

Hepatitis B virus infection in prisons

A seroepidemiological survey in prisoners and attending staff

BY M. CHIARAMONTE, R. TRIVELLO*, G. RENZULLI*, L. ZAMPIERI,
A. FANECCO, A. FLOREANI AND R. NACCARATO

*Clinica Medica I, Cattedra di Gastroenterologia and * Istituto di Igiene,
Università di Padova, Italy*

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SUMMARY

Prisoners and attending staff from six houses of detention were screened for serum HBsAg, antiHBs, antiHBc and transaminases. Both prisoners and warders showed an increased prevalence of HBV serum markers with respect to age- and sex-matched general population control groups. The HBsAg carrier rate was 6·7% in prisoners and 6·6% in staff. Sixty-five per cent of the HBsAg-positive subjects were antiHBe-positive. When the blood samples were taken, all the HBsAg-positive subjects were asymptomatic; transaminases were normal in 80% and only slightly elevated in 20%.

Illicit drug abuse was found to be a relevant risk factor for HBV infection among prisoners under 35 years of age, but not in the older group, whereas no correlation emerged between presence of HBV serum markers and tattoos or admitted homosexuality. A high prevalence of HBV serum markers was also found among young warders who had been in service for a short time: most of them, however, come from areas of Italy with a particularly elevated HBV circulation.

Although the results suggest that many of the HBV infections are not recently acquired within the institution, this survey confirms that prisons should be regarded as high risk areas for HBV infection, both for prisoners and warders.

INTRODUCTION

Closed institution residents carry an increased risk of type B hepatitis (Szmunes & Prince, 1971). The HBV infection rate is particularly elevated among parenteral drug abusers (Blanck, Ream & Conrad, 1979), homosexual males (Szmunes *et al.* 1975) and prostitutes (Papaevangelou *et al.* 1974). In the United States the HBsAg carrier rate was found to be higher among paid blood donors coming from penal institutions than among volunteer blood donors (Kliman, 1971; Muniz, Malyska & Levin, 1971).

All these observations suggest that among prisoners there should be an increased incidence of HBV infection. However, few data are reported in the literature

(Watson, Watts & Nelson, 1973; Koplan, Walker & Berquist, 1978) and no study has included research of all the HBV serum markers now available.

In order to throw light on the prevalence of HBV infection among prisoners and in an attempt to evaluate the role of this type of institutionalization in the spread of HBV, a seroepidemiological survey was carried out in several houses of detention in Veneto, a region of north-east Italy.

MATERIAL AND METHODS

Study protocol

Six houses of detention were included in the study. Both prisoners and attending staff were surveyed. From each consenting subject blood was collected for HBV serum marker (HBsAg, antiHBs, antiHBc) detection and transaminase assay. Information about age, length of imprisonment or employment, history of liver disease, parenteral drug abuse, sexual habits, exposure to parenteral HBV contamination (blood transfusions, major surgery, dental care, injections, tattooing) was recorded on a card accompanying each serum. The interviews and the collection of blood were carried out by a member of the prison medical and nursing staff.

Serum specimens sent to our laboratory for HBsAg, antiHBs and antiHBc detection were stored at -20°C until tested by radioimmunoassay using commercially available kits (Abbott Laboratories, Chicago, Illinois) according to the manufacturer's instructions. When the amount of serum allowed it, HBsAg-positive samples were tested for HBeAg/antiHBe by RIA (supplied by Abbott Laboratories). This test was not included in the original protocol of the study. Transaminase assays were done in different local laboratories using conventional methods.

Statistical analysis was done using the χ -square test.

Study groups

Prisoners

Three hundred and eighty-five subjects, corresponding to a proportion ranging from 40 to 65% of the actual population of each house of detention, were studied. Two hundred and twenty-five were males and 48 females. Their ages ranged from 15 to 76 years, with mean ages of 31 ± 5.5 and 32 ± 5.6 years for males and females respectively.

Staff

Two hundred and fifty-five attending personnel (225 males and 30 females) corresponding to 70% of the total employees (warders, clerical and nursing staff) were studied. Their ages ranged from 19 to 75 years. Of the male staff tested, 68% were less than 35 years of age. This group consisted mainly of warders, who usually start service at the age of 18–20. Most members of the female staff had domestic or nursing jobs; their mean age (44.9 ± 6.7 years) was higher than that of males (31.5 ± 5.6 years).

