

Potential risk of salivary-mediated viral hepatitis type B transmission from oral exposure to fomites

BY M. T. OSTERHOLM

*Minnesota Department of Health and School of Public Health,
University of Minnesota, Minneapolis, Minnesota 55440, U.S.A.*

B. J. MAX

Gaylord Public Schools, Gaylord, Minnesota 55334, U.S.A.

M. HANSON AND H. F. POLESKY

*Minneapolis War Memorial Blood Bank, Minneapolis,
Minnesota 55416, U.S.A.*

(Received 27 March 1979)

SUMMARY

Twelve grade school and junior high school students had oral exposures to hepatitis B surface antigen (HBsAg) positive saliva via contact with contaminated musical instruments. The 12 exposed students and 18 students who served as age and sex matched controls were tested for the presence of HBsAg and antibody to the hepatitis surface antigen (anti-HBs) at 2 weeks, 8 weeks and 6 months after exposure. All students were negative for HBsAg and anti-HBs on all dates tested and reported no illness during that time suggestive of viral hepatitis. There was no evidence of viral hepatitis, type B transmission from the exposure. The students probably experienced the maximum possible oral exposure from direct or fomites contact, since there was no cleaning of the musical instruments between use by the students and teacher. Based on these results, the risk of transmission of viral hepatitis, type B from oral contact with fomites is unlikely.

INTRODUCTION

Hepatitis B surface antigen (HBsAg) has been reported in saliva (Ward *et al.* 1972; Orga, 1973; Heathcote, Cameron & Dane, 1974; Villarejos *et al.* 1974; Kistler, Sonnabend & Krech, 1973; Irwin *et al.* 1975; Feinman *et al.* 1975) and it has been suggested that this secretion may be a vehicle for viral hepatitis, type B transmission. Three studies have reported the transmission of viral hepatitis, type B to a human (MacQuarrie, Forghani & Wolochow, 1974), gibbons (Bancroft *et al.* 1977) and chimpanzees (Alter *et al.* 1977) after subcutaneous or intravenous injections of saliva containing HBsAg. One of the studies also attempted to transmit type B hepatitis by nasal and oral exposure of gibbons with saliva containing HBsAg, but failed (Bancroft *et al.* 1977). The role of saliva in the transmission of type B hepatitis to humans by oral exposure has not been

determined. We have completed a study that reports a lack of transmission of type B hepatitis to humans after oral exposure to HBsAg-positive saliva.

METHODS

Twelve rural Minnesota grade school and junior high school students had exposures to HBsAg-positive saliva via musical instