On the Role of Sexual Behavior in the Spread of Hepatitis B Infection

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There is a significant excess of serologic evidence of hepatitis type B infection in two high-risk-potentiality populations: patients with venereal diseases and their unrelated sexual contacts (15% to 18%) and male, but not female, homosexuals (37% to 51%). Spouses of asymptomatic chronic carriers of antigen had a higher prevalence (26% to 28%) than spouses of noncarriers (10% to 11%); however, the prevalence in the former is relatively low when compared with rates seen in other relatives of carriers. Persons who had a higher-than-average probability of exposure to potentially infective partners or whose patterns of sexual behavior made such exposure more likely (large numbers of sexual partners, long duration of homosexuality, involvement in predominantly anal intercourse) were found to have serologic evidence of hepatitis B more frequently than those with other patterns of sexual behavior. This study showed a strong association between serologic evidence of type B hepatitis and patterns of sexual behavior. However, whether or not transmission of hepatitis type B virus occurs through vaginal intercourse could not be ascertained.

Type B Hepatitis Virus

It is now generally acknowledged, can be transmitted by nonpercutaneous routes (1-5). However, the exact mechanisms of virus transmission from person to person by means other than infected blood remain obscure. Recent studies report that the hepatitis B virus can be transmitted by sexual contact. The hepatitis B surface antigen (HBsAg) was reported to be present in menstrual blood (6), in semen (7, 8), and in vaginal secretions (9) of chronic antigen carriers. Numerous cases of type B hepatitis among sexual partners of symptomatic or asymptomatic carriers of HBsAg have been described (10, 11) and an apparent excess prevalence of antigen or antibody to hepatitis B surface antigen (anti-HBs) in heterosexual or homosexual patients with venereal diseases has been reported (12-14).

On the other hand, two studies (15, 16) carried among prostitutes did not show any significant excess HBsAg, while in only one of these studies prostitutes with anti-HBs positive more frequently than control women. Similarly, our own pilot study among 119 spouses of blood donors who were chronic carriers of HBsAg provided evidence of the significance of sexual transmission between married couples: spouses were found to have a higher prevalence of anti-HBs, while the presence of HBsAg documented much less frequently among spouses of other members of the family (17).

Due to these inconclusive data, a retrospective study was carried out to ascertain the role of sexual behavior an the validity of the sexual-transmission hypothesis. Several large samples of people with varying patterns of sexual behavior were surveyed for serologic evidence of past or present hepatitis type B infection; hepatitis antigen-carriers and noncarriers, patients with gonorrhea, syphilis and their sexual contacts, and homosexuels. Unfortunately, it was not possible to select a meaningful sample of prostitutes.

Our basic assumption was that if sexual transmission does in fact occur, then (1) the prevalence of serologic evidence of hepatitis B infection should vary significantly between these groups of people known or supposed to have various patterns of sexual behavior; (2) within each group the prevalence of hepatitis B events should be correlated with certain features relevant to the intensity and diversity of sexual behavior; and (3) spouses of carriers should be at higher risk than spouses of noncarriers or other comparable population groups.

We further speculated that because sexual behavior, particularly sexual outlets and number of sexual partners, depends on marital status (18), then it is reasonable to expect an excess of singles among antigen carriers as compared with noncarriers. Therefore, the marital status of a large number of blood donors, both antigen carriers and noncarriers, was analyzed.

Methods

Sample Number I: This study consisted of 238 spouses of white and black volunteer blood donors from New York during routine screening, were found to be HBsAg negative.
found to be antigen negative. Both groups of donors have been surveyed by means of a comprehensive self-administered questionnaire and were found to be comparable with each other in most of the analyzed variables, except ethnicity.

QUESTIONNAIRE SURVEY

All participating persons from the four study samples, as well as a 7% systematic subsample of the 10,000 controls, were surveyed for pertinent sociodemographic and epidemiologic information by means of a self-administered questionnaire. The questionnaire used in the survey of Samples Number 3 and 4 contained, in addition, a large number of questions dealing with sexual behavior. The rationale and objectives of the survey were explained to all participants, and assurances of strict confidentiality of information obtained were given.

The response rate to the questionnaire survey among donors and their spouses was 72% and among the high promiscuity groups up to 85%.

