

# PREVALENCE OF HEPATITIS B SURFACE ANTIGEN AND RISK FACTORS OF HBV INFECTION IN A SAMPLE OF HEALTHY MOTHERS AND THEIR INFANTS IN SANA'A, YEMEN

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Since the 1970s there has been a tremendous increase in information on viral hepatitis, a major public health problem affecting millions of people throughout the world.<sup>1</sup> Viral hepatitis is a major cause of morbidity and mortality in humans, both from acute infection and its chronic sequelae, which include hepatitis B and hepatitis C infection, chronic hepatitis, cirrhosis and primary liver cancer.<sup>2,3</sup>

The endemicity of hepatitis B virus (HBV) infection varies greatly worldwide.<sup>4-6</sup> The endemicity of infection is considered high in Yemen, where prevalence of positive HB surface antigen (HBs Ag) ranges from 8% to 20%, and up to 50% of the population generally have serological evidence of previous HBV infection.<sup>7,8</sup> Yemen introduced universal immunization against HBV for infants in early 2000.

In high endemic areas of the world, infections occur either during the prenatal period or early in childhood, and these account for the high rates of chronic HBV infection in this population. Risk of HBV infection also continues after the first five years of life, but its eventual contribution to the high rate of chronic infection is less significant.<sup>5,6</sup> Chronic infection with HBV is strongly associated with primary hepatocellular carcinoma (PHC), and areas of high endemicity have the highest death rates due to this neoplasm.<sup>2,9,10</sup> The main aim of this study was to determine the prevalence of HBs Ag among mothers and their infants, and to determine the risk factors among both groups using HB surface antigen as an indicator for infection.

## Subjects and Methods

Mothers with infants aged between six and 12 months were selected from the attendance register of the Family Planning Center in Sana'a, Yemen. Only mothers and infants who had no acute illness requiring bed rest, and who provided informed consent, were enrolled. Volunteers answered a brief demographic and epidemiological questionnaire, and they were not vaccinated for HBV.

Based on an expected HBs Ag prevalence of 7%, approximately 178 randomly selected subjects were needed out of an estimated total of 200,000 individuals in each group in Sana'a city, at a confidence level of 99.9%. A systematic random sampling of every 5th subject was selected.

Capillary blood was collected from both infants and mothers. Then blood samples were examined by enzyme immunoassay (EIA) for hepatitis B surface antigen to hepatitis B virus with commercially available kits (Organon Teknika B.V., Boxtel, Holland). Specimens which proved repeatedly reactive by EIA in two separate tests were considered positive for hepatitis B surface antigen. Positive HBs antigen samples of mothers were also tested for hepatitis B "e" antigen (HBe Ag).

From two-by-two tables, the odds ratios were calculated and *P*-value was determined using the uncorrected chi-square test. Fisher's exact test was used for the small-expected cell sizes with a two-tailed probability value.

## Results

A total of 544 volunteers completed the study questionnaire and donated blood. Tables 1 and 2 outline prevalence and the odds ratio (OR) estimates by their 95% confidence intervals (95% CI), and by Fisher's exact test for cell value less than 5, for positive serological tests of hepatitis B virus and expected risk factors of contracting hepatitis B virus, and with statistically significant *P*-value using uncorrected chi-square test.

The total seroprevalence among mothers was 13.2% and 4% for infants. When the age of mothers was considered in relation to predisposition to hepatitis B virus infection, there was a significant effect of older age on contracting hepatitis B virus, and a highly significant effect of the over 30 years age group, when compared with the younger age groups (Table 1).

In the case of risk factors of hepatitis B virus infection for mothers, it was found that there was a highly significant association of history of blood transfusion, hospitalization and positive history of surgery with contracting the disease, but no significant association with history of immunization, jaundice, and/or parental exposure (Table 1).

In the case of risk factors of hepatitis B virus infection for infants, there was a significant association of history of birth in hospital, with higher significance of birth by

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TABLE 1. Prevalence of hepatitis B surface antigen in different age groups and risk factor analysis of hepatitis B virus infection in a sample of mothers in Sana'a, Yemen (1999).

	Number	% positive	Odds ratio (95% CI)	P-value
<b>Age group</b>				
<20 years	36	8.3	0.56 (0.1-1.95)	NS
20-30 years	204	12.7	0.72 (0.3-1.68)	NS
+30 years	32	25	3.1 (1.8-7.92)	<0.05
Total	272	13.2%	-	-
<b>History</b>				
Immunization*	170	4.7	0.13 (0.05-0.32)	<0.05
Jaundice	25	12	0.9 (0.16-3.2)	NS
Blood transfusion	5	60	10.3 (1.12-125)	<0.05
Hospitalization	40	25	2.6 (1.07-6.4)	<0.05
Parental exposure (IM, IV)	78	10.3	0.68 (0.27-1.65)	NS
Surgery**	28	28.8	3.09 (1.13-8.29)	<0.05

\*Yemen immunization schedule 1998 includes diphtheria, tetanus, pertussis, polio, measles and BCG; \*\*excluded from hospitalization group; CI=95% confidence interval, NS=non-significant.

