Hepatitis B Surface Antigen in Saliva, Impetiginous Lesions, and the Environment in Two Remote Alaskan Villages

NORMAN J. PETERSEN,* DAVID H. BARRETT, WALTER W. BOND, KENNETH R. BERQUIST, MARTIN S. FAVERO, THOMAS R. BENDER, AND JAMES E. MAYNARD

Phoenix Laboratories Division, Center for Disease Control, Phoenix, Arizona 85014,* and Alaska Activities, Bureau of Epidemiology, Center for Disease Control, Anchorage, Alaska 99501

Received for publication 28 June 1976

A study was conducted in an area of hepatitis B hyperendemicity to determine whether contact with infective bodily secretions or contaminated environmental surfaces could be involved in the transmission of the hepatitis B virus. Hepatitis B surface antigen was detected in gingival swab, saliva, and impetiginous lesion exudate samples from children. Hepatitis B surface antigen also was found in swab samples of surfaces frequently touched or placed in the mouth. In the absence of classical exposure to infectious blood or blood products, these findings suggested that, in a crowded home environment, saliva and cutaneous exudates containing hepatitis B virus may play a role in the transmission of hepatitis B.

Epidemiological and serological studies in two remote Alaskan villages revealed an unusually high (55%) overall rate of infection with hepatitis B virus (HBV) among native residents. A high (55%) prevalence of antibody to hepatitis B surface antigen (HB,Ag) in adults coupled with a 46% prevalence rate of HB,Ag in the group consisting of persons 0 to 10 years old in one village suggested that infection was acquired during childhood. A subsequent study of the e determinant system confirmed hepatitis B hyperendemicity in the area (4a). In the absence of the more common methods of exposure to contaminated blood or blood products usually associated with the transmission of hepatitis B, it was suspected that other routes of transmission might be involved. These included some obscure possibilities for contact, perhaps environmentally mediated, with infective bodily secretions such as saliva or cutaneous exudates. To determine whether additional supporting evidence of such transmission could be documented, saliva, impetiginous lesions, and environmental surfaces were sampled and assayed for the presence of HB,Ag. Positive results from a significant number of samples confirmed that in these villages the opportunity for transmission of hepatitis B by other than classic routes does exist.

MATERIALS AND METHODS

The study was conducted in Lower Kalskag (population, 206) and Akiachak (population, 332), two isolated Eskimo villages located on the Kuskokwim River northeast of Bethel, Alaska. In both villages families reside in small, two- or three-room dwellings, most of which are served by indoor running water from a community supply. Most homes in Lower Kalskag are equipped with flush toilets, whereas more-primitive means of waste disposal are used in Akiachak. Crowding and the absence of good personal hygiene were evident in most homes in both villages. Modern, well-maintained elementary schools are located in each village.

To determine whether HB,Ag was present in oral secretions of seropositive individuals, the buccal and lingual gingiva of each of 25 schoolchildren in Lower Kalskag were rubbed gently with a sterile cotton swab. Each swab was immediately rinsed by swirlingly the cotton tip in 1 ml of 1% bovine serum albumin in normal saline (BSAS). The BSAS contained 0.1% sodium azide to suppress bacterial multiplication. Excess fluid was expressed from each swab on the inside of the 1-dram screw-cap vial containing the rinse fluid, the swab was discarded, and the capped vial was frozen (−30°C). Six months later, saliva samples were obtained from 38 Lower Kalskag schoolchildren by rubbing the tongue of each with a lemon-glycerine swab to stimulate salivary flow and extracting approximately 2 ml of saliva from beneath the tongue with a sterile medicine dropper. The saliva was placed in a screw-cap vial containing sodium azide to effect a 0.1% final concentration. Capped vials were kept frozen until assayed in the laboratory. Impetiginous lesions on three different children were swabbed, the swab tips were rinsed in BSAS, and the samples were frozen in a manner identical to that described for gingival swabs. A blood specimen was obtained from each individual whose saliva or lesion was sampled.

Swab samples were collected from surfaces of inanimate objects in the schools in both villages, in nine homes in Lower Kalskag, and in seven homes in Akiachak. Eight homes in Lower Kalskag and the seven Akiachak homes were selected for sampling on the basis of having had at least one HB,Ag-
positive resident during a serological survey 6 months earlier. One home in Lower Kalskag in which all residents had been HBsAg negative in two previous serological surveys was sampled as a control. Surfaces frequently handled or placed in the mouth were selected and sampled by rubbing and rotating a sterile cotton swab, moistened in BSAS, over the surface. The swab tips were rinsed, and the rinse fluid was frozen in a manner identical to that described previously.