LABORATORY METHODS

Screening for HB,Ag was done by radioimmunoassay (21) and reverse passive hemagglutination (22); positive specimens were confirmed by neutralization methods. Screening for anti-HB, was done by passive hemagglutination (23). Antigen determinants a, d, and y were assayed by hemagglutination inhibition method (24). Screening for antibody against the core antigen (anti-HB,) in a selected group of 302 specimens negative for surface antigen and antibody was done by complement fixation (22). Serologic tests were done under code and all positive results were confirmed by retesting. Serum glutamic pyruvic transaminase (SGPT) determinations were done by the spectrophotometric method. The chi-square and Mantel-Haenszel tests (20) were used to determine statistical significance between frequency rates.

Results

Table 1. Comparison of the Four Study Samples and Controls According to Certain Sociodemographic and Epidemiologic Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Spouses of Noncarriers (n = 238)</th>
<th>Spouses of Carriers (n = 280)</th>
<th>Patients of Venereal Disease Clinics (n = 597)</th>
<th>Homosexuals (n = 674)</th>
<th>Controls (n = 700)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>17.5</td>
<td>13.2</td>
<td>72.4</td>
<td>92.9</td>
<td>64.2</td>
</tr>
<tr>
<td>Non-whites</td>
<td>10.5</td>
<td>20.0</td>
<td>59.6</td>
<td>13.9</td>
<td>8.6</td>
</tr>
<tr>
<td>40 years old</td>
<td>47.4</td>
<td>38.5</td>
<td>9.9</td>
<td>17.7</td>
<td>31.1</td>
</tr>
<tr>
<td>Foreign born</td>
<td>13.0</td>
<td>12.6</td>
<td>NA†</td>
<td>9.1</td>
<td>13.8</td>
</tr>
<tr>
<td>2 years of education</td>
<td>95.6</td>
<td>94.7</td>
<td>96.1</td>
<td>97.6</td>
<td>98.5</td>
</tr>
<tr>
<td>Residence in New York City</td>
<td>44.3</td>
<td>50.6</td>
<td>NA†</td>
<td>98.1</td>
<td>45.4</td>
</tr>
<tr>
<td>&gt;10 sex partners in last 6 months</td>
<td>NA</td>
<td>NA</td>
<td>11.8</td>
<td>50.3</td>
<td>NA</td>
</tr>
<tr>
<td>History</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viral hepatitis or jaundice</td>
<td>1.0</td>
<td>2.4</td>
<td>8.0</td>
<td>23.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Venereal disease</td>
<td>4.2</td>
<td>2.8</td>
<td>45.6</td>
<td>59.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>3.1</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
<td>3.3</td>
</tr>
<tr>
<td>Drug addiction</td>
<td>0.2</td>
<td>2.0</td>
<td>10.4</td>
<td>5.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Heavy drinking</td>
<td>NA†</td>
<td>NA</td>
<td>4.0</td>
<td>5.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

† NA = data not available.

of the index-donors were anti-HB, positive). Because of an unusually high prevalence of HB,Ag and anti-HB, seen among donors of oriental origin (19), they were excluded from this and other study samples. A comparison of the families who consented to participate with those who refused did not show significant differences with respect to a number of sociodemographic characteristics. Due to the fact that the majority of blood donors are white men, most of the spouses tested were white women.

Sample Number 2: This study consisted of 280 spouses (87%) who were wives and black donors who were persistent carriers of HB,Ag (repeated detection of antigen in at least two specimens drawn 6 months apart). Due to the relatively high frequency of HB,Ag detection among blacks of this area (19), the proportion of blacks in this sample was larger than in Sample Number 1 (20% versus 10.5%).

The methods of selection and survey of Samples Number 1 and 2 have been described in more detail elsewhere (17).

Sample Number 3: This study consisted of 597 heterosexual patients attending two venereal disease clinics in New York City. 272 of them were either under treatment for syphilis or gonorrhea or had had treatment in the past, while the remaining 325, mostly unrelated sexual contacts of venereal disease patients, attended the clinics for screening and did not have a history of known venereal infection. The sexual identity and sexual behavior patterns of these 597 subjects were established during a personal, confidential interview; all were exclusively or predominantly heterosexual.

Sample Number 4: This study consisted of 674 homosexuals solicited to participate in this survey through two recognized homosexual organizations and two health clinics. Only persons who declared themselves as exclusively or predominantly homosexual were included in this sample. Ninety-three percent of the entire sample were men. No essential differences with respect to age, ethnicity, duration of homosexuality, and history of venereal disease between the surveyed homosexuals from different organizations and institutions were seen.

The frequencies of hepatitis B infections in these four study samples were compared with the results of screening by the same laboratory assays of a random, control sample of 10,000 healthy adults from the same area (volunteer blood donors).

Table 1 shows that, in addition to sex and ethnicity, the four samples surveyed differed from each other and from the control population in certain other characteristics known or supposed to be independently associated with the likelihood of exposure to hepatitis B infection. Hepatitis B frequency rates in the study samples were, therefore, standardized in reference to the controls taken as a normal standard (20).

Most of the 590 male donors found to be HB,Ag positive during routine screening carried out in 1971-1973 and in a randomly selected sample of 663 male donors who donated during the same time period and who were
Table 2. Results of Serologic Testing for Hepatitis Type B Infection in the Surveyed Populations

<table>
<thead>
<tr>
<th></th>
<th>Spouses of Noncarriers</th>
<th>Spouses of Carriers</th>
<th>Patients of Venereal Disease Clinics</th>
<th>Homosexuals</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Prevalence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBsAg</td>
<td>0.4</td>
<td>0.7</td>
<td>1.3</td>
<td>4.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Anti-HB, (≥1:8)</td>
<td>10.5</td>
<td>26.4</td>
<td>16.6</td>
<td>42.8</td>
<td>7.0</td>
</tr>
<tr>
<td>HBeAg or anti-HBe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude</td>
<td>10.9</td>
<td>27.1</td>
<td>17.9</td>
<td>48.1</td>
<td>7.3</td>
</tr>
<tr>
<td>Standardized for sex*</td>
<td>11.3</td>
<td>28.2</td>
<td>17.6</td>
<td>37.3</td>
<td>...</td>
</tr>
<tr>
<td>Standardized for age*</td>
<td>10.8</td>
<td>28.3</td>
<td>18.1</td>
<td>51.1</td>
<td>...</td>
</tr>
<tr>
<td>Standardized for ethnicity*</td>
<td>11.2</td>
<td>26.7</td>
<td>14.9</td>
<td>47.4</td>
<td>...</td>
</tr>
<tr>
<td>Anti-HB, (≥1:8)†</td>
<td>ND†</td>
<td>5.1</td>
<td>6.0</td>
<td>12.4</td>
<td>0</td>
</tr>
</tbody>
</table>

Relative risk

|                      |                        |                     |                                     |             |          |
| HBsAg                | 1.3                    | 2.3                 | 4.1                                 | 13.0        | 1.0      |
| Anti-HB              | 1.5                    | 3.7                 | 2.4                                 | 6.3         | 1.0      |
| HBeAg or anti-HBe    | 1.5                    | 3.7                 | 2.4                                 | 6.6         | 1.0      |

* By direct method in relation to controls.
† In negatives for surface antigen and antibody.
* For definition see text.
ND = not done.

In the study, and anti-HBe was detectable in 26.4% of all tested spouses of carriers (25.4% of white and 33.9% of blacks), or 2.0 to 3.3 times as frequently as among spouses of noncarriers or controls. As expected, prevalence of HBsAg (1.3%) was seen in the sample of heterosexuals attending venereal disease clinics; however, the rate of all hepatitis B events (HBeAg or anti-HBe) in this sample was lower than in the spouses of HBsAg carriers (1.7% versus 2.7%). Twenty-four percent of patients with venereal disease diagnoses were antigen or antibody positive, as compared with 16.6% of their unrelated sexual contacts. An unusually high prevalence, for this area, was seen in the sample of homosexuals: 4.3% were antigen positive (13 times more frequently than controls), and 43.8% were antibody positive (4 to 5 times more frequently than controls). The difference in cumulative prevalence rates between the four samples was essentially unchanged by adjustment for age, sex, or ethnicity. The only exception occurred for the group of homosexuals, where standardization for sex brought the adjusted rate slightly closer to rates for the other three groups. The frequency of antibody to core antigen in the spouses of carriers and the high promiscuity groups was also significantly higher than that observed in the controls. In the great majority of persons with detectable antigen, surface or core antibody-apparent parenteral exposure (buccal transplants or shared needles) could be excluded. The relative distribution of ef and ay subtypes in the HBsAg were similar to that seen in the general population of this area.

The homosexuals were found to have significantly higher titers of hemagglutinating anti-HBs (log10 geometric mean of titer = 2.56 ± 0.87) when compared with antibody-positives among the three other samples (1.91 ± 0.85). Antibody levels in the homosexuals were also much higher than those ordinarily seen in other, nontropical populations.

Prevalence according to sex, age, and ethnicity

As can be seen from data presented in Table 3, differences in prevalence of antigen or antibody by sex, age, and ethnicity are small or statistically insignificant in the samples of spouses or heterosexuals from venereal disease clinics. In contrast, in the homosexual population there seems to exist a strong correlation with all three characteristics. Although no antigen and very little antibody was detected among female homosexuals, as many as 4.6% of all tested males homosexuals were antigen positive and 46.5% were antibody positive. Both antigen and antibody were also detected significantly more frequently in homosexuals 40 or more years old than in those under 40 years of age; this age-dependence seems to be related not to the age-factor as such but to duration of homosexuality. Certain differences in relation to ethnic background also seem to exist.

Other risk factors in the homosexual population

Due to the small number of female homosexuals surveyed and the negligible prevalence of hepatitis B events among them, further analysis will be confined to men. From more than 20 variables analyzed, Table 4 presents only those that seem to be associated with the prevalence of antigen, antibody, or both.

As many as 23% of the surveyed homosexuals gave a past history of viral hepatitis; the great majority of these events were recognized by a physician. Among those with such a history, serologic evidence of hepatitis B was detected in 65%; the latter frequency is significantly higher than that in homosexuals without a history of viral hepatitis ($P < 0.001$).

Relatively few of the homosexuals admitted to shared needle injections of narcotics (5.1% as opposed to 10.4% among patients attending venereal disease clinics). In those homosexuals with a history of drug-addiction, antigen was detected with nearly the same frequency as in those without such a history; however, the cumulative prevalence of both antigen and antibody was higher in the former than in the latter.

A well-known feature of homosexual behavior, primarily in men, is an extraordinarily high degree of sexual promiscuity (18). In the sample studied, nearly 54% reported 10 or more (up to 60) sexual partners during a
Table 3. Frequencies of Hepatitis Type B Detection in the Study Samples in Relation to Sex, Ages, and Ethnic Background

<table>
<thead>
<tr>
<th>Variable</th>
<th>HBsAg Carriers</th>
<th>HBsAg Noncarriers</th>
<th>Anti-HBs Carriers</th>
<th>Anti-HBs Noncarriers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spouses of</td>
<td>Heterosexuals</td>
<td>Spouses of</td>
<td>Heterosexuals</td>
</tr>
<tr>
<td></td>
<td>Carriers</td>
<td></td>
<td>Carriers</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>0</td>
<td>1.4</td>
<td>4.6</td>
<td>10.0</td>
</tr>
<tr>
<td>Women</td>
<td>0.8</td>
<td>1.2</td>
<td></td>
<td>10.0</td>
</tr>
<tr>
<td>&lt;40 years old</td>
<td>1.2</td>
<td>1.1</td>
<td>4.4</td>
<td>10.0</td>
</tr>
<tr>
<td>≥40 years old</td>
<td>0</td>
<td>3.4</td>
<td>5.7</td>
<td>10.0</td>
</tr>
<tr>
<td>White, non-Jews</td>
<td>0.5</td>
<td>0.7</td>
<td>4.6</td>
<td>9.3</td>
</tr>
<tr>
<td>Jews</td>
<td>0</td>
<td>0</td>
<td>3.0</td>
<td>11.4</td>
</tr>
<tr>
<td>Blacks</td>
<td>1.8</td>
<td>2.0</td>
<td>8.3</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0</td>
<td>1.4</td>
<td>5.8</td>
<td>33.3</td>
</tr>
</tbody>
</table>

*Statistically significantly higher than in other comparable group(s); P < 0.01.
† Included into the three other ethnic groups.

6-month period before this survey. When this group was compared with homosexuals reporting less than 10 partners during the same period, no differences with respect to antigenemia were seen; however, antibody was detected with a high excess (60.5% versus 30.9%).

