Prevalence of Antibodies to Hepatitis C Virus (anti-HCV) in Different Populations in Taiwan

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The prevalence of antibodies to hepatitis C virus (anti-HCV) was investigated among different populations in Taiwan, where anti-HCV was detected in 0.8% (24/2,944) of adult volunteer blood donors, 0.1% (1/1,380) of youngsters and children, 12.5% (8/64) of adult volunteer blood donors with elevated alanine aminotransferase (ALT), 36.5% (28/77) of hemodialysis patients, 4.1% (13/315) of male homosexuals, 25.4% (16/63) of cases positive for antibodies to human immunodeficiency virus (anti-HIV), 83.2% (578/703) of intravenous drug users (IVDUs), and 10.3% (23/223) of female prostitutes (FPs). Among patients with chronic liver diseases including chronic hepatitis, cirrhosis and hepatocellular carcinoma (HCC), the overall prevalence rate for anti-HCV was 34.1% (42/123), and a higher prevalence was noted in hepatitis B surface antigen (HBsAg)-negative cases than in HBsAg-positive cases. The prevalence of anti-HCV in volunteer blood donors and high prevalence found in IVDUs, hemodialysis patients, anti-HIV positive cases, and FPs are consistent with those results from other countries. These findings suggest that hepatitis C virus (HCV) infection is transmitted by both blood-borne and sexual contact routes. Among flavivirus infections, anti-HCV was detected in 0.3% (1/293) and 1.3% (4/210) of Japanese encephalitis and dengue fever patients, respectively. In conclusion, in Taiwan, an area with high endemicity of hepatitis B virus (HBV) infection, the epidemiological status of HCV infection is similar to that observed in other countries, and no serum cross-reactivity was noted between HCV and flavivirus infections.

Key words: Hepatitis C virus (HCV). Anti-HCV. Flavivirus infections. Epidemiology.

In Taiwan, an area with high endemicity of hepatitis B virus (HBV) infection, chronic liver diseases (chronic hepatitis, cirrhosis, hepatocellular carcinoma) are common, and counted among the ten leading causes of death.

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More than 80% of patients with those diseases are associated with HBV infection(1-4). Among 60% of the remaining 20% of patients with chronic liver diseases are preliminarily known to be related, by anti-HCV serological test (C100-3, Chiron), to hepatitis C virus (HCV) infection(5-7).

This report presents the prevalence of serum anti-HCV among both the general population and high risk groups in Taiwan. It also clarifies the possibility of serum cross-reactivity between flavivirus infections and HCV.

MATERIALS AND METHODS

Subjects: Two groups of serum samples were tested for anti-HCV. The first group (n: 6,331) (Table 1) included: 1) 2,999 volunteer blood donors (aged 20-60 years, from Taipei Blood Center) before screening tests for HBsAg and ALT, 2) 1,200 students (aged 6-17 years) from primary, middle and high schools in Taipei City, 3) 105 children (aged under 5 years) receiving HBV (hepatitis B virus) vaccination in Taipei County, 4) 64 volunteer blood donors from Taipei Blood Center with elevated serum ALT level higher than 45 IU/L, 5) 63 hemodialysis patients from Taipei Municipal Chuong-Hsiau Hospital, and Provincial Tainan Hospital, 6) 318 male homosexuals, 7) 63 anti-HIV positive cases, 8) 703 IVDUs in prison from Taiwan Provincial Institute of Maternal and Child Health, 9) 223 FP's from Taipei Municipal Venereal Disease Institute, 10) 289 patients with Japanese encephalitis confirmed by positive serological tests (HI, hemagglutination inhibition, and IgM-ELISA test for Japanese encephalitis), and 11) 310 patients with dengue fever confirmed by virus isolation and positive serological tests (HI).

The second group (Table 2), a total of 123 cases of chronic liver disease included: 1) 51 chronic active hepatitis (CAH) patients (40 HBsAg-negative, and 11 HBsAg-positive cases), 2) 23 liver cirrhosis patients (13 HBsAg-negative, and 10 HBsAg-positive cases), and 3) 49 hepatocellular carcinoma patients (35 HBsAg-negative, and 16 HBsAg-positive cases). The diagnosis was made based on clinical and/or histopathological features. The sera tested in this group were freshly obtained within one month before testing, except for 45 samples that had been stored for 5 years at -70° C.

Methods: All tests for serum markers needed for clinical diagnosis of viral hepatitis B were done using commercially available kits (Abbott Laboratories, Chicago, Ill.). For anti-HCV assay, anti-C100-3 ELISA kits manufactured by Abbott Laboratories (Chicago, Ill.) and/or Ortho diagnostic (Raritan, N.J.) were used with test procedures according to the manufacturer's instructions. The test results were recognized as positive after repeated positive reaction.
RESULTS

The prevalence rates of anti-HCV in each group are shown in Table 1. In the general population, the seroprevalence rates of anti-HCV were 0.5% (24/2994) among adult volunteer blood donors, and only 0.1% (1/1295) among students and pre-school age children (age under 17 years). The only positive case among the students had history of neither blood transfusion nor operation, and none of his five family members was positive for anti-HCV. Among the high risk groups, the seroprevalence rates of anti-HCV were 12.5% (8/64), 30.5% (23/763), 25.4% (16/63), 82.2% (378/463), and 10.3% (23/223) for blood donors with abnormal ALT, hemodialysis patients, anti-HIV positive individuals, IV drug users, and FP's, respectively; all showed statistically significant difference (p<0.001) compared to the 0.5% prevalence of adult volunteer blood donors. No definite serum cross-reactivity between HCV and flavivirus infections (Japanese

Table 1. Prevalence of antibodies to hepatitis C virus (anti-HCV) among different population in Taiwan