TABLE 2. Risk factor analysis of hepatitis B virus infection among a sample of infants in Sana'a, Yemen (1999).

History	Number	% positive	Odds ratio (95% CI)	P-value
Birth in hospital	26	15.3	7.3 (1.58-32.3)	<0.05
Birth by cesarean*	8	37.5	22 (2.76-137)	<0.05
Parental exposure (IM, IV)	110	6.3	2.58 (0.77-8.6)	NS
Mother +ve HbsAg	36	5.5	1.7 (0.17-8.8)	NS
Total	272	4	-	-

CI=95% confidence interval; NS=non-significance; \*excluded from born-in-hospital group.

contracting the disease; but no significant association with history of parental exposure, and/or positive mother for HB surface antigens (Table 2). As well, the HBe antigen-positive mothers constituted 60% of HBV carrier mothers.

## Discussion

There has been inadequate information on the prevalence and risk determinants of viral hepatitis among the different population groups in Yemen. A much higher prevalence (13.2%) of HBs Ag has been reported among mothers in Yemen than in Saudi Arabia, which was estimated at between 2.3% and 5.4%,<sup>11-13</sup> and among blood donors and healthy subjects in the United States and Europe.<sup>9</sup>

In our study, the prevalence rate of HBs Ag increased with age among the mothers in the 30+ age group, where it reached up to 25% (Table 1). This increase could indicate an accumulated risk of infection over time. In addition, the results indicated that the horizontal spread of hepatitis B virus may be of greater importance than vertical transmission.

There was an association between HBs Ag and history of surgery, blood transfusion and hospitalization for mothers, and this is consistent with findings by Scott et al.<sup>7</sup>

that prior factors were significant risk factors for hepatitis B virus infection in Yemen.

Direct association was not found between positive hepatitis B antigen and the history of jaundice in mothers. This suggests that other hepatitis viruses could be the cause of jaundice among our adult subjects.

Although hospitalization was a risk factor, history of parental exposure and immunization did not appear to be an important mode of transmission of hepatitis B virus. Availability and widespread use of disposable needles and syringes in the community and the strict policy of ensuring use of disposable needles and syringes by the immunization programs in Yemen could explain this. The association of hospitalization and contracting hepatitis B virus reflects poor hygienic practices with inadequately sterilized medical instruments in most hospitals in Yemen.

The study shows that infants in Yemen are at a high risk of becoming infected in their early years. The first risk for infection occurs in the first few days spent in hospitals during normal delivery or by cesarean section, and this confirms that use of unsterilized or inadequately sterilized contaminated instruments are a possible route of infection. It is likely that there was insufficient protection for persons admitted to hospitals in Yemen. Sterilization, disinfection and general standards of training and proficiency are generally deficient in most hospitals in Yemen.

Person to person spread of HBV can occur in settings involving interpersonal contact over a long period of time, such as when a chronically infected person resides in a household.<sup>14-16</sup> In this setting, nonsexual transmission occurs from adult (primarily mothers) to infants, and this second possible risk for infection occurred among the infants in our study. The precise mechanism of transmission is unknown, however, contamination of mucus membrane of an infant's mouth with the saliva of an adult during kissing the newborn in the mouth (a common practice in Yemen) is one of the main possible methods of transmission of HBV infection. Because of the extremely high concentration of virus in saliva and the number of virions in even small amounts, it can be infectious, thus saliva is a possible source for HBV infection.<sup>14-17</sup>

The prevalence of HBe antigen (HBe Ag), which is a convenient marker for high infectivity,<sup>18</sup> was 60% among mothers, while there was no significant association with risk of contracting HBV infection among infants of HBs antigen-positive mothers. This result may be due to chance because of the small sample size, or it may be that vertical transmission is possible though not very common, and infection of children more often occurs during the first few years of life. If so, this result is different from that reported from Asia, where prenatal transmission is more common.<sup>19</sup>

Evidence from these studies in Yemen suggests that vertical transmission from mother to child is relatively uncommon, but that there is a steady increase in exposure

to HBV over a lifetime. Hospital-acquired HBV infection is very common in Yemen, and prevention is ultimately possible by applying standard policies of sterilization, disinfection and personal training to enforce this policy and ensure refinements in the screening of blood donors.

In Yemen, vaccination should be considered for everyone living in a place where over 10% of the population are carriers (WHO recommendations). Programs to immunize all newborn babies with a target of 80% coverage should be conducted in the next 2 to 4 years, in parallel with health education.

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