

Patient-to-Patient Transmission of Hepatitis B in a Dermatology Practice

ABSTRACT

Objective. The purpose of the study was to investigate infection with hepatitis B virus (HBV) and human immunodeficiency virus (HIV) among patients in a dermatology practice.

Methods. Historical cohort, matched case-control, and cross-sectional survey methods were used.

Results. The age-specific incidence of reported HBV infection in the practice from 1985 through 1991 was more than 12 times the expected rate. The dermatologist was not an HBV carrier. He practiced neither universal precautions nor sterile surgical technique. Seroprevalence of markers for HBV infection was highest (36.8%) among patients who had had surgery on the same day that HBV was apparently acquired by an index case; seroprevalence was near the expected background level for patients not exposed to index cases. Of HBV-infected patients with known dates of onset, 72% had had surgery during their incubation periods. All of 30 HBV antigen specimens tested were of the same subtype. None of the patients tested, including 74 patients exposed to surgery on the same day as a patient with acquired immunodeficiency syndrome, had evidence of HIV infection.

Conclusions. HBV, but not HIV, was transmitted from patient to patient by the dermatologist's failure to apply either universal precautions or sterile surgical technique. (*Am J Public Health*. 1993;83:1689-1693)

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Introduction

Concerns regarding the risk of acquiring hepatitis B virus (HBV) and other blood-borne infections during medical and dental procedures have increased owing to the epidemic of acquired immune deficiency syndrome (AIDS) and apparent transmission of the human immunodeficiency virus (HIV) in a dental practice.¹ Transmission of HBV in health care settings is much more common than transmission of HIV. Outbreaks of HBV infection have resulted from transmission of the virus from infected health care workers to their patients,²⁻⁴ and patient-to-patient transmission has been described in nosocomial outbreaks⁵⁻⁷ and in alternative-care settings, such as acupuncture clinics.⁸⁻¹⁰ In this report, we describe a large outbreak of HBV infection that was the first identified as resulting from patient-to-patient transmission in a conventional outpatient medical practice.

In September 1991, public health officials in Lee County, Florida, recognized that eight patients with acute HBV infection reported since 1985 had visited a Fort Myers dermatologist prior to onset of their disease. The dermatologist had no history of acute hepatitis or hepatitis B immunization. In 1987, he was found to be hepatitis B surface antigen (HBsAg) negative and hepatitis B surface antibody (HBsAb) positive, indicating that he was not a carrier but had been previously exposed to HBV. Patient records indicated that he had seen more than 10 000 patients since 1985, most of whom were White and older than 54 years of age.

Although the investigation was initiated by reports of HBV-infected patients, there was concern that HIV may have been transmitted as well.

Methods

Practice Evaluation

The dermatologist was interviewed regarding office practices and procedures, and he was instructed regarding universal precautions to control the spread of HBV and other blood-borne disease.¹¹ He was subsequently observed with 16 consecutive patients by one of the authors (W. G. H.) to determine whether universal precautions were being followed. Office autoclaves were tested for proper timing, temperature, and pressure.

Incidence Study

Only records for active patients and patients whose charts had been open in 1985 or later were available for review. Chart review identified all of the dermatologist's patients who had been reported to the Lee County Public Health Unit with acute HBV infection from January 1985 through September 1991, including those for whom exposure to the dermatologist was not mentioned in the original case reports. The findings were used to calculate the proportion of all reported cases of acute HBV infection who were patients of

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the dermatologist and to estimate the incidence of reported cases in his practice.

Case-Control Study

Early in the course of the investigation, we conducted a case-control study to test the hypothesis that HBV-infected patients were more likely than other patients to have had a surgical procedure during the incubation period of the disease (45 to 180 days before onset of symptoms). Case patients were persons reported with acute HBV infection with a known date of onset for whom treatment records were available from the dermatologist. Three randomly selected control patients with available treatment records were matched with each of 20 case patients by age (\pm 10 years) and year of visit—that is, controls visited the dermatologist at least once during the same year that the corresponding cases acquired their infections. The control patients were randomly selected from among patients of the dermatologist who were not reported with hepatitis B.

