Hepatitis B Infection in Health Care Personnel of an Institution for Mentally Handicapped Children and Adults

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The health care personnel (HCP) of an institution for the mentally handicapped were serially tested for the presence of hepatitis B surface antigen (HB_sAg) and antibody over a period of 1.5 years. HB_sAg was present in 1.8% and anti-HB_s in 20.8% of HCP. The prevalence of seropositive HCP appeared to be related to the age and the prevalence of seropositive residents cared for by the HCP. The occurrence of seropositivity was higher in the HCP who cared for children under 15 years of age, who demonstrated a high prevalence of HB_sAg or anti-HB_s. Although the prevalence of HB_sAg-positive subjects was 4- to 8-fold lower in HCP than in residents, the degree of seroconversion in susceptible seronegative HCP and residents was strikingly similar. These observations suggest that HCP working in a closed institutional setting are at considerable risk of contacting hepatitis B infection.

The occupational hazard of hepatitis B infection in health care personnel (HCP) has recently come to the forefront. Outbreaks of hepatitis B have been reported in hospital wards (1), laboratories (11), surgical theatres (10), oncology wards (18), and in hemodialysis units (2, 9, 14). These outbreaks have resulted in considerable morbidity and mortality both in patients and the medical staff (7).

Although certain epidemiological features of hepatitis B infection have been studied in schools for the mentally handicapped (4, 12), the precise magnitude and the characteristics of its spread in such environments remain to be clearly defined. In addition, the occurrence of hepatitis B virus infection in the employees of such institutions has not been evaluated in careful detail.

The present studies were undertaken to determine the extent of hepatitis B infection in HCP of a school for mentally handicapped children and adults. The characteristics of this infection relative to the extent of the infection in the resident population of patients were also investigated.

MATERIALS AND METHODS

Study population. The study population was drawn from the employees of an institution for mentally handicapped children and adults at West Seneca, N.Y. The institute has about 1,000 full-time employees. Of these, 332 subjects representing physicians, registered nurses, nurses aides, and person-

nel engaged in physiotherapy, occupational therapy, and dietetic services were recruited for the study. All subjects were directly involved in patient care and were prone to close contact with the resident population of patients. The subjects ranged from 20 to 60 years in age and the duration of their employment at the institution ranged from 6 months to 13 years. Approximately 74% of the subjects were females.

Hepatitis B infection is endemic in the resident population of about 2,000 patients in this institution. Approximately 10% of the existing patients have been found to be positive for hepatitis B surface antigen (HB_sAg) and 35% have been found to be positive for hepatitis B antibody (anti-HB_s) in the serum. In addition, many patients with chronic asymptomatic HB_sAg carrier state and recent clinical or subclinical evidence of HB_sAg infection have been found to shed, inconsistently, the HB_sAg in the external secretions.

Hepatitis testing. Specimens of serum were collected at regular intervals from all subjects and tested for HB_sAg, anti-HB_s, and serum glutamic pyruvic transaminase levels. The initial screening for hepatitis infection was carried out in July 1973 and subsequent retesting was done on two to six occasions 4 to 6 months apart over 1 to 1.5 years.

Specific HB_sAg activity in the samples was determined by counterelectrophoresis and solid-phase radioimmunoassay by using the Abbott Ausria II System (6). All specimens found to be positive for HB_sAg were subsequently confirmed by specific blocking procedures using human anti-HB_s (6).

Anti-HB_s activity was detected by passive hemagglutination using commercial reagents obtained from Electronucleonics, Bethesda, Md. (17).

RESULTS

The distribution of HB_sAg and anti-HB_s-positive and -negative subjects observed in the HCP on initial testing is presented in Table 1. About 2% of HCP were found to be HB_sAg positive in the serum and 20.5% were found seropositive for anti-HB_s. The remaining 78% of the HCP were seronegative for both HB_sAg and anti-HB_s.

The serological status of HCP relative to their sex, race, and past history of clinical hepatitis is presented in Table 2. Of the HCP who were positive for HB_sAg, 4.6% were males and 0.8% were females. All HB_sAg-positive HCP were Caucasians. HCP who gave a history of past clinical hepatitis had higher prevalence of HB_sAg than HCP without any past clinical evidence of hepatitis. The anti-HB_s activity was observed more frequently in the female HCP, regardless of the racial background. In addition, anti-HB_s activity was detected more frequently in HCP with a past history of clinical hepatitis. Thus, approximately 42% of HCP with prior history of clinical hepatitis had serological evidence of hepatitis B infection.

The serological status of the HCP relative to their present age and duration of employment is shown in Table 3. Highest frequency of HB_sAg and anti-HB_s was observed in those subjects who were over 25 years of age and in those who had been employed full-time at the institute for longer than 3 years.

Considerable variation existed in the distribution of HB_sAg and anti-HB_s in the HCP when viewed in terms of the serological status and age of the resident population cared for by the HCP. As shown in Table 4, 7.2 and 47.2% of residents under 15 years of age were positive for HB_sAg and anti-HB_s, respectively. Of the HCP involved in the care of this age group of residents, 3.5 and 40.5% were found to be positive for HB_sAg and anti-HB_s, respectively. On the other hand, the HCP involved in the care of residents over 30 years of age manifested significantly lower frequency of HB_sAg and anti-HB_s seropositivity, although the serological status of the resident population in this age group was strikingly similar to residents under 15 years of age (Table 4).

TABLE 1. Initial distribution of HB_sAg and anti-HB_s in HCP working in a school for mentally handicapped children and adults

Status ^a	No.	%
HB _s Ag+	6	1.8
Anti-HB _s +	68	20.5
HB _s Ag-anti-HB _s -	258	77.7

^a Symbols: +, Present; -, absent.

Sixty-six HCP and 534 existing residents who were initially found to be seronegative for HB_sAg and anti-HB_s and 77 newly admitted seronegative residents were retested sequentially for 1 to 1.5 years. A comparative follow-up evaluation manifested several changes in preexisting serological status in these subjects. Approximately 6% seronegative HCP developed HB_sAg in the serum and 13.6% developed seroconversion for anti-HB_s without any detectable antigenemia during the 1.5-year follow-up (Table 5). The remaining HCP continued to manifest no HB_sAg or anti-HB_s activity in the serum. A strikingly similar change in the preexisting serological status is observed in the new and existing seronegative resident population followed concurrently. Approximately 5% of new residents and 3% of existing residents manifested seroconversion for HB_sAg and about 20% of new residents and 12% of existing residents developed anti-HB_s activity. All other residents have continued to remain seronegative to date.

DISCUSSION

The initial survey of HCP in a closed institutionalized setting indicated that 1.8% of such subjects contain HB_sAg and about 20% have anti-HB_s in their serum. These values appear to be 5- to 10-fold lower than those observed for the distribution of HB_sAg-positive resident patients in the same setting. Subsequent follow-up testing revealed that approximately 6 and 13% of previously seronegative subjects manifested seroconversion for HB_sAg and anti-HB_s, respectively, when tested serially over a period of 1 to 1.5 years. The degree of seroconversion in seronegative HCP was remarkably similar to the incidence of seroconversion observed in a newly admitted susceptible seronegative and the existing seronegative resident population. Although the initial survey indicated a point prevalence rate of about 2% for HB_sAg and 20% for anti-HB_s in the HCP, subsequent follow-up testing demonstrated a seroconversion rate of 6% for HB_sAg and 13% for anti-HB_s in this population. The differences in the prevalence rates observed at different times suggest that hepatitis B infection exists in this population in a dynamic state, with continual acquisition of subclinical or occasional clinical infection in the susceptible seronegative subjects.

Recent studies have suggested that the frequency of HB_sAg in general hospital-based HCP is about 0.80% and 0.40% in non-health care (control) personnel (5). Its frequency in commercial blood donors ranges between 0.4 to 0.8% (13) and in personnel in hemodialysis units between 1.5 to 2% (14).

TABLE 2. *Distribution of HB_sAg and anti-HB_s in HCP in relationship to the sex, race, and prior history of clinical hepatitis*

Category	No. tested	HB _s Ag+		Anti-HB _s +		HB _s Ag anti-HB _s sero-negative	
		No.	%	No.	%	No.	%
Sex							
Males	87	4	4.6	11	12.6	72	82.7
Females	245	2	0.8	57	23.2	186	76.0
Race							
Whites	283	6	2.1	57	20.2	220	77.7
Nonwhites	49	0	0	11	22.5	38	77.5
Prior history of hepatitis							
Yes	24	2	8.3	8	33.3	14	58.4
No	308	4	1.3	60	19.5	244	79.2

TABLE 3. *Distribution of HB_sAg and anti-HB_s in HCP relative to their present age and the duration of employment in the institution*

Category	No. of subjects	HB _s Ag+		Anti-HB _s +		HB _s Ag Anti-HB _s seronegative	
		No.	%	No.	%	No.	%
Age (years)							
<25	64	0	0	5	7.8	59	92.2
26-35	112	5	4.5	25	22.3	82	73.2
36-45	54	0	0	11	20.4	43	79.6
>45	102	1	0.9	27	26.5	74	72.6
Duration of employment (years)							
<3	59	0	0	5	8.5	54	91.5
3-6	132	2	1.5	26	19.7	104	78.8
7-10	92	3	3.2	26	28.2	63	68.6
>10	49	1	2.0	11	22.4	37	75.6

TABLE 4. *Distribution of HB_sAg and anti-HB_s in HCP relative to the age and serological status of the residents cared for by the HCP*

Residents					HCP			
Age group	Total no.	HB _s Ag+ (%)	anti-HB _s + (%)	Seronegative (%)	Total no.	HB _s Ag+ (%)	anti-HB _s + (3)	Seronegative (%)
<15	110	7.2	47.2	45.6	84	3.5	40.5	56.0
16-29	231	14.3	48.8	26.9	97	2.0	25.7	72.3
>30	453	6.3	41.7	52.0	151	0.6	5.9	93.5

TABLE 5. *Comparative evaluation of hepatitis B infection in seronegative HCP and newly admitted seronegative and existing seronegative residents on follow-up testing*

Current serological status	HCP		New residents		Existing residents	
	No.	%	No.	%	No.	%
Seroconversion for HB _s Ag	4	6.0	4	5.2	18	3.3
Seroconversion for anti-HB _s	9	13.6	16	20.8	64	12.0
Remained HB _s Ag and anti-HB _s negative	53	80.4	57	74.0	452	84.7
Total seronegative population studied	66	100	77	100	534	100

The observation presented in this report suggest that HCP in a closed institutionalized environment are exposed to the risk of hepatitis B infection to the same magnitude as the staff and patients in hemodialysis units and in oncol-

ogy wards. However, unlike dialysis and oncology units, in which the transmission of infection is thought to occur via the parenteral routes, through the therapeutic use of blood or blood products, or contamination in the dialysis

equipment (7), the route of hepatitis B infection in HCP in institutions for the mentally handicapped remains to be clearly elucidated.

With the introduction of disposable needles and syringes and improvement in administration of parenteral medications in such institutions, the risk of hepatitis B infection should have disappeared or decreased considerably, particularly among HCP. On the contrary, the present data suggest that hepatitis B infection occurs frequently in the personnel involved in direct patient care in this institution. It is possible that HCP may be exposed via a parenteral route (through small breaks in the skin) by direct contact with blood or blood products of infected resident patients. Several recent epidemiological studies have observed familial clustering of HB_sAg in spouses and siblings of asymptomatic carriers, HB_sAg-positive blood donors and antigen-positive patients with chronic liver disease (3, 15). In addition, the presence of HB_sAg in the secretions of external mucosal surfaces has been suggested by several investigators (8, 16, 19; M. L. Tikku, B. L. Kaul, R. I. Ramirez, and P. L. Ogra, *Abstr. Annu. Meet. Am. Soc. Microbiol.* 1975, S99, p. 230). Villarejos et al. (16) have demonstrated the presence of HB_sAg in droplets of nasopharyngeal secretions of antigen-positive patients in endemic states and have raised the possibility of infection via the respiratory tract. The presence of HB_sAg in the secretions of infected subjects may be an effective outlet for natural exposure to the antigen in susceptible HCP in such institutions.

It is interesting that the prevalence of HB_sAg and anti-HB_s was notably higher in HCP involved in the care of residents under 25 years of age. The residents in this age group have poor toilet training, fecal and/or urinary incontinence, and poor oro-dental hygiene. The HCP caring for children frequently have more intimate physical contact with the residents than HCP looking after adults and older subjects. The role of these epidemiological factors in the spread of hepatitis B infection in such segments of the HCP may be quite significant. However, their precise contribution in this population of HCP remains to be determined.

In light of the magnitude of serological evidence of hepatitis B infection in the present population, it is apparent that specific precautionary measures need to be instituted to safeguard the welfare of personnel in this institution and in similar institutions elsewhere. It would be desirable to test regularly such HCP for HB_sAg and anti-HB_s. An attempt should also be made to place the HB_sAg-positive resident patients in an environment where they are

unlikely to transmit the infection to susceptible seronegative HCP and other patients. In the near future it may be possible to provide specific passive immunoprophylaxis with hepatitis B gamma globulin and immunization with hepatitis B vaccine in susceptible employees.

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