

## **Hepatitis B serology in Greek prostitutes: significance of the different serum markers**

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### SUMMARY

One hundred and ninety-eight prostitutes (mean age 41·8 years) and 117 control women of low socio-economic class (mean age 43·8 years) were tested by solid-phase radioimmunoassay for hepatitis B surface antigen (HBsAg), its antibody (anti-HBs) and antibody to hepatitis B core antigen (anti-HBc). The prevalence of HBsAg was higher among prostitutes (11% *v.* 4%,  $P \sim 0\cdot06$ ). This difference was accounted for by the higher infection rate of prostitutes to hepatitis B virus (HBV) (97% *v.* 45%,  $P < 10^{-6}$ ), since the proportion of HBsAg carriers among those infected was practically the same between the two groups (11% *v.* 9%). Among the previously infected prostitutes who did not become carriers the majority (75%) were positive for both anti-HBc and anti-HBs, whereas among control women about half (52%) were positive only for anti-HBc.

### INTRODUCTION

Viral hepatitis B (HBV) occurs endemically in all parts of the world (Zuckerman, 1978) and is an important public health problem in Greece. The magnitude of the problem is reflected in the high prevalence of HBsAg among military recruits and other population groups (Trichopoulos *et al.* 1976; Papaevangelou *et al.* 1976). There is evidence that hepatitis B may spread between sexual partners (Hersh *et al.* 1971; Jeffries *et al.* 1973). Thus the prevalence of hepatitis B infection is very high among prostitutes (Papaevangelou *et al.* 1974) who could be considered as the group at the highest risk for sexually transmitted HBV.

The purpose of this study was to determine the prevalence of hepatitis B surface antigen (HBsAg) and its antibody (anti-HBs), as well as the antibody to core antigen (anti-HBc) in registered prostitutes of the Greater Athens area. The results were compared with those obtained from a sample of women matched for age and, as far as possible, socio-economic class, and the significance of the various HBV serological patterns was evaluated.

## MATERIALS AND METHODS

Blood samples were collected from 198 registered prostitutes of the Greater Athens area who were attending the Venereal Diseases Clinic of the Ministry of Social Services for periodic medical examination. Their ages ranged between 22 and 58 years (mean 41·8 years). Blood samples were also taken from 117 women of low socio-economic class, age range 21–60 years (mean 43·8 years) who served as controls. Blood samples were allowed to clot, the serum was separated the same day and stored at  $-20^{\circ}\text{C}$ . All samples were collected from March 1978 to March 1979.

Serological tests for the presence of HBsAg, anti-HBs and anti-HBc were performed by solid-phase radioimmunoassay Ausria II-125, Ausab, and Corab (Abbot, diagnostic division) respectively.

## RESULTS

The results are shown in Tables 1 and 2 and they are summarized in Table 3. Among the 198 prostitutes only 6 had no evidence of previous infection by HBV (3%) (Tables 1 and 3), whereas among the 117 controls 64 were negative for all HBV markers (55%) (Tables 2 and 3). The difference is statistically highly significant ( $\chi^2 = 110\cdot63$ ,  $P < 10^{-6}$ ) and indicates that prostitutes are indeed at a very high risk of infection by HBV.

Among the 192 prostitutes with evidence of previous infection by HBV 22 were carriers of HBsAg (11%). Among the 53 controls who were similarly infected by HBV, 5 were carriers (9%). The two proportions are practically identical, and the finding indicates that the only reason for the higher prevalence of HBsAg among prostitutes (11% *v.* 4%) is the correspondingly higher level of infection by HBV among them.

Among the infected prostitutes who did not become carriers three-quarters were positive for both anti-HBc and anti-HBs (128/170 or 75%) and less than one-quarter were positive for anti-HBc alone (40/170 or 24%). By contrast, among the corresponding group of control women more than half were positive only for anti-HBc (25/48 or 52%), whereas women positive for both anti-HBc and anti-HBs were about one-third of the total (18/48 or 38%). The difference was statistically highly significant ( $\chi^2$  with two degrees of freedom = 28·19;  $P < 10^{-3}$ ).