Relative risk was estimated by the matched odds ratio (OR) with a 95% confidence interval (CI).¹² The probability (P) that the observed matched odds ratio might have occurred by chance was obtained by stratified Mantel-Haenszel analysis, with each stratum consisting of one case and three matched controls.¹³

Cross-Sectional Study of HBV Seroprevalence

On the basis of the results of the case-control study, we defined patients at high risk of exposure as those who had had surgery within 1 day of surgery on HBV-infected patients during their incubation periods and those who had had surgery on the day of or the day after surgery on HBV-infected patients subsequent to their incubation periods. Nearly all of the surgical procedures consisted of excisional biopsies, but no appointment records were available for years prior to 1991; therefore, most of the high-risk patients were identified through pathology reports, which indicated the date on which a surgical specimen was submitted. High-risk patients were notified individually by mail of the possibility that they had been exposed to HBV and “other blood-borne disease” and were urged to appear for testing. In addition, media publicity attracted a large number of patients for testing who had not been identified as high risk. All patients who appeared for testing were offered tests for HBsAb, HBsAg, and antibodies to HIV.

Testing was provided free of charge from November 7 to December 18, 1991. Sera were screened for HBsAg and HBsAb with standard enzyme immunoassay reagents (Abbott Laboratories). Positive HBsAg results were confirmed by virus neutralization. In addition, the HBsAg in specimens from 30 patients—selected because they had known dates of onset or documented exposures to other infected patients—were subtyped, using monoclonal antibodies with restricted specificity in an enzyme immunoassay.¹⁴ Screening for antibodies to HIV was also performed by enzyme immunoassay (Genetic Systems).

Informed consent was obtained for all testing, and pre- and posttest counseling was given to all patients who consented to be tested for HIV. All patients with positive test results were interviewed regarding hepatitis B vaccination, compatible clinical illness, onset dates, and possible risk factors, such as blood transfusions, injection drug use, male homosexuality, and contact with an infected family member or sexual partner.

The test results from patients without a history of hepatitis B vaccination were used to calculate prevalence of serum markers for infection for several categories of exposure. Only patients with a single exposure in a single given category were included in these calculations, with one exception—all unvaccinated patients not identified as being at high risk of infection were included in a comparison group, regardless of the number of times they were seen in the practice. Standard methods based on the binomial probability distribution were used to calculate confidence intervals for prevalence and to test the significance of differences in prevalence ratios between categories.¹⁵

A number of patients were tested by private health care professionals. Because not all results were reported to us, patients tested privately who did report their positive results to us were included in case counts but were not included in the calculation of prevalence ratios.

Cross-Sectional Study of HIV Seroprevalence

Local AIDS surveillance staff searched patient files in the dermatology practice to find records for patients who had been reported with AIDS and to abstract their treatment histories. Patients who had had surgery on the day of or the day after surgery on a patient with AIDS were identified as being at high risk of exposure to HIV. These patients were then

notified and tested in exactly the same manner described above.

Results

Reported Incidence

A total of 30 of the dermatologist's patients were reported with acute HBV infection from 1985 through 1991. Twenty-three were older than 54 years at the time of diagnosis, representing 52% (23/44) of all HBV-infected patients reported from Lee County in that age group. The estimated incidence of reported HBV-infected patients older than 54 years in the dermatology practice was 71.8 per 100 000 person-years, more than 12 times the rate of 5.9 observed for the same age group in the county as a whole during the same period.