In the laboratory, samples of rinse fluid and saliva were thawed and tested for HBsAg by a radioimmunoassay (RIA, Ausris-I, Abbott Laboratories) and for occult blood by using Hemastix (Ames). Serum samples were tested for HBsAg, and all HBsAg-positive samples were confirmed by specificity analysis using antibody to HBsAg.

RESULTS

Seventeen of the 25 (68%) children in Lower Kalskag from whom gingival swabs were obtained were seropositive for HBsAg. The swab rinse fluids from 15 of these 17 (88%) seropositive children were also positive for HBsAg, while occult blood was not detected in any of the gingival samples. In the second survey 30 of 38 (79%) children from whom saliva was collected were HBsAg seropositive. Five saliva samples contained occult blood and were eliminated from the analysis of test results. Thirteen of the 25 (52%) blood-free saliva samples from seropositive children were positive for HBsAg.

Two of three swab samples of impetiginous lesions were positive for HBsAg, as were serum samples from these two individuals. Both the swab sample from the impetiginous lesion and the serum from the third individual were HBsAg negative. Neither of the two HBsAg-positive swab samples contained occult blood.

A total of 431 swab samples of environmental surfaces were collected and assayed. Sixteen (3.7%) samples were positive for HBsAg. The locations from which these samples were obtained are presented in Table 1. All samples positive for HBsAg were negative for occult blood, although blood was detected in 1.5% of the total surface samples. The items on which positive surfaces were detected are summarized in Table 2. Ten of the 16 HBsAg-positive samples were from surfaces predominantly associated with children.

DISCUSSION

The occurrence of HBsAg in saliva has been reported by several investigators (6-8); however, in the absence of occult blood, the precise mechanism by which HBsAg enters the saliva is not known. It has been suggested that HBsAg might enter the mouth in crevicular fluid (2), which originates at the root-capillary interface, is expressed at the gum line, and contains serous material. In this study, the prevalence of HBsAg in gingival swab rinse samples (88%) from HBsAg seropositive children was significantly higher (P < 0.05) than the prevalence in saliva samples assayed directly (52%). Because the two types of samples were not collected simultaneously, a variety of factors might explain this difference. If the difference is not an artifact, one interpretation would suggest that HBsAg is concentrated at the gum line and, therefore, more easily detected by the swab-rinse technique than by direct assay of saliva. This interpretation would support speculation that HBsAg and, probably, HBV enter the mouth in crevicular fluid, which subsequently becomes mixed with saliva.

The three swab samples of impetiginous le-
lemons constitute an admittedly small sample; however, the absence of occult blood in the two HBsAg-positive samples suggested that the serous fluid itself contained HBsAg. This implied that exudates from other cutaneous lesions may also contain the HBV.

HBsAg is very stable on surfaces under a variety of environmental conditions (3). Although its presence on a surface does not necessarily indicate the presence of viable HBV, it does suggest previous contamination of the surface with infectious material. Consequently, the technique of surface swab sampling has been used to elucidate potential routes of hepatitis B transmission in hemodialysis centers (4). The detection of HBsAg on surfaces in the homes and schools in these two Alaskan villages demonstrated that potentially infectious material had contaminated a variety of surfaces, many of which offered a common point of contact for several individuals. The absence of occult blood in the HBsAg-positive samples, as well as the observation that the involved surfaces (i.e., baby bottles, toothbrush racks, cup) were subject to contact with oral secretions, indicated that saliva may have been the source of contamination.

It has been suggested that crowded living conditions frequently associated with poor socioeconomic groups facilitate the transmission of hepatitis B (1, 5). Epidemiological data from these two villages supported this proposal, since significantly higher infection rates were found in homes with an HBsAg carrier than in homes with no carrier, and larger households showed a significantly higher proportion of infected members than smaller households. The positive findings in this study suggested a means by which transmission may have occurred. In a crowded environment where personal contact and the common use of blankets, eating utensils, and toys are enhanced, saliva and cutaneous exudates containing HBV may play a role in transmission of hepatitis B, possibly through contact with nonintact skin surfaces or oral mucosa.

LITERATURE CITED