

Sexual transmission of hepatitis B surface antigen

Infection of husbands by HBsAg carrier-state wives

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SUMMARY The husbands of 68 hepatitis B surface antigen (HBsAg) carrier-state wives were tested for the presence of hepatitis B surface antibody (HBsAb) and antigen (HBsAg) to assess possible transmission of HBsAg. Eight (11.8%) of the 68 husbands gave negative results for HBsAg and 22 (32.4%) positive results for HBsAb. Furthermore, eight (26.7%) of 30 husbands with presumed HBsAg transmission from their wives developed acute viral hepatitis after marriage, and e antigen (eAg) was detected in the serum from all eight wives. Although HBsAg was not detected in specimens of sputum and cervical mucus of carrier-state women by reverse passive haemagglutination, it was detected in the vaginal discharge of women during days 1-6 of the menstrual cycle at a rate ranging from 20-60%. Thus, sexual transmission of HBsAg seems to occur, particularly if sexual contact takes place during or immediately after menstruation.

Introduction

Studies on the prevalence of hepatitis B surface antibody (HBsAb) in populations with different levels of promiscuity have suggested the possibility of sexual transmission of hepatitis B surface antigen (HBsAg) (Hersh *et al.*, 1971; Heathcote and Sherlock, 1973; Papaevangelou *et al.*, 1974; Froesner *et al.*, 1975). HBsAb studies on Athenian prostitutes by Papaevangelou (1974) support this hypothesis, and Froesner *et al.* (1975) reported that the prevalence of HBsAb in West German prostitutes tended to increase with age and length of prostitution. Another study performed in Cali by Adam *et al.* (1974), however, showed no significant HBsAb percentage difference between the sera of prostitutes and of control populations.

We studied the incidence of HBsAg and HBsAb in husbands of HBsAg-carrier-state wives to assess possible sexual transmission of HBsAg.

Patients and methods

Thirteen thousand pregnant women attending 35 obstetric institutions in Chiba Prefecture were screened for HBsAg and HBsAb. Of 195 HBsAg-positive pregnant women and their husbands 68 were

selected (as indicated below) for study and followed up for periods ranging from one to two years. The women were designated as asymptomatic HBsAg carriers on the following criteria: (1) the presence of serum HBsAg for at least six months; and (2) the absence of any clinical manifestations of liver disease or laboratory abnormalities in liver function.

The husbands were interviewed regarding premarital and extramarital sexual partners, and living parents and siblings were tested for serum HBsAg or HBsAb either at our hospital or, in a few cases, at other institutions. Most husbands participating in this study had had no premarital sexual partners other than their wives and no extramarital intercourse. All parents and siblings tested gave negative results for HBsAg and HBsAb. Husbands who had episodes of acute viral hepatitis shortly after marriage had no family history of acute hepatitis, hepatoma, or liver cirrhosis.

Sputum samples were obtained repeatedly from the 68 HBsAg-positive women before and after delivery. Specimens of cervical mucus were collected from 18 postpartum women before menstruation restarted. Samples of vaginal discharge from five postpartum women were obtained every day for 30 days and tested for HBsAg. Samples of sputum, cervical mucus, and vaginal discharge were diluted (1/1) with Ringer's solution, centrifuged at 3000 × g, and stored at -20°C. Blood samples were obtained from the 68 husbands. For comparison 28 HBsAg-negative pregnant women and their husbands were also tested.

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Serum samples were screened for HBsAg at dilutions of 1/2, 1/4, 1/8, 1/16, and 1/256. Titres over 1/4 were considered to be positive. Testing for HBsAg was carried out by immune adherence haemagglutination (IAHA) (Mayumi *et al.*, 1971) and reverse passive haemagglutination (R-PHA) (Schuurs and Kaoki, 1974). HBsAb was determined by passive haemagglutination (PHA) (Vyas and Shulman, 1974). Positive results were confirmed by absorption with HBsAg or human HBsAb. Antigen and antibody subtyping was performed by the haemagglutination inhibition (HI) technique (Imai *et al.*, 1974). Carrier-e-system was determined by the micro-Ouchterlony method (Magnius and Espmark, 1972).

Results

Of 68 husbands with HBsAg carrier-state wives, 30 (44.2%) were either HBsAg-positive (11.8%) or HBsAb-positive (32.4%). Antigen-subtypes or antibody-subtypes were identical in all 30 pairs. No significant difference in adr:adw ratio was found among the groups with and without HBsAg transmission (Table 1).

Of the husbands of the 28 HBsAg-negative pregnant women, none was HBsAg-positive and only one was HBsAb-positive.

Serum eAg was found in samples from four of eight HBsAg-positive women whose husbands were

HBsAg-positive and in those from 17 (77.3%) of 22 wives with HBsAb-positive husbands. Three (8%) of 38 women whose husbands were HBsAg-negative or HBsAb-negative had serum eAg, and 23 (60.5%) women had serum eAb. Eight (26.7%) of 30 husbands with presumed HBsAg transmission from their wives had a history of acute viral hepatitis shortly after marriage and eAg was present in the sera of all eight wives (Table 1). No other source of infection was detected.