<table>
<thead>
<tr>
<th>Group</th>
<th>No. tested</th>
<th>No. positive</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood donors (Volunteer)</td>
<td>2,994</td>
<td>24</td>
<td>0.8</td>
</tr>
<tr>
<td>Students (4-17 years)</td>
<td>1,219</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Children (Under 5 years)</td>
<td>103</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Blood donors (With elevated ALT)</td>
<td>64</td>
<td>24</td>
<td>12.5</td>
</tr>
<tr>
<td>Hemodialysis patients</td>
<td>63</td>
<td>23</td>
<td>36.5</td>
</tr>
<tr>
<td>Homosexuals (Male)</td>
<td>318</td>
<td>13</td>
<td>4.1</td>
</tr>
<tr>
<td>Anti-HIV (+) users</td>
<td>63</td>
<td>16</td>
<td>25.4</td>
</tr>
<tr>
<td>Intravenous drug users</td>
<td>103</td>
<td>38</td>
<td>37.4</td>
</tr>
<tr>
<td>Prostitutes (Female)</td>
<td>231</td>
<td>23</td>
<td>10.3</td>
</tr>
<tr>
<td>Japanese encephalitis patients</td>
<td>29</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Dengue fever patients</td>
<td>349</td>
<td>4</td>
<td>1.2</td>
</tr>
</tbody>
</table>

* p<0.001
* HBsAg: (-)

Table 2. Prevalence of antibodies to hepatitis C virus (anti-HCV) among chronic liver diseases in Taiwan

<table>
<thead>
<tr>
<th>Group</th>
<th>No. tested</th>
<th>No. positive</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAH</td>
<td>40</td>
<td>15</td>
<td>37.5</td>
</tr>
<tr>
<td>HBeAg (-)</td>
<td>11</td>
<td>5</td>
<td>22.7</td>
</tr>
<tr>
<td>CRR.</td>
<td>13</td>
<td>8</td>
<td>61.5</td>
</tr>
<tr>
<td>HBeAg (+)</td>
<td>30</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>HCC</td>
<td>18</td>
<td>9</td>
<td>27.8</td>
</tr>
<tr>
<td>HBeAg (-)</td>
<td>26</td>
<td>2</td>
<td>7.7</td>
</tr>
</tbody>
</table>

CAH: Chronic hepatitis; CRR.: Cirrhosis; HCC: Hepatocellular carcinoma
* GD for positive: >1.0

57
encephalitis or dengue fever) was observed.

The seroprevalence rates of anti-HCV for various liver diseases are shown in Table 2 as higher for anti-HCV compared with the general population. In addition, seroprevalence of anti-HCV was higher among HbsAg-negative than HbsAg-positive individuals among all three groups of patients with chronic liver diseases. HbsAg-negative cirrhotic patients showed the highest seroprevalence rate for anti-HCV (61.5%). Chi-square test was used for statistical analysis.

DISCUSSION

This study showed that the prevalence rates for anti-HCV in Taiwan are similar to those reported from other parts of the world as demonstrated by: 1) the 0.8% prevalence rate among the general population, 2) high prevalence in high risk groups, blood donors with elevated ALT, anti-HIV-positive cases, hemodialysis patients, IVDUs, and FPs, and 3) high prevalence in patients with various chronic liver diseases.

The extremely high prevalence of 82.2% for anti-HCV as compared to 20.3% for HbsAg (Wu, Jd al., in Human retrovirology conference—HIV and HTLV, Sep. 20-22, 1990, in Taipei, abstract) in the same IVDUs group induced concern about differences in modes of transmission between the HCV and HCV. The prevalence rate for HbsAg among IVDUs was the same as that of the general adult population in Taiwan, which suggested that the intravenous drug abusers had already been infected by the HbsAg before they began to use drugs. In Taiwan, more than 90% of the adult population have been infected with HbsAg, and become either carrier state or immune to HbsAg infection.

Concerning the mode of transmission of HCV, Alter et al. and Rees et al. have indicated the importance and possibility of transmission by sexual contact. A statistically significant higher prevalence rate (10.2%) for anti-HCV as compared to that of the general adult population in female prostitutes was also obtained here, suggesting that HCV could be transmitted by sexual contact.

The results of a prevalence for anti-HCV among HbsAg-negative chronic liver disease patients higher than in HbsAg-positive patients are consistent with the report by Chen. Meanwhile, results here show lower prevalence rates than reported by Chen. Some factors including the long-standing storage of serum samples and non-specific reactions might have caused the difference in results.

All these findings indicate that, in Taiwan, the epidemiological status of the HCV infection is similar to those reported from elsewhere, and is not a particular endemic viral infection, unlike the
HBV infection with high endemicity in Taiwan.

The similarity of protein sequence shared by HCV and members of flaviviruses and picornaviruses suggested the possible existence of a cross-reactivity among these viral infections. However, results in this study disclosed no such cross-reactivity between HCV and flaviviruses (Japanese encephalitis and dengue fever) infections at this moment.

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REFERENCES

C 型肝炎病毒抗體在臺灣地區各種人口羣中之盛行率

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對臺灣地區不同人口群測試 anti-HCV 之陽性率之結果顯示，成人白領階層之陽性率為 6.5% (24/2934)，青少年 0.1% (1/1356)，ALT 值偏低者佔 12.5% (8/64)，接受透析治療者為 36.5% (23/63)，男性性病患者為 4.1% (13/318)，anti-HIV 患者為 25.4% (16/63)，銷售藥師患者為 82.2% (578/700)，性工作者為 10.3% (23/223)。在慢性肝炎患者中，慢性肝炎、併發症、肝細胞癌、抗體 anti-HCV 陽性率為 30.1% (12/123)。其中 HBsAg 陽性者之陽性率為 91.6% (91/123)。