

Hepatitis B Virus Transmission in a Public School: Effects of Mentally Retarded HBsAg Carrier Students

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Abstract: In 1980, 18 institutionalized children, carriers of hepatitis B virus (HBV), were enrolled into two special education schools, and staff and students were monitored for HBV markers. Eleven HBV exposures were observed and those exposed were given hepatitis B immune globulin. After 3.5 years, no remaining staff showed serological evidence of HBV infection but three of 61 susceptible students did so. The three students probably acquired the infection outside the school. At the conclusion of the project, one

school located in the community decided not to institute a vaccine program for students or staff. The other school, located inside the mental retardation institution, established an organized vaccine initiative. Indications for use of hepatitis vaccine in schools should be individualized to accommodate for differences in student and staff interaction, physical design of the school, and number and behaviors of HBsAg carrier students. (*Am J Public Health* 1987; 77:476-478.)

Introduction

Mentally retarded residents of large institutions are often chronic carriers of hepatitis B virus (HBV).¹ Community placement of these carriers has understandably caused concern that HBV would spread within the community. Public school officials have been especially concerned because their programs may allow for close personal interaction between students and staff.²⁻⁵

Since 1980, we have prospectively studied HBV transmission in two schools that have integrated carrier mentally retarded students into their educational programs. After a 14-month period of study, we reported a 1.8 percent incidence of HBV acquisition among peer students and no occurrence of hepatitis B infection among school staff.⁶ Now, 3.5 years since the project began, we report the final results of this study.

Methods

In September 1980, 18 institutionalized hepatitis B surface antigen (HBsAg) carrier mentally retarded students, ages 5-18 years, were placed in one of two public school special education programs. One school was located on the campus of the institution whose 900 residents lived in 50 cottages located on 400 acres. Its programs for 90 profoundly handicapped individuals employed 47 staff. The community school, with programs for educable, trainable, and profoundly mentally handicapped students had 78 staff and 185 students. During the study, an educational program instructed all staff regarding prevention of hepatitis B infection. Any situation of potential HBV exposure was evaluated; if indicated, hepatitis B immune globulin (HIGB) was administered according to the manufacturer's recommendations.

At the beginning of the project, serum was obtained by venipuncture from staff and students in both school locations and assayed using radioimmunoassay (ABBOTT Laboratories, North Chicago, Illinois)* to determine HBsAg, antibody to the surface antigen (Anti-HBs), antibody to the core antigen (anti-HBc), hepatitis B e antigen (HBeAg), and antibody to the e

antigen (anti-HBe) in HBsAg positive students. At 14 months and 3.5 years later (May 1984), serum was again obtained from staff and students who had participated in the initial screening. In 1980, HbcAb was performed only on those persons with low anti-HBs levels (less than 15 sample ratio units). For both screenings, persons with low anti-HBs levels were considered anti-HBs negative. Tests were performed by the Division of Viral Diseases, Center for Infectious Diseases, Centers for Disease Control, Atlanta. Based on the findings of both serum assays, staff and students were grouped into the following categories: immune (anti-HBc positive, HBsAg negative), carrier (HBsAg positive, anti-HBc positive), susceptible (anti-HBc negative, anti-HBs negative), and seroconverter (susceptible in 1980 and anti-HBc positive in 1984).

During the monitoring period, students and staff were allowed to transfer freely to either school. Total number of staff and students in each school for each year was recorded but individual classroom assignments for all students were not concurrently recorded during the study and could not be reliably retrieved at the conclusion of the study. Individuals who seroconverted were investigated regarding student classroom assignments, school activities, and environmental details of their home residence. A behavioral checklist was used to describe usual and aberrant behaviors of HBsAg carrier students. The classroom assignments of aggressive or biting carriers were available and were correlated with the assignments of seroconverter students.

Results

Of the 122 participating staff in 1980, 56 (46 per cent) were still employed and 45 agreed to participate in the follow-up study. Thirty of the 45 worked in the community school and 15 worked in the institutional school. Of the 252 participating students in 1980, 151 (60 per cent) still attended either school and 117 participated in the 1984 study. Non-participating staff, students, or parents of students felt the study did not benefit them, or objected to the discomfort of venipuncture. Administrators and staff were not aware of the departure of any staff or student from the school because of illness or problems related to hepatitis.

In 1980, there were 18 carrier students placed in the schools and 13 remained enrolled at the conclusion of the project. Initially, seven carriers attended the community school and 11 attended the institutional school but, at the conclusion of the project, only two carriers attended the community school and 11 attended the institutional school. Paired sera were obtained on 11 carriers; one of these lost

*Use of trade names is for identification only and does not indicate endorsement by the Public Health Service or the US Department of Health and Human Services.