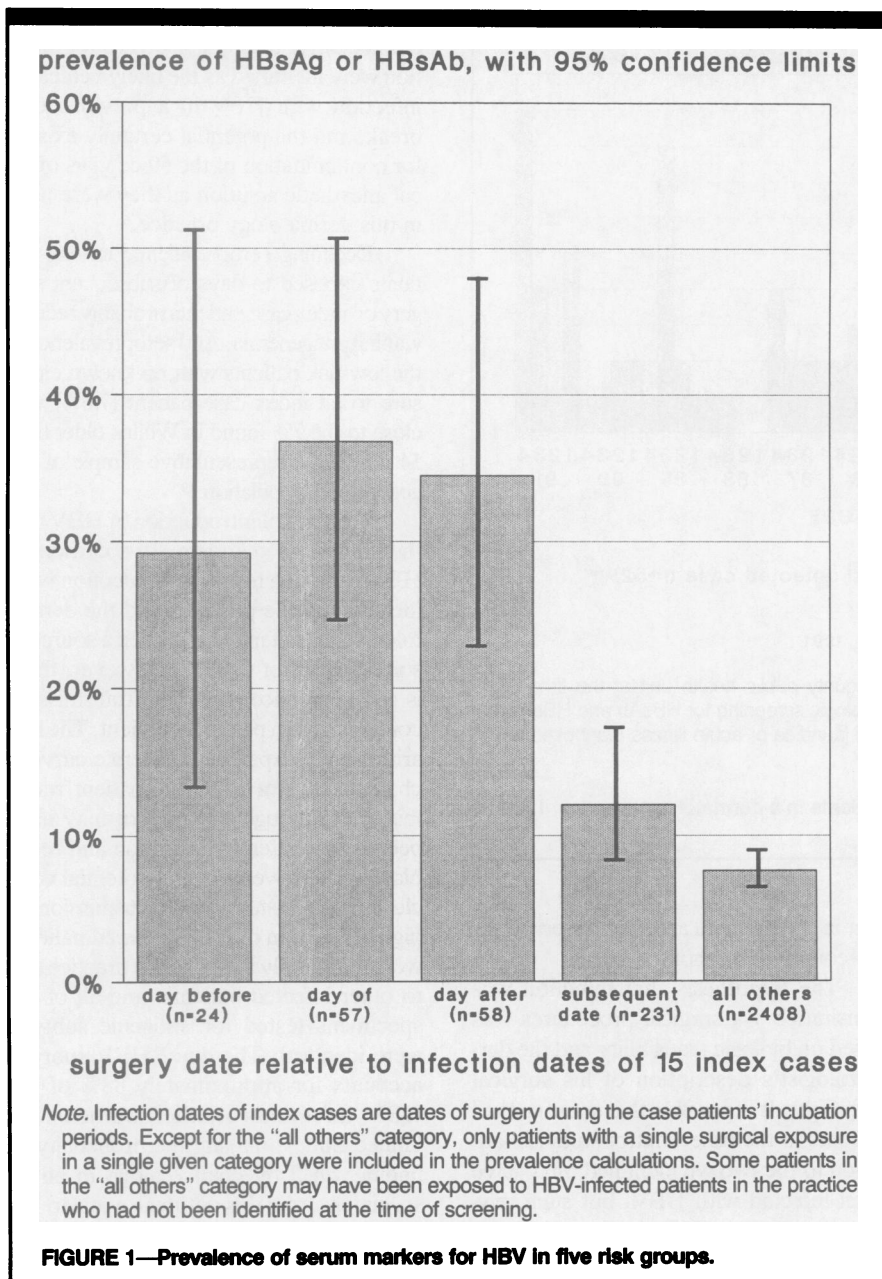
Case-Control Study

Eighty percent (16/20) of the case patients and 40% (24/60) of the matched control patients had had surgery during the case patients' incubation periods (matched OR = 9.00; 95% CI = 1.82, 44.45; P = .003). Subsequently, six of the control patients appeared for screening; two were identified as having been infected with HBV. Neither had a known date of onset, and both had had surgery in the practice during the incubation periods of their matched case patients. When these two control patients were deleted from the analysis, the matched OR was 9.33 (95% CI = 1.93, 45.04; P = .002).

Cross-Sectional Study of HBV Seroprevalence

Surgery dates of 22 HBV-infected patients (index case patients) were used to identify a total of 736 patients as being at high risk of infection. Four hundred (54%) of these high-risk patients, excluding those who had received hepatitis B vaccine, were tested for HBsAb and HBsAg. Twenty percent (80) tested positive by one test or the other, compared with 7.6% (183) of 2408 other unvaccinated patients who appeared for testing as a result of media publicity or because they were identified as high risk only for infection with HIV (risk ratio = 2.63; 95% CI = 2.07, 3.35; P < .01).

The seroprevalence results were further divided into five categories of exposure, shown in Figure 1. Seroprevalence of markers of HBV infection was highest, at 36.8% (95% CI = 24.7, 50.7), among those patients who had had surgery on the same day that an index case patient ap-



parently acquired his or her infection. Seroprevalence was also relatively high among those who had had surgery the day before or the day after an index case patient's apparent infection date. Having a surgical procedure on days when index case patients had subsequent surgical procedures was also associated with a prevalence significantly greater than that observed for patients not in a high risk category (12.1% vs 7.6%, $\chi^2 = 5.86$, $P = .02$).

Exposure Histories

A total of 305 unvaccinated patients in the dermatology practice, including index case patients, had serological evidence of infection with HBV. Of these, 69

had known dates of onset and patient records available for review. These patients had an average age at onset of 67 years (range: 29–91); 38 were men and 31 were women. Patient records documented surgery by the dermatologist during the incubation periods for 50 (72%) of the HBV-infected patients with known dates of onset, including 2 who eventually died of the disease. The mean incubation period was 126 days (range: 58–168 days).

Of the 19 HBV-infected patients with known dates on onset and available treatment records who had no record of surgery during their incubation periods, 2 were spouses of patients with HBV infection who had had surgery in the practice during their incubation periods, 1 was a

homosexual man, and 3 had been seen during their incubation periods but there was no record of a surgical procedure. The remaining 13 patients had no known risk factors for HBV infection.

None of the HBV-infected patients with documented surgery in the practice during their incubation periods had any other risk factors for HBV infection.

HBsAg Subtyping

The epidemic curve (Figure 2) shows 70 of the 72 HBV-infected patients with known dates of onset. The 2 patients not shown were both chronic carriers of HBV, one with onset in 1945 and the other with onset in 1965. Subtyping of HBsAg from the patient with onset in 1945, along with 29 others, showed that all were subtype *adw2*.

HIV Exposures and Seroprevalence

The practice included 22 patients with AIDS; all had died by the time of the investigation. Two had no identified risk factors. Each of these 2 had had only one surgery in the practice, at 5 and 15 months prior to their deaths. A total of 11 surgical procedures had been performed on 9 of the patients with AIDS in the practice, but none on a day that HBV was apparently transmitted. One hundred eighty-nine patients had had surgery on the same day as surgery on an AIDS patient or on the day after, and 74 of these, including 2 who were exposed twice, were tested for antibodies to HIV. Results for all of the 74 exposed patients and all of the other 2621 patients tested were negative.

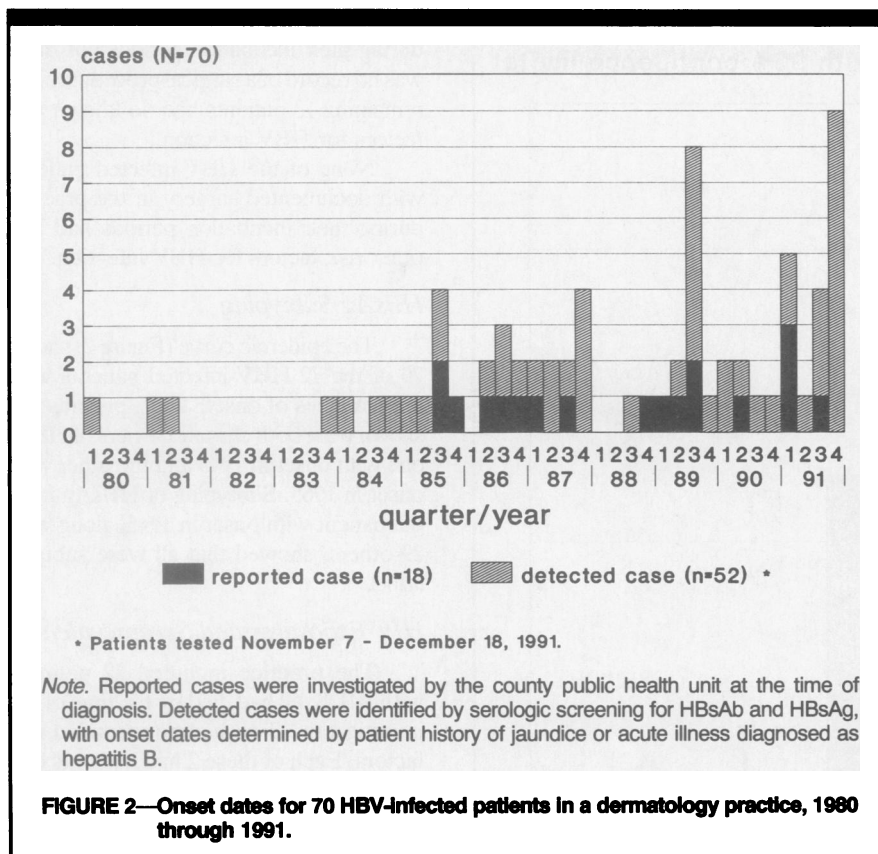
Possible Vehicles for HBV Transmission

Possible vehicles for HBV transmission between patients included the dermatologist's hands, injectable solutions in multiple-use vials, electrocautery tips, and liquid nitrogen.

The dermatologist's hands were often contaminated with blood, as he routinely operated without gloves and failed to wash his hands after every patient.