The prevalence of HBsAg decreased with age (Tables 1 and 2) although the trend was not statistically significant ( $\chi^2$  for trend with one degree of freedom calculated according to Mantel's (1963) method is 3·73;  $P \sim 0\cdot06$ ). The trend is more evident among prostitutes where the prevalence declines from 31% among women less than 30 years old to 5% among women older than 50 years. The prevalence of all infection markers (taken together) increases with age among prostitutes but decreases with age among controls, although in neither instance is the trend statistically significant ( $\chi^2$  with one degree of freedom is 2·14 and 1·93 respectively; in both instances  $0\cdot10 < P < 0\cdot20$ ).

Table 1. Serological markers of HBV infection among Greek prostitutes by age

HBsAg	Anti-HBc	Anti-HBs	20-9	30-9	40-9	50-9	Total
+	+	+	1	1	3	1	6
+	+	-	6	7	2	0	15
+	-	+	0	0	0	0	0
+	-	-	1	0	0	0	1
-	+	+	12	69	33	14	128
-	+	-	2	23	10	5	40
-	-	+	2	0	0	0	2
-	-	-	2	3	1	0	6
Total			26	103	49	20	198

Table 2. Serological markers of HBV infection among control women by age

HBsAg	Anti-HBc	Anti-HBs	20-9	30-9	40-9	50-9	Total
+	+	+	0	0	0	0	0
+	+	-	0	2	1	0	3
+	-	+	0	1	0	0	1
+	-	-	0	1	0	0	1
-	+	+	5	9	4	0	18
-	+	-	6	11	8	0	25
-	-	+	0	4	1	0	5
-	-	-	12	30	15	7	64
Total			23	58	29	7	117

Table 3. Hepatitis B serology among prostitutes and control subjects (grouped data)

	Prostitutes	Controls	Total
Active infection*	22	5	27
Anti-HBc only	40	25	65
Both anti-HBc and anti-HBs	128	18	146
Only anti-HBs	2	5	7
All markers negative	6	64	70
Total	198	117	315

\* Active infection is indicated by the presence of HBsAg with or without anti-HBs or anti-HBc.

#### DISCUSSION

The prevalence of HBV markers among male homosexuals and prostitutes has been studied in several countries including Greece (Papaevangelou *et al.* 1974; Ellis *et al.* 1979).

However, the sensitive RIA techniques for the detection of HBsAg, anti-HBs and anti-HBc were not available when the earlier studies were performed in Greece. The importance of prostitutes in Greece for the study of the epidemiology

of HBV stems from the fact that they represent a high risk group in a general population which is already at high risk of HBV infection.

The results of the present study confirm that prostitutes are at a very high risk for HBV infection, since 97% of the women of this group had serological evidence of previous infection by HBV compared with only 45% among control women. However, the proportion of HBsAg carriers among those previously infected by HBV was the same in the two compared groups, and this finding indicates that the co-factors which may affect the establishment or persistency of HBsAg carrier state are equally distributed among prostitutes and control women and are probably of an endogenous nature (Kaklamani *et al.* 1978).

Anti-HBc alone was present in 21% (40/192) of previously infected prostitutes and in 47% (25/53) of previously infected control women. Anti-HBc, the antibody to the inner core of the Dane particle and to the 27 nm viral nucleocapsid particle found in the nuclei of infected hepatic cells, appears during the period of HBV replication at about the time of onset of clinical symptoms. Its titre decreases after recovery but in chronic infections anti-HBc may be detectable for life (Hoofnagle *et al.* 1978a; Krugman *et al.* 1979). During the period between HBsAg disappearance and the appearance of anti-HBs, anti-HBc alone is detectable (Szmuness *et al.* 1976; Howard & Burrell, 1976). Therefore, the presence of anti-HBc alone is thought to indicate either active infection (Hoofnagle, 1978b; Omata *et al.* 1978) (in which case the titre of anti-HBc is usually high) or resolution from the chronic symptomless carrier state. However, the finding in the present study of a very high prevalence of anti-HBc alone, even among control women, makes it unlikely that this pattern is indicative of active infection and suggests that anti-HBc alone (particularly in low titres) may also be indicative of past infection.

The high prevalence among prostitutes of the serological pattern with co-existing anti-HBc and anti-HBs antibodies suggests that this pattern may indicate conditions of continuous exposure to HBV which favour frequent and repeated boosters for both antibody types. Szmuness *et al.* (1976) and others have demonstrated a close correlation between the level of risk and the prevalence of co-existing antibodies anti-HBc and anti-HBs.

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