When surveyed for the most frequently or exclusively used type of sexual method, 42% reported oral-genital, 26% anal-genital, and the remaining 32% equal use of both of the above. Among those reporting oral-genital methods, 2.3% were antigen positive and 39% were antibody positive; in the mixed-method group, 4.7% and 56%, respectively; and in the group reporting predominantly or exclusively rectal intercourse, 7.5% and 51%, respectively. These differences are statistically highly significant.

The cumulative prevalence of antigen and antibody (but not that of antigen only) also seems to depend on the duration of homosexuality. In homosexuals 30 or less years old, 33% of those with a duration of homosexuality of less than 6 years were hepatitis B positive, in contrast to a positivity rate of 50% to 58% among those with a longer duration; in the age group of 30 to 49 years old, these rates were 29% and 58% to 66%, respectively. The aforementioned dependence of prevalence on age at screening was found to be secondary to the duration of homosexuality. Similarly, persons who reported that they had been involved in homosexual practices beginning in childhood (11 years or younger) were found to be hepatitis B positive more frequently than those with a beginning of homosexuality at an older age; this association was also secondary to duration of homosexual life.

As many as 63% of all surveyed homosexuals gave a past or present history of gonorrhea, syphilis, or both. Similarly high frequencies of venereal infections in this population were reported by other workers (27, 28).

Cumulative prevalences of antigen and antibody were 31.7% among persons without a history of venereal disease, 55.9% among those with a history of gonorrhea, 62.2% among those with syphilis, and as much as 80.3% among those with both syphilis and gonorrhea (chi-square = 68.621; P < 0.001). These differences, however, do not seem to be related to venereal disease at such, but to various characteristics that distinguish those persons with venereal disease from those without it.

Persons who gave a history of venereal disease also reported a greater number of sexual partners within the preceding 6 months than those without such a history. They had practiced homosexuality for a longer period of time, they reported genital sores, abrasions, and similar lesions more frequently, and they had been involved more frequently in rectal intercourse. It would thus seem that the same factors that increased the risk of venereal disease also enhanced the likelihood of acquiring hepatitis B. In other words, association between hepatitis B and venereal disease does not seem to be a causal one.

An unusually high proportion of antigen-positive homosexuals was found to have abnormally elevated serum glutamic pyruvic transaminase (SGPT) levels; 62% of all carriers had levels higher than 40 Karmen units, and 48% had values higher than 60 Karmen units. In antigen positives from the other three samples, the frequency of SGPT abnormalities was similar to that ordinarily seen in asymptomatic carriers, that is, 20% to 25% (29).

Table 4. Relation Between Serologic Evidence of Hepatitis Type B and Certain Risk Factors in 626 Male Homosexuals

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Person with HBsAg (%)</th>
<th>Anti-HBs Pos (%)</th>
<th>Person with HBsAg (%)</th>
<th>Anti-HBs Pos (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past viral hepatitis</td>
<td>144 (23.1)</td>
<td>7.0</td>
<td>65.0*</td>
<td></td>
</tr>
<tr>
<td>Drug addiction</td>
<td>32 (5.1)</td>
<td>6.3</td>
<td>68.8</td>
<td></td>
</tr>
<tr>
<td>≥10 sex partners last 6 months</td>
<td>338 (53.6)</td>
<td>4.8</td>
<td>62.5*</td>
<td></td>
</tr>
<tr>
<td>Predominantly anal intercourse†</td>
<td>159 (26.5)</td>
<td>7.5*</td>
<td>58.5</td>
<td></td>
</tr>
<tr>
<td>≥10 years of homosexuality</td>
<td>233 (45.0)</td>
<td>3.9</td>
<td>60.0*</td>
<td></td>
</tr>
<tr>
<td>Present or past venereal disease</td>
<td>396 (63.3)</td>
<td>6.1*</td>
<td>62.1</td>
<td></td>
</tr>
</tbody>
</table>

* Difference in prevalence between those with the factor and those without; statistically significant, (P < 0.01).
† Versus predominantly oral.