Injectable anesthetic solution (1% lidocaine without epinephrine) in multiple-use 50-cc vials may have been contaminated. Only one 5-cc syringe was used per patient. If additional solution was required, the same syringe was refilled through a needle that remained in the vial and was common to all other patients seen that day.

Electrocautery tips were neither changed nor cleaned between patients, and cotton-tipped liquid nitrogen applicators were occasionally returned to the res-



ervoir after use (although liquid nitrogen was not used in the surgical procedures examined by our investigation). We found no other problems with office sterilization equipment or procedures for cleaning and sterilizing instruments.

Discussion

Investigation of this outbreak was complicated by several factors. The infections occurred over a long period of time among a large number of people. Many infections were asymptomatic, and reporting of symptomatic infections was incomplete. Nevertheless, a strong argument can be made that patient-to-patient transmission of HBV occurred with disturbing frequency. The observation that HIV was not also transmitted in this setting is consistent with earlier estimates of the relative infectivity of the two viruses¹⁶⁻¹⁸ and further emphasizes the importance of HBV as a blood-borne pathogen in the health care setting.

The incidence calculations confirmed the existence of an outbreak. The number of person-years of exposure to the practice was necessarily a rough estimate for calculation of a rate of infection. However, any error introduced was unlikely to account for the 12-fold difference between the estimated rate of reported HBV infec-

tion in the practice and that observed for the county as a whole.

The hypothesis that infection was transmitted via surgical procedures was based on biologic plausibility and the dermatologist's description of his surgical technique. It is possible that some control patients in the case-control study, in addition to the two we identified, may have been infected with HBV, but such misclassification would only have reduced our estimate of the matched odds ratio. The level of risk indicated by the matched odds ratio, therefore, represents a minimum estimate.

The results of the case-control study suggested high-risk subsets of patients to actively screen for evidence of infection, both with HBV and with HIV, and the validity of this classification was confirmed by the test results. Seroprevalence of markers for HBV infection was significantly elevated among high-risk patients in a pattern predicted by our hypothesis that patient-to-patient transmission occurred during surgical procedures.

The elevated prevalence of markers of HBV among patients who had had surgery the day before or the day after apparent infection of an index case patient is consistent with transmission by a vehicle, such as contaminated solutions for injec-

tion, that could have been used on successive days. Multiple-use vials for injection were identified as the likely vehicle of infection with HBV in a previous outbreak, and the potential certainly existed for contamination of the 50-cc vials of local anesthetic solution as they were used in this dermatology practice.⁶

Declining seroprevalence among patients exposed to days of subsequent surgery on index case patients probably reflects waning antigenemia. And seroprevalence in the low-risk patients with no known exposure to an index case patient (7.6%) was close to the 7% found in Whites older than 54 years in a representative sample of the general US population.¹⁹

The time of introduction of HBV into the practice is unknown. Two carriers of HBV with long histories of infection were identified in the practice, and the dermatologist himself may have been a source at some time prior to 1987. However, there is good evidence that HBV transmission continued from patient to patient. The logarithmically expanding epidemic curve is characteristic of patient-to-patient transmission, although this pattern may have been exaggerated by detection and recall biases. There were several potential vehicles for patient-to-patient transmission. A high proportion of HBV-infected patients were temporally linked to the practice and to other infected patients, and all of the specimens tested for antigenic subtype were identical. The *adw2* HBV subtype accounts for approximately 88% of the HBV infections in the southeastern United States, making the probability of finding *adw2* by chance alone in all 30 specimens from this outbreak equal to 1 in 50 ($P = .02$).²⁰

In summary, we found more than 12 times the expected rate of patients reported with acute hepatitis B in a dermatology practice; most cases had had surgery in the practice during their incubation periods. Transmission from patient to patient appeared to result from failure to observe either universal precautions or sterile surgical technique. Finally, although HBV appears to have been freely transmitted, we found no evidence of transmission of HIV.

These findings strongly support efforts to increase awareness of blood-borne infections among physicians and to ensure that universal precautions are universally practiced. They also emphasize the importance of reporting blood-borne diseases to public health authorities, along with detailed exposure histories, and demonstrate once again that continuing review

of case reports by health departments is useful in identifying and controlling outbreaks. The outbreak described here was so insidious and of such long duration that it could easily have escaped detection if only the numbers of reported cases had been examined, without an epidemiologic review of potential sources of infection. Finally, consideration should be given to establishing standards of care for office-based procedures that would prevent the spread of blood-borne disease in much the same way that standards for food handling are used to prevent the spread of enteric disease. □

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