Table 1. Prevalence of HBV markers in houses of detention

| | Number tested | HBsAg (± antiHBc) | AntiHBs (± antiHBc) | AntiHBc alone | Total HBV |
|---------------------------|---------------|----------------------|------------------------|------------------|--------------|
| | | Number (%) | Number (%) | Number (%) | Number (%) |
| Prisoners | | | | | |
| Males | 337 | 24 (7.1)** | 111 (32.9)** | 36 (10.6)** | 171 (50.7)** |
| Females | 48 | 2 (4.1)† | 18 (37.5)** | 6 (12.5)** | 26 (54.1)** |
| Total | 385 | 26 (6.7)** | 129 (33.5)** | 42 (10.9)** | 197 (51.1)** |
| Staff | | | | | |
| Males | 225 | 16 (7.0)** | 75 (33.3)** | 17 (7.5)† | 108 (48.0)** |
| Females | 30 | 1 (3.3)† | 10 (33.3)** | 2 (6.6)† | 13 (43.3)** |
| Total | 255 | 17 (6.6)** | 85 (33.3)** | 19 (7.4)* | 121 (47.4)** |
| Civilian workers | | | | | |
| Males | 57 | 3 (5.2)† | 10 (17.5)† | 7 (12.2)** | 20 (35.5)† |
| General population | | | | | |
| Males | 927 | 28 (3.0) | 161 (17.3) | 43 (4.6) | 232 (25.0) |
| Females | 971 | 19 (1.9) | 133 (13.6) | 41 (4.2) | 193 (19.8) |
| Total | 1898 | 47 (2.4) | 294 (15.4) | 84 (4.4) | 425 (22.3) |

Statistical analysis: studied group vs respective control group (general population): † not significant; * $P < 0.05$; ** $P < 0.01$; staff vs prisoners: differences not statistically significant.

Civilian workers

From one prison we received the sera and the cards of 57 civilian workers (all males, mean age 46.9 ± 6.8 years) who were also included in the screening as they had been working together with prisoners in a workshop inside the house of detention for many years.

Controls

As controls we used 1898 subjects (927 males and 971 females) of the same age range who had been tested for HBsAg, antiHBs, antiHBc during an epidemiological survey carried out by the same laboratory on the general population of Padova and its district. The sera of these control subjects were collected on the occasion of health certificate requests or hospital admission for minor surgery, for childbirth or as casualties and were tested by the same methods as study groups.

RESULTS

HBV infection

The overall prevalence of HBV infection (evaluated on the basis of serum positivity for at least one of the following: HBsAg, antiHBs, antiHBc) was 51.1 % among prisoners and 47.4 % among staff, while the prevalence in the worker groups was not significantly different from that observed in age-matched male controls from the same town (35 % vs 25 %) (Table 1).

The HBsAg prevalence, higher in males than in females, was very similar between prisoners and warders in both males (7.1 % in prisoners vs 7.0 % in staff) and females (4.1 % in prisoners vs. 3.3 % in staff). In all cases except four the HBsAg

Table 2. *HBV marker prevalence according to age and sex in prisoners*

| | HBsAg (± antiHBc) | | AntiHBs (± antiHBc) | | AntiHBc alone | | Total HBV | |
|-------------------------|----------------------|--------|------------------------|--------|------------------|--------|-----------|--------|
| | Number | (%) | Number | (%) | Number | (%) | Number | (%) |
| Males | | | | | | | | |
| < 35 years (N = 253) | 20 | (7.9) | 76 | (30.0) | 26 | (10.2) | 122 | (48.2) |
| > 35 years (N = 84) | 4 | (4.7) | 35 | (41.6) | 10 | (11.9) | 49 | (58.3) |
| Females | | | | | | | | |
| < 35 years (N = 29) | — | | 8 | (27.5) | 3 | (10.3) | 11 | (37.9) |
| > 35 years (N = 19) | 2 | (10.5) | 10 | (52.6) | 3 | (15.7) | 15 | (78.9) |

positivity was associated with antiHBc positivity. AntiHBs without antiHBc was found in nine subjects only.

Thirty-two HBsAg-positive serum samples (22 from prisoners and 10 from warders) were tested for HBeAg/antiHBe. Six of 32 (18.7%) were HBeAg-positive and 21 of 32 (65.6%) were antiHBe-positive. Results were negative both for HBeAg and antiHBe in 5 cases. The proportion of HBeAg-positive sera in warders was less than that of prisoners (10% vs 22%).