Discussion

To prove retrospectively type B hepatitis is difficult, and it is a long-pertinent question whether genital transmission of hepatitis B virus is a causal factor in the pathological spread of the disease. In this study, patients infected with hepatitis B virus in the absence of other risk factors were excluded. The review of the literature shows that the infection rate of the general population is relatively low. However, in the present study, 26.8% of the homosexuals were positive for hepatitis B virus. This result is in agreement with the findings of other studies. The high prevalence of hepatitis B infection in this population may be explained by the high prevalence of underlying medical conditions, such as diabetes mellitus, chronic liver disease, and other autoimmune diseases. Such conditions may increase the risk of hepatitis B infection by impairing the immune system. Additionally, the high prevalence of hepatitis B infection in this population may be related to factors such as needlestick injuries, iatrogenic infections, and vertical transmission. The high prevalence of hepatitis B infection in this population highlights the importance of implementing effective prevention strategies to reduce the transmission of hepatitis B virus.
carriers is statistically significant for both whites and non-whites. No such predominance of singles was found among female carriers.

Discussion

To prove conclusively by means of a cross-sectional, retrospective study that an infection such as asymptomatic type B hepatitis can be transmitted venereally, in addition to many other potential modes of transmission, is a difficult task indeed. Firstly, discussion of sexual behavior is a long-standing taboo and, therefore, collection of pertinent information presents great difficulties; if provided, there is no easy way to test its reliability. Secondly, populations that seem to be the most suitable for the study of venereal transmission, spouses and high-promiscuity groups, differ from each other with respect to many other characteristics that are independently associated with risk of type B hepatitis (Table 1); no statistical treatment can overcome these disparities in sample composition. Finally, and most importantly, because hepatitis B virus can most probably be transmitted through viruses-containing saliva, urine, and other vehicles (5), it is practically impossible to differentiate between the role of sexual intercourse and that of some inapparent parenteral route or close personal contact that occurs between sexual partners, for example, kissing, touching, and so forth. Hence, even a strong association between promiscuity and hepatitis B prevalence does not yet prove that the virus is transmitted by sexual contact, particularly by vaginal intercourse.

On the other hand, the markers of hepatitis B infection used in this study (antigen, surface and core antibody, and transaminase elevation) are known to persist only in a proportion of persons exposed; hence, failure to detect these markers in a person's serum does not exclude past exposure to a potential route of transmission.

In reviewing the results obtained in the present study, two separate aspects of the role of sexual behavior in the spread of the hepatitis B virus should be distinguished: (1) the possibility that this virus can be transmitted by vaginal intercourse per se and, therefore, that hepatitis B may be regarded as a venereal disease, at least under certain circumstances; and (2) the indirect impact of certain sexual behavior patterns on the spread of hepatitis B virus in different population groups. An infectious agent may not be directly transmitted venereally, yet certain patterns of sexual behavior may sustain or inhibit its circulation and dissemination by means of other potential routes.

As to the possibility of sexual transmission, particularly by vaginal intercourse, observations made during this study are ambiguous; they neither exclude such a possibility nor do they provide convincing evidence in support of this hypothesis. Although observations made in high promiscuity samples (Numbers 3 and 4) are compatible with the sexual transmission hypothesis, the results of screening in the sample of spouses did not provide convincing evidence supporting this hypothesis.

In our pilot study we found that 4 out of 119 (3.4%) carriers' spouses tested were HBeAg positive and as many as 36.4% were anti-HBc positive, exceeding several times the rate among the general population. However, due to the fact that among other relatives of the index-carriers the prevalence of antibody was found to be equally high and antigen was detectable much more frequently, we speculated that sexual transmission does not seem to be of great importance in the intrafamilial spread of type B hepatitis (17). As the number of spouses tested in this study was substantially increased and ethnic-specific prevalence rates were computed, the rate of antigen detection among spouses became smaller and differences in prevalence between spouses and other relatives became greater. Three out of five spouse-carriers detected during the entire survey were observed in a small group of Orientals tested. Chinese and Filipino groups known to have unusually high antigen prevalence (19), while prevalence in other ethnic groups was essentially the same as in the general population: 0.4% in whites and 1.8% in blacks. In comparison, the same survey showed that prevalence of antigen among siblings of both races was 15% to 30%; among parents, 12% to 25%; and among children, 1.5% to 6% (30). These relatively low antigen rates in spouses of carriers would be difficult to explain if sexual intercourse were of great importance as a route of transmission. Antigen carriers were not detected among spouses recently screened in Canada as well (31). It is also of interest that during extensive surveys carried out in high-prevalence areas, neither Blumberg and colleagues (32) nor Ceppellini and colleagues were able to make their other family members did. Our own observations in families of chronic dialysis patients with acute hepatitis B showed a high attack rate among spouses (26). Likewise, surveillance of over 5000 family units with an index-patient with acute hepatitis, mostly type B (which was conducted in Poland...
in the 1960s), showed high attack rates of secondary cases among spouses (3). These obvious differences between asymptomatic carriers and patients with acute illness in terms of potentials for sexual transmission may be related to varying levels of infectivity. Variations in infectivity associated with clinical manifestation are a well-known feature of many communicable diseases.

