PREVALENCE OF HEPATITIS B VIRUS INFECTION AND RELATED RISK FACTORS IN A RURAL COMMUNITY OF MEXICO

MARTIN CISNEROS-CASTOLO, LILIAN HERNÁNDEZ-RUIZ, IRMA E. IBARRA-ROBLES, IRMA H. FERNÁNDEZ-GARATE, AND JORGE ESCOBEDO-DE LA PEÑA
Division of Epidemiology, Coordination of Community Health, Mexican Institute of the Social Security, México

Abstract. A cross-sectional survey of the seroprevalence of hepatitis B virus (HBV) markers among healthy people was conducted in San Juanito, a rural community in the northern state of Chihuahua, Mexico. The overall prevalence in 970 people was 6.6% for antibody to hepatitis B core antigen. There was an age effect on the prevalence of HBV infection, and a gradual increase in prevalence was observed in patients up to the age of 40 years. Those subjects with a history of dental procedures had a 2-fold higher risk for HBV infection (odds ratio [OR], 2.4; 95% confidence intervals [CI], 1.01–5.86), and there was a 74% increased risk for each blood product transfusion (OR, 1.74; 95% CI, 1.09–2.77). Horizontal transmission seems to be the major source of endemity in San Juanito because no woman was a chronic carrier. To lower HBV transmission rate, an adequate active screening program for blood donors should be implemented, together with a universal infant immunization program.

INTRODUCTION

It has been considered that Mexico has a low prevalence of hepatitis B, although recent estimates have suggested that its prevalence may be similar to the one observed in Central and South America countries. The National Health and Nutrition Examination Survey (NHANES III), conducted in the United States in 1988–1994, showed a higher prevalence of hepatitis B infection in Mexican Americans when compared with the non-Hispanic white population of that country, mainly in those citizens ≥ 50 years of age. Prevalence in older people seemed to be 2-fold higher in Mexican Americans, and the global incidence rate was 20% greater in Mexican Americans. Whereas the pattern of disease of the younger generation may resemble the pattern of the adopted country, the patterns exhibited by older generations may reflect those of their homeland, or a higher exposure to known risk factors. Direct percutaneous exposure to human blood, sexual transmission, and mother-infant transmission are the most common modes by which hepatitis B virus (HBV) is spread. Surgical and dental procedures have also been considered related risk factors.

Indigenous populations in some countries of South America have shown a high occurrence of hepatitis B. In Central America, Belize has reported a high prevalence of hepatitis B infection, and more than three quarters of the Mayan indigenous population may have been infected. An extremely high prevalence of hepatitis B infection (91%) has been reported in the southern border of Mexico, both in Mexican communities and in Guatemalan refugee camps.

Hepatitis B infection is an important public health problem due to its chronic serious sequelae. It has been estimated that at the most, 33% of the infected subjects have evidence of clinical hepatitis, and depending on the age of infection, up to one third of infected patients become chronic carriers of hepatitis B surface antigen (HBsAg). Chronic carriers have a higher incidence of and mortality due to hepatocellular carcinoma and cirrhosis. Furthermore, knowledge of hepatitis B infection frequency and distribution is necessary to evaluate the need of preventive measures, such as universal immunization. Seroepidemiologic studies provide a more comprehensive scenario of the distribution of this disease than does epidemiologic surveillance of acute cases.

Rural populations may show a higher prevalence of hepatitis B infection. Several studies have been conducted in Mexico, but most of them have been carried out in urban populations. No population-based prevalence study has been conducted so far in rural communities of Mexico; nor have they included indigenous inhabitants. We conducted a study with the objective of estimating the prevalence of hepatitis B infection in a rural Mexican community; we also sought to correlate serologic findings with epidemiologic data and known risk factors.

PATIENTS AND METHODS

A cross-sectional study was carried out in San Juanito, in the northern state of Chihuahua, Mexico, in the summer of 1997. San Juanito is a small rural town in the mountain range of Chihuahua, with a population of nearly 6,000 inhabitants, with high migration fluxes. San Juanito is considered a town of high marginality and extreme poverty. The community is often isolated in the wintertime because of heavy snow. Because San Juanito is the town with the largest number of inhabitants in this zone, there is much commercialism, and the town attracts people to the area for school and work.