Of the 44 HBsAg-positive subjects, the transaminases of 35 (79.5%) were normal and of 9 (20.4%) were slightly elevated. In no case was the increase more than three times the normal value.

Analysis of risk factors

Prisoners

Seventy-five per cent of male and 60% of female prisoners studied were under 35 years of age. The prevalence of HBsAg-positive subjects decreases and the prevalence of antiHBs increases with age in both males and females (Table 2).

Of the younger age group, 59/282 subjects (20.9%) admitted drug abuse: 79.6% of these had evidence of HBV infection, whereas the HBV marker prevalence in those who did not declare drug addiction was 38.3%. The relative risk factor was 6.2. Only one subject over 35 years of age declared drug abuse.

Eighteen (7.1%) of 253 males under 35 years of age admitted homosexual practice: 11 of 20 (55%) of these had evidence of HBV infection.

Forty-three per cent of the younger males and 14.2% of the older group were tattooed: the relative risk calculated in the two groups together was 1.3.

Personnel

The prevalence of HBV infection was shown to increase with advancing age in the female staff, whereas in males the HBsAg or antibody prevalences of the younger group were similar to those of the older age group (Table 3). As there were several discrepancies in the answers to the questionnaires it was not possible to

Table 3. HBV marker prevalence according to age and sex in personnel

| | HBsAg (± antiHBc) | | AntiHBs (± antiHBc) | | AntiHBc alone | | Total HBV | |
|-------------------------|----------------------|-------|------------------------|--------|------------------|--------|-----------|--------|
| | Number | (%) | Number | (%) | Number | (%) | Number | (%) |
| Males | | | | | | | | |
| < 35 years (N = 157) | 11 | (7.0) | 59 | (37.5) | 7 | (4.4) | 77 | (49) |
| > 35 years (N = 68) | 5 | (7.3) | 16 | (23.5) | 10 | (14.7) | 31 | (45.5) |
| Females | | | | | | | | |
| < 35 years (N = 10) | — | | 1 | (10) | 1 | (10) | 2 | (20) |
| > 35 years (N = 20) | 1 | (5) | 9 | (45.0) | 1 | (5) | 11 | (55) |

make a statistical correlation between the HBV serum marker prevalence and the length of employment; however, since warders generally start their service at the age of 18–20 years, one can assume that the correlation with age reflects a correlation with duration of employment in the prison environment.

Two subjects only admitted illicit drug abuse, none said he was homosexual.

DISCUSSION

The results of this survey confirm that prisoners can be considered a high prevalence group for HBV infection. Most of the prisoners surveyed (probably more than those who confessed it) practised illicit drug abuse and several admitted to homosexual relations: both practices are well-recognized risk factors in HBV transmission (Blanck *et al.* 1979; Szmuness *et al.* 1975). Furthermore, tattoos are very popular among these people: this habit can also partially contribute to the HBV spread (Sterner *et al.* 1971).

The prison environment also seems to constitute a high-risk situation for people working in it. The increase of antiHBs prevalence according to age, observed in females, may be consistent with nursing activity in HBV medium-risk areas. However, the high prevalence of infection observed in male staff, even in the group of young people with only a short term of service, was unexpected. This finding might indicate that warders contract the HBV infection inside the prison during their first months of employment. However, in interpreting these data we must consider that (1) most of the warders come from areas of Italy (such as Sardinia) with a particularly elevated HBV circulation (Ceppellini *et al.* 1970), and (2) an increased prevalence of jaundice among them has not been reported. It is therefore possible that the high prevalence of HBV markers in young warders may precede their employment. Further epidemiological studies are needed to verify this hypothesis.

The majority of HBsAg carriers (both prisoners and warders) were found to be antiHBe-positive, indicating, on the one hand longstanding infection (Hoofnagle,

1980), and on the other low infectivity (Alter *et al.* 1976) and, therefore, low risk of HBV spread among contacts. This finding further supports the hypothesis that many of the HBV infections were not recently acquired within the institution.

In conclusion, prisons should be regarded as areas of relatively high HBV circulation, both for prisoners and for attending staff. However, while in other communities or in the household the spread is directly correlated to the proportion of HBeAg-positive HBsAg carriers and to the duration of close cohabitation with them, in prisons the institutionalization may act mainly as a concentration of individuals already highly exposed to HBV because of their social or ethnic background and/or their life style. However, some of these risk factors may be enhanced by enforced cohabitation in prisons.

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