Observations made in the sample of homosexuals, contrary to those in spouses, are consistent with the sexual transmission hypothesis. Homosexuals, well known to have high prevalences of HB (s) and antibody in homosexuals is in part associated with a high incidence of acute and chronic hepatitis B in this population. A considerable proportion of homosexuals predominantly involved in sexual behavior.

Another point of interest in this population is the close parallelism in the distribution of venereal diseases and hepatitis B events. Both these infections behaved in a similar way and tended to be widespread in a group of persons with a specific pattern of sexual behavior. Thus, in this population hepatitis B is a number of features in common with venereal diseases.

A relation between hepatitis B and sexual behavior does not seem to exist in the sample of heterosexuals from venereal disease clinics as well, although due to the small numbers in the numerators these relations did not always yield statistical significance. Promiscuity, increased exposure, and higher risk of contracting hepatitis B would also explain the excess of unmarried people among antigen carriers detected in 1971-1973 (Table 5).

It should be noted that the high prevalence of antigen and antibody in homosexuals is in part associated with a high incidence of acute and chronic hepatitis B in this population. A considerable proportion of homosexuals (23%) gave a past history of acute viral hepatitis; the majority of antigen carriers (up to 62%) had biochemical evidence of liver damage, while the levels of antibody in those anti-HB antigen-positive were unusually high. A high proportion of persons with a recent episode of acute disease or with chronic active hepatitis would also be suggested by the excess prevalence of antibody to core antigen (10% versus 0% in normal controls and 5% to 6% in the other samples).

An unexpected finding in this study was the high prevalence of hepatitis B in homosexuals whose sexual activity included rectal intercourse, and a relatively low prevalence among those whose activity involved predominantly oral-genital intercourse; the latter had a hepatitis B prevalence comparable with heterosexuals. Because oral intercourse generally involves swallowing of semen and close contact with saliva, both found to contain antigen, one would not expect such a difference. The high prevalence in homosexuals predominantly involved in rectal intercourse may be explained by two factors: [1] damage of the mucous membrane of the rectum, which frequently occurs during rectal intercourse (the surveyed persons reported proctitis as one of the most common complications); and [2] the mucosa of the rectum may be a better portal of entry for the virus than the digestive tract.

In summary, this study showed a strong association between patterns of sexual behavior and the prevalence of type B hepatitis infection. This study seems to confirm that in certain populations promiscuity, intimate contact with large numbers of sexual partners, and extravaginal intercourse may be responsible for a large part of clinically apparent or inapparent infections. Whether or not type B hepatitis is really transmitted by vaginal intercourse could not be ascertained in the present survey.

Our data would suggest that avoidance of rectal intercourse by homosexuals might substantially reduce the transmission of hepatitis B among them, and, due to the high risk of gonorrhea, syphilis, and hepatitis B for homosexuals, it would seem that they should be advised to refrain from blood donations. Although no exact incidence rates of homosexuality are available, studies carried out by Kinsey, Pomeroy, and Martin (18) in the 1940s indicated that a substantial proportion of men in the United States, particularly unmarried (up to 37%), are involved in homosexual activity.

Large-scale prospective studies dealing with sexually associated type B hepatitis, both overt and asymptomatic, seem to be indicated.

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References


5. VILLAGE A: Sexual behavior and the risk of hepatitis B. Lancet 1:845-848, 1971


11. HEATHY, London

12. HEALTHY, London

13. JUFNAS, Clinics.


16. PAPAZ, Preva

17. SEMM, Sex

18. KING H, Sex

19. SCHM, Sex

20. SIMMONS, Sex

* Bell A: Personal communication.
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