San Juanito is a low-income town with a low educational level. Nearly two thirds of the adult population have a primary-school-level education or less. Many school-age children abandon their studies and start working to improve family income. Nearly 14% of the inhabitants are native Mexican Indians (mostly Raramuri-Tarahumara, but also Pima Indians), whereas the rest of the population is mestizo (people of mixed parentage, mainly Spanish and Mexican Indians). More than half of the inhabitants are women because young men frequently migrate out of town, looking for better-paying work. Most women are housewives. Men usually work as peasant employees in the local sawmills or have blue-collar jobs in nearby industries.

Study population. There is a rural hospital in the community ruled by the IMSS-Solidaridad program, which provides medical care to all inhabitants in the community and maintains an annual census of all families living there. One
were tested for HBsAg with the Auszyme test (Abbott Laboratories, North Chicago, IL), and positive specimens by enzyme-linked immunosorbent assay (Corzyme, Abbott Laboratories). All sera were tested for antibody to hepatitis B core antigen (anti-HBc) with the Auszyme test (Abbott Laboratories). All positive samples were tested twice for confirmation. Positive antibodies to hepatitis B core antigen was considered to define the presence of any HBV infection, and chronic HBV infection was defined when there were both HBsAg and antibodies to hepatitis B core antigen.

**Statistical analysis.** Global, age-specific, sex-specific, and ethnic group-specific seroprevalences, with 95% confidence intervals (CIs), were calculated. Age-adjusted prevalence for both sexes was also estimated by use of the whole population age distribution. The chi-square test was used to compare categorical data and to evaluate association with risk factors. The strength of the association with the studied risk factors was measured by prevalence odds ratios (OR). To control for potential confounders, a multivariate logistic regression analysis was performed, and the corresponding ORs with 95% CIs were also estimated.

**RESULTS**

A total of 1,015 subjects were identified and interviewed, with a 100% response rate. The serum sample was suitable for hepatitis B serologic markers in 970 people (95.6%), who were the basis for analysis in this report. Table 1 shows demographic characteristics of the studied sample. There were more women (65%) than men in the study. Ages ranged 5–92 years (mean, 30.4 ± 15.2 years; median, 28 years). There were 124 Mexican Indians (only 2 were Pima Indians; the rest were Raramuri-Tarahumara). The age, sex, and ethnic distribution of the 45 subjects whose serum samples were not suitable for analysis for serum markers were similar to those seen in the 970 subjects whose sera could be analyzed for serum markers.

The results of serologic testing are shown in Table 2. The overall prevalence of HBV infection in this population was 6.6% (95% CI, 5.12–8.34). Crude prevalence was slightly higher in girls and women, but age-adjusted prevalence was similar in both sexes (6.7%). There was an age effect on the prevalence of hepatitis B infection. Prevalence rose from 4.1% in children aged 5–11 years to a peak of 8.7% in people aged 30–39, after which it declined to 2.1% in people aged ≥ 60 years. A similar pattern was observed in girls and women. The number of studied men aged > 40 years was small, so no pattern could be properly identified in this cohort. Prevalence of hepatitis B infection was higher in girls and women than in boys and men in all age groups, but this difference was well within the sampling errors associated with the survey. Mexican Indians had a slightly higher prevalence of hepatitis B (8.1%, 95% CI, 3.9–14.3) than did mestizos (6.4%, 95% CI, 4.8–8.3). The youngest people with antibodies to hepatitis B were 2 boys aged 10 years, and the oldest was a 73-year-old woman.

**TABLE 2**

Age-specific seroprevalence of hepatitis B virus infection

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Girls and women</th>
<th>Prevalence</th>
<th>95% CI</th>
<th>Boys and men</th>
<th>Prevalence</th>
<th>95% CI</th>
<th>Total</th>
<th>Prevalence</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–11</td>
<td>1/32 (3.1%)</td>
<td>0.1–16.2</td>
<td></td>
<td>2/42 (4.8%)</td>
<td>0.6–16.2</td>
<td></td>
<td>3/74 (4.1%)</td>
<td>5.8–7.9</td>
<td></td>
</tr>
<tr>
<td>12–19</td>
<td>6/109 (5.5%)</td>
<td>2.0–11.6</td>
<td></td>
<td>3/72 (4.2%)</td>
<td>0.9–11.7</td>
<td></td>
<td>9/181 (5.0%)</td>
<td>0.9–11.4</td>
<td></td>
</tr>
<tr>
<td>20–29</td>
<td>16/196 (8.2%)</td>
<td>4.7–12.9</td>
<td></td>
<td>6/77 (7.8%)</td>
<td>2.9–16.2</td>
<td></td>
<td>22/273 (8.1%)</td>
<td>5.1–11.9</td>
<td></td>
</tr>
<tr>
<td>30–39</td>
<td>13/141 (9.2%)</td>
<td>5.0–15.3</td>
<td></td>
<td>6/78 (7.7%)</td>
<td>2.9–16.0</td>
<td></td>
<td>19/219 (8.7%)</td>
<td>5.3–13.2</td>
<td></td>
</tr>
<tr>
<td>40–49</td>
<td>3/81 (3.7%)</td>
<td>0.8–10.4</td>
<td></td>
<td>4/27 (14.8%)</td>
<td>4.2–33.7</td>
<td></td>
<td>7/108 (6.5%)</td>
<td>2.6–12.9</td>
<td></td>
</tr>
<tr>
<td>50–59</td>
<td>3/42 (7.1%)</td>
<td>1.5–19.5</td>
<td></td>
<td>0/26 (0%)</td>
<td>–</td>
<td></td>
<td>3/68 (4.4%)</td>
<td>0.9–12.4</td>
<td></td>
</tr>
<tr>
<td>≥60</td>
<td>1/28 (3.6%)</td>
<td>0.1–18.4</td>
<td></td>
<td>0/19 (0%)</td>
<td>–</td>
<td></td>
<td>1/147 (2.1%)</td>
<td>0.1–11.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>43/629 (6.8%)</td>
<td>5.0–9.1</td>
<td></td>
<td>21/341 (6.2%)</td>
<td>3.9–9.3</td>
<td></td>
<td>64/970 (6.6%)</td>
<td>5.1–8.3</td>
<td></td>
</tr>
</tbody>
</table>

* CI = confidence interval.
HEPATITIS B VIRUS INFECTION IN RURAL MEXICO

Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prevalence OR</th>
<th>95% CI</th>
<th>Adjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age†</td>
<td>–</td>
<td>0.99</td>
<td>0.97–1.01</td>
<td></td>
</tr>
<tr>
<td>Female sex</td>
<td>1.12</td>
<td>0.63–2.00</td>
<td>0.91</td>
<td>0.51–1.62</td>
</tr>
<tr>
<td>Raramuri ethnicity</td>
<td>1.28</td>
<td>0.37–1.69</td>
<td>1.61</td>
<td>0.78–3.31</td>
</tr>
<tr>
<td>History of procedures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical</td>
<td>1.63</td>
<td>0.94–2.81</td>
<td>1.48</td>
<td>0.83–2.65</td>
</tr>
<tr>
<td>Dental</td>
<td>2.4</td>
<td>0.98–6.27</td>
<td>2.43</td>
<td>1.01–5.86</td>
</tr>
<tr>
<td>Transfusion†</td>
<td>2.48</td>
<td>1.08–5.57</td>
<td>1.74</td>
<td>1.09–2.77</td>
</tr>
</tbody>
</table>

* CI = confidence interval; OR = odds ratio.
† Included as continuous variable in the multivariate analysis.

Table 3 shows the results of the analysis that identified risk factors for infection in this population. The 2 main risk factors identified were a history of blood product transfusion and exposure to dental procedures. There was no relation of hepatitis B infection to a family history of HBV infections, to number of sexual partners, to socioeconomic conditions, or to intravenous drug use. There were 27 drug users, and none had evidence of HBV infection. We provided HBV vaccination to 66 subjects, but only 34 of them were fully immunized.

In the bivariate analysis, a history of a surgical procedure seemed to be associated with hepatitis B infection, but this association had a lack of precision in the multivariate analysis while controlling for other variables. In the multivariate analysis, those with a history of dental procedures had a 2-fold higher risk for hepatitis B infection (OR, 2.4; 95% CI, 1.0–5.8). There was a 74% increased risk for each blood product transfusion (OR, 1.74; 95% CI, 1.09–2.77).

Only one person of 970 had a positive determination of HBsAg: a 40-year-old mestizo man. His only identified risk factor was having been exposed to dental procedures 16 times before the survey. He had received no blood-product transfusion, and he was not an intravenous drug user. Therefore, the prevalence of hepatitis B chronic carriers in the studied population was 0.10% (95% CI, 0.01–0.57).

DISCUSSION

The prevalence found in this study is lower than the prevalence estimated for Mexico by the Latin American Regional Study Group (16.8%). Even the prevalence of HBsAg is 10 times lower than their estimate (1%). However, the overall prevalence of hepatitis B infection in San Juanito is 2 times higher than the prevalence found in Mexican Americans in the United States in the NHANES III study (6.6% in this report versus 3.36% in NHANES III). Prevalence is higher in our study in all age groups except in those aged > 50 years.