HBsAg was detected by R-PHA neither in the sputum from the 68 HBsAg carrier-state women nor in the cervical mucus of the 18 women examined before the start of menstruation. HBsAg was detected in 20-60% of samples collected during the first six days of the menstrual cycle (Table 2) but not in any sample collected later in the cycle.

Discussion

Although Piccinino (1975) found the incidence of HBsAg to be higher among children than among their parents, according to Inaba *et al.* (1977) the vertical transmission rate of HBsAg in Japan is approximately 38%. Inaba *et al.* (1977) also showed that of 13000 pregnant women screened for HBsAg and HBsAb, 195 (1.5%) were HBsAg-positive, and 1560 (12%) HBsAb-positive. Among male blood donors in Tokyo, the incidence of HBsAg was approximately 2.3% (Okochi *et al.*, 1970) and that of

Table 1 Incidence of HBsAg transmission from HBsAg-carrier-state wives to their husbands and correlation with e-system and subtype in women's sera

Husbands' serum results	Results in serum of HBsAg-carrier wives											
	No.		e-system				Subtype					
			eAg+		eAb+		eAg- and eAb-		adr		adw	
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
HbsAg+	8	11.8	4	50.0	2	25.0	2	25.0	7	87.5	1	12.5
HbsAb+	22	32.4	17	77.3	3	16.7	2	9.1	18	81.8	4	18.2
Total	30	44.2	21	70.0	5	16.7	4	13.3	25	83.3	5	16.7
HBsAg- and HbsAb-	38	55.8	3	8.0	23	60.5	12	31.5	34	89.5	4	10.5
Total	68	100	24	35.3	28	41.2	16	23.5	59	86.8	9	13.2
Cases with acute viral hepatitis	8		8						6	75.0	2	25.0

+ Positive - negative

Table 2 Detection of HBsAg in vaginal discharge of five HBsAg-carrier-state wives

Findings in vaginal discharge	Day of menstrual cycle													
	1		2		3		4		5		6		After 6	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
HBsAg+	2	40	3	60	3	60	2	40	2	40	1	20	0	0

+ Positive

HBsAb 18.1% (Nishioka *et al.*, 1973). By comparison, the present study shows that the incidence of HBsAg and HBsAb in husbands with HBsAg carrier-state wives is extremely high (44.2%). As expected the husbands of the HBsAg-negative women were also HBsAg-negative.

Some authors reported that the radioimmunoassay (RIA) method detected HBsAg in sputum samples (Kawana *et al.*, 1973; Villarejos *et al.*, 1974). In the present study, however, R-PHA failed to detect HBsAg in any of the 68 sputum and 18 cervical mucus samples from premenstrual HBsAg carrier-state women. This fact suggests that the potential for HBsAg infection via sputum or cervical mucus is low. Although HBsAg was not detected in the vaginal discharge of women beyond day 7 of the menstrual cycle, it was detected up to day 6.

We believe, therefore, that our findings support the hypothesis of sexual transmission of HBsAg, especially if intercourse occurs during or immediately after menstruation.

Serum eAb was detected in 23 (60.5%) of 38 carrier-state women whose husbands were serum HBsAg-negative or HBsAb-negative, while only five (16.7%) of 30 women with HBsAg-positive or HBsAb-positive husbands were serum eAb-positive.

Of 30 carrier-state women with husbands infected with HBsAg or HBsAb, 21 (70%) were found to be eAg-positive. Eight (26.7%) of the 30 husbands had a history of acute viral hepatitis shortly after marriage and eAg was detected in the sera of all eight wives.

When the group in which HBsAg transmission had occurred (30 cases, 44.2%) is compared with that in which it had not (38 cases, 55.8%), the serum eAg detection rate among the wives was 8.8 times higher in the transmission-positive group. Furthermore, the serum eAb detection rate among the women was 3.6 times higher in the transmission-negative group.

The results of Okada *et al.* (1976) and of our earlier study (Inaba *et al.*, 1977) on vertical HBsAg transmission suggest that the presence of eAg in maternal sera may be a valuable indicator for predicting the potential for vertical transmission of hepatitis B virus (HBV). From our present findings we consider further that the presence of serum eAg in carrier-state wives may also represent an indicator for predicting the potential for transmission of HBsAg to their husbands. Since eight of 30 HBV-infected husbands had a marital history of acute viral hepatitis and that eAg was detected in the sera of all eight wives we suggest that husbands with eAg-positive wives should be followed up closely to detect hepatitis B at the earliest possible stage.

The present data confirm that transmission of HBsAg may be sexual and suggest that, in Japan, the transmission of HBsAg from carrier-state wives to

their husbands is an important route of HBV infection. Furthermore, our finding that 70% of the wives with HBV-infected husbands were eAg positive suggests that the e-system determination of carrier-state wives may be valuable in predicting the potential of sexual HBV infection.

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