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TABLE 1—Summary of Behaviors of HBsAg+ Students (n = 11)

Skill Level	Yes	No
Independent feeding ability	11	0
Care for self at toilet	6	5
Care for own menstrual needs	1	0
Able to dress/undress self	7	4
Brush own teeth	5	6
Ambulatory	10	1

Behaviors	Never	Occasionally	Frequently
Dropoling	8	2	1
Biting	10	1	0
Self-injurious behavior	6	4	1
Aggressive toward others	6	3	2
Interpersonal behaviors (kissing, touching, etc.)	3	6	2
Urinary or fecal incontinence	4	3	4

TABLE 2—Summary of Paired Serum Data Obtained during Monitoring Period for Staff and Students from Both Schools

		1980 Screening Results			
1984 Screening Results		HBsAg+	HBsAb+	HBsAb-	HBsAB+ HBcAb-
Staff (n = 45)	HBsAg+				
	HBcAb+ HBsAb+	1	3		
	HBcAb- HBsAb-			40	
	HBcAb- HBsAb+				1
	HBsAg+	10			
Students (n = 117)	HBsAg+	10			
	HBcAb+ HBsAb+	1	38	2	
	HBcAb- HBsAb-			57	1
	HBcAb- HBsAb+				1
	HBcAb- HBsAb+ (vaccine)			7	

HBsAg and was no longer a carrier, and seven were HBeAg positive. Of the remaining 10 carriers (HBsAg positive), six attended the institutional school throughout the study, three attended the community school for the first 2.8 years then transferred to the institutional school, and one attended the community school continuously. Results of a behavioral checklist completed by teachers on the carriers are summarized in Table 1. Five were reported to be either frequently or occasionally aggressive, and one of these was an occasional biter. The mean age of these 11 carriers was 18.5 years (range 12.0 to 20.0 years) and 10 were male. The level of retardation was profound in 10 and moderate in one.

Table 2 outlines the screening results for staff and students obtained in the 3.5 year follow-up. Of 68 susceptible students, 14 attended the institutional school and 52 attended the community school; their mean age was 15 years (range 9–22 years). Seven susceptible students received hepatitis B vaccine because they lived in an institution which initiated a vaccination program beginning in 1982. Of the remaining 61 susceptible students, two seroconverted to immune status during the study

and one student seroconverted in 1981, was detected in the 14-month survey, but did not participate in the 1984 screen. Of 40 susceptible staff, there were no seroconversions. The seroconversion rate during the study period for students and staff was 4.9 per cent and 0.0 per cent, respectively (S.E. = 2.3 per cent). During the 3.5 year period, 267.2 person-years (includes 1981 survey data, and includes a five-week period of summer vacation each year) of contact with HBsAg carrier students were recorded for susceptible peer students. This represented a seroconversion rate of 89.1 years of school exposure or 0.85 per cent per year seroconversion among susceptible students. Similarly, 170.3 person-years of exposure to the school environment were recorded for susceptible staff and no staff demonstrated seroconversion.

The three students who seroconverted lived in the institution. One attended the community school and two attended the residential school. One student seroconverted during the last 1.5 years of the study. He had no history of illness suggesting hepatitis B, but review of his living unit at the institution revealed that six of his 21 roommates were hepatitis B carriers. No aggressive or biting HBsAg carriers were in his class during the first three school years but, during the last year, an occasionally aggressive and frequently spitting carrier student was in his classroom. His school experience, however, was unremarkable regarding any reported blood, serum, or secretion exposures from HBsAg carrier peer students. Two students seroconverted during the first two years of the study. They also lived in cottages that had carrier roommates. For one student, a chronic epidemic of skin abscesses in the residential cottage may have allowed transmission of the HBV. During the two-year period when he seroconverted, this student was assigned to a classroom that included an aggressive or biting carrier student. There were no classroom or school exposures reported for this student, however. The student living in the other cottage was placed in classrooms containing only immune or susceptible classmates and had no known classroom contact with or exposure to a carrier student.

During the study period, there were 11 documented behavioral events which were judged by the physician-authors to be significant exposures by staff or students to HBV; HBIG was given after each event. These episodes included two bites, three saliva to mucosal exchanges, and six events of scratching. Of the 11 exposures, repeat blood testing in seven showed no seroconversion one year after HBIG administration. Of the remaining four, one refused follow-up testing and three were no longer employed at the school. All four were interviewed by telephone and they reported no history suggestive of hepatitis illness.

