	2.09	2.51	2.72	1.58	1.91	1.69	1.56	1.10	1.16	0.83	S
	31~35	4.77	4.40	3.28	3.81	2.67	2.13	2.66	2.15	1.83	1.47	S
	36~40	6.76	5.38	4.97	3.96	4.08	3.35	2.93	3.49	3.30	3.06	S
	41~45	8.36	7.99	6.57	5.15	5.82	5.76	5.26	5.01	4.72	3.77	S
	46~50	7.32	6.75	6.95	6.70	5.29	7.01	7.29	7.22	5.67	6.08	S
	51~55	8.94	10.58	9.37	9.03	9.18	7.93	7.93	8.31	8.40	6.42	S
	56~	15.09	11.34	12.89	10.49	10.42	10.70	11.00	10.88	10.83	9.32	S
Total		3.73	3.39	3.49	3.11	2.92	2.74	2.93	2.93	2.80	2.56	S
Total	16~20	1.49	1.36	1.31	1.13	1.22	1.13	0.94	1.02	0.92	1.03	S
	21~25	1.86	1.97	1.58	1.63	1.30	1.15	1.30	1.01	1.10	0.97	S
	26~30	2.08	2.54	2.59	2.12	2.15	1.98	1.81	1.55	1.70	1.06	S
	31~35	4.04	3.85	3.44	3.20	2.75	2.43	2.43	2.34	2.45	2.32	S
	36~40	5.84	5.02	4.01	3.78	3.98	3.33	3.21	3.12	2.79	2.91	S
	41~45	6.20	6.30	5.27	4.98	5.17	4.98	4.81	4.67	4.45	3.89	S
	46~50	6.75	6.64	5.79	5.39	5.37	5.87	6.17	6.04	5.16	5.26	S
	51~55	7.25	7.01	7.20	6.98	6.74	6.53	6.51	6.80	7.24	6.02	*
	56~	10.82	9.53	9.81	8.50	7.93	8.20	8.84	8.03	8.24	7.50	S
Total		3.39	3.29	3.25	3.08	3.07	2.88	3.02	2.98	2.94	2.78	S

S: Significant ($p < 0.005$, $*p < 0.05$).

assay or/and enzyme immunoassay were few ($\leq 7.2\%$, detailed data not shown), and did not significantly affect the calculation of the positive rate.

The positive rate of HTLV-1 antibodies was 13.14–0.81% and decreased with the years. Three routes of transmission of HTLV-1 are recognized: from mother to children, between spouses and blood transfusion (9–11). The route of mother to child is mediated by breast feeding. After 1950, formula feeding became more frequently used as some mothers thought that formula feeding is better than breast feeding, or because more mothers went to work. The decrease in breast feeding is inverse to the spread of formula feeding (12). We speculate that the decrease of breast feeding is one of the causes for the decrease in the positivity rate of HTLV-1 antibodies among blood donors.

In addition to the above-mentioned three routes, other trans-

mission routes have also existed but these were blocked with the improvement of environmental sanitation. Although anti-HTLV-1 screening of donated blood was instituted in Japan in 1986, only from 1999 have the results of the test been reported to donors. Therefore, positive donors have donated repeatedly. The screening of HTLV-1 antibodies does not have a significant influence on the positive rate, because the results in Table 1 are the data at the first donation. The positive rate of HTLV-1 antibodies by age group has decreased with year (Table 2).

The positive rate is lower in females than in males in age groups under 35. The reason for that may be that pregnant women have been given the result of HTLV-1 antibody screening in Nagasaki since 1987.

Donor groups that donated in 1990 become 10 years older groups in 2000. If we try to analyze the difference of the data in the period of 10 years, it will be appropriate to compare the

data of age groups which donated in 1990 and that of age groups which donated in 2000. However, we do not have yet the data of 2000. Therefore, for example, we tried to compare the data of 16–20 aged groups of 1990 and that of 26–30 aged group of 1999 (Table 2). There was no statistically significant difference between the positive rate among donor groups in 1990 and in 1999, except for 4 groups (in 1990, 16–20 and 26–30 aged people, 21–25 aged males and 16–20 aged females) (χ^2 test).

A significant difference in the positive rate was observed in four groups (χ^2 test, $p < 0.05$). We could not clarify the reason for this difference in this study. Although the incidence in residents may be not equivalent to that in donors, we are convinced that the incidence trend in donors represents that in residents. The data should be of use for the analysis of various HTLV-1 associated disorders and for precautionary measures for HTLV-1 transmission from mother to child.

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