There are no recent national reports on the prevalence of hepatitis B infection in Mexico. However, studies performed in some selected populations may still be suitable for comparative purposes. The prevalence that was found in San Juanito is higher for young women when compared with Mexican female sex workers, although after the age of 33 years, the prevalence is lower in this community. Prevalence is also higher in the population of San Juanito than the one observed in pregnant women in Mexico City, in pregnant Mexican American women in San Francisco, and in Hispanic and non-Hispanic women seeking gynecological care. It is also substantially higher in the children of San Juanito than in children of the same age group (5–17 years) living in the Texas-Mexico border (5.2% versus 1%). The overall observed prevalence is similar to the reported one in non-drug abusing prostitutes in Mexico City. Nevertheless, the prevalence is lower than the reported one in some Latin American and Caribbean countries, as has been notified in Brazil, Bolivia, Nicaragua, Jamaica, or Belize.

San Juanito could be considered as a low endemicity area of hepatitis B. The very low rate of positivity to HBsAg (0.10%) suggests that horizontal rather than vertical transmission is the major source of this endemicity (6.6%). In areas of low endemicity, transmission occurs primarily among young adults, and there is an age effect on the prevalence of hepatitis B infection.

Horizontal transmission of hepatitis B has been related to socioeconomic conditions, socioprofessional status, and risky behaviors, such as sharing of bath towels, chewing gum, partially eaten candies, or dental cleaning materials, as well as biting fingernails in conjunction with scratching the backs of carriers. It has been shown that the improvement of socioeconomic conditions may lead to a decreasing exposure to HBV infection. The increased risk of hepatitis B infection in recent generations in San Juanito may be related to an increased exposure to risk factors in conjunction with poor sanitary and socioeconomic conditions. It should be stressed that the lack of heterogeneity in socioeconomic conditions in the community prevented us from finding any relation of HBV infection and socioeconomic conditions.

Sexual activity, injection drug use, or occupational exposure did not seem to be important risk factors in San Juanito inhabitants. Blood transfusion seemed to be the most relevant risk factor. Since the exclusion of commercial and hepatitis B antigen-positive donors in Mexico, blood-transfusion-related hepatitis B infection has decreased. However, in remote, low-income, rural areas, blood transfusion may not have been safe until recent years. The rural hospital in San Juanito was built in 1984, when screening for hepatitis B markers in blood donors began. Blood transfusion thus may still have been an important risk factor for hepatitis B infection as recently as a few years ago. There was also a strong relation with the antecedent of dental procedures. There was a lack of precision regarding any surgical procedure and hepatitis B infection. It has been reported transmission of HBV to patients treated either by general surgeons or oral surgeons. No further research was conducted to identify potential sources of infection, but an improvement in the quality of these 3 identified risky medical procedures (surgical, dental, and transfusion) will certainly lead to a reduction in the risk of HBV infection in the inhabitants of San Juanito.

Maternal transmission does not seem to be a prominent mode of HBV transmission in San Juanito because no women had HBsAg. Even though no child aged < 5 years was included in the study (due to parents’ reluctance to allow blood sampling in young children), the lack of HBV infec-
tion in children aged < 10 years supports the low probability of vertical transmission.

Hepatitis B virus infection is a health problem in this rural area of Mexico, and Mexican Indians seem to be a high-risk group. The overall low prevalence of HBsAg (0.1%), similar to previous reports in Mexico,20 also supports the hypothesis that horizontal transmission is the major source of infection in this community. Therefore, improvement in sanitary conditions should be one of the main interventions undertaken to decrease hepatitis B infection.21 Adequate screening of donors before donation, as well as exclusion of high-risk donors, should be kept in mind to minimize HBV transmission, in spite of lack of resources. Nevertheless, blood transfusion will still be a risk factor for hepatitis B transmission due to undetected donors with early acute infection, resolving infection, silent infection, or infection with atypical virus serology.22

Universal infant immunization against hepatitis B has been advocated to prevent perinatal and early childhood HBV transmission in areas of high HBV endemicity. However, in low-endemicity areas as San Juanito, the use of hepatitis B vaccine is particularly advisable in the high-risk adult population.2 Universal infant immunization against hepatitis B does not seem to be a fundamental intervention in this community so far, but its recent inclusion in the recommended childhood immunization schedule in Mexico should be a primary means of preventing HBV transmission in San Juanito.

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Reprint requests: Jorge Escobedo-de la Peña, Apartado Postal 40-028, Delegación Cuauhtémoc, 06140 México, D.F., México.

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