Discussion

The behaviors and skill levels of the carrier students were predominantly the usual behaviors associated with mental delay and were not behaviors expected to transmit HBV. However, aggressive behavior and history of biting were the two most troublesome behaviors which led to exposure situations and to the subsequent use of gamma globulin administration. Mid-way into our study, HBV vaccine became available and a vaccination program was routinely begun inside the institution for all susceptible residents; this helped in protecting seven students in the late phase of this study. No staff in either school received the vaccine and gamma globulin use was thus an essential component of the prevention program for both of these schools.

We found no clear evidence of hepatitis B virus transmission from carrier students to either peer students or to staff in

the public school classroom. This confirms our preliminary observations and suggests that, in this school program, customary educational services were provided without undue risk of transmission of HBV and without implementation of a comprehensive hepatitis B vaccination program.

It should be emphasized that, throughout this project, we maintained an ongoing inservice program to educate all staff regarding the potential risk, not only for the spread of hepatitis B, but for other infectious diseases. Staff were fortunate to have reasonable access to classroom sinks and ample supplies to facilitate hand washing. Also, throughout the project, vigilance was maintained regarding potential hepatitis B exposures and HBIG was offered when clinically significant exposures occurred.

Because of high staff turnover and student turnover, the final monitoring did not include a significant number of the initial cohort of staff and students. It is possible that some seroconverters were thus missed, but our review of staff and student reasons for non-participation indicates that seroconverters were equally likely to be in either group.

For the three students who seroconverted, epidemiologic information suggests that their acquisition of HBV infection was due to living in the residential institution rather than attending the school program. HBV is endemic to most residential institutions and has been documented inside this institution. However, two of the seroconverters were in classrooms with an aggressive or biting student and, although no exposures were reported, HBV transmission from these carriers is a possibility.

Interpretation of our data was confounded by the problem of not knowing precisely to what extent students had physical contact with each other or with staff. Over the period of study, class and school assignments changed and inter-class activities also varied depending on changes in curriculum. Most important of these changes was the movement of carrier students so that, by 1984, all but two carriers were attending the institutional school. Susceptible students and staff attending the community school thus had less exposure to carrier students than staff and students in the institutional school. It was not possible to accurately retrieve individual student and staff assignments for the duration of the study. The pooled data thus contains persons with minimal and maximal exposure to carrier students although the majority had minimal exposure.

The spread of hepatitis B in public schools and other programs providing care to mentally retarded persons has been reported.^{2,7-10} Breuer, *et al.*,¹⁰ have also monitored the long-term risk for hepatitis B transmission once identified carriers were integrated into an educational program. Their study involved a larger number of HBV seronegative students and school staff who had contact with developmentally delayed HBV carriers during four years in 68 New York City public schools. Seroconversion rates for staff and students in classes with carrier students was higher than in classrooms without HBV carriers. The authors concluded that there was a significant risk of HBV transmission from these carrier students.

The Centers for Disease Control recommends hepatitis B vaccination for susceptible staff and residents in institutions or in smaller facilities where mentally retarded HBsAg carriers live.¹¹ These facilities presumably include community-based residential, group and foster homes. However, there are no specific recommendations pertaining to agencies providing only day services. These day programs often have less prolonged and intimate interaction with carriers. Such agencies may be reluctant to consider hepatitis B vaccination because of limited

funds, high staff or client turnover rate, or failure to appreciate the medical and social costs of hepatitis B disease.^{12,13}

An option for these agencies is to first determine the number, behaviors, and the potential infectivity of participating HBsAg carriers. Behaviors associated with infectiousness include aggressive behavior, biting, scratching of chronic skin lesions, and other activities which allow significant environmental contamination with secretions, blood, or sera.^{2,5,7,14-16} Presence of HBeAg is also clearly associated with increased infectivity.¹⁷ If HBV carriers have behaviors associated with transmission, and especially if carriers are HBeAg positive as well, then limited or comprehensive use of hepatitis B vaccine should be offered to persons having close physical contact with the carriers.

The presence of mentally retarded hepatitis B carriers in day service programs requires careful individual scrutiny to assess the potential risk of hepatitis B virus transmission. Due to the heterogeneity of these programs, global recommendations regarding use of hepatitis B vaccine do not seem prudent. Agencies providing day services to hepatitis B carriers should review their program in light of current knowledge about hepatitis B virus transmission and its prevention by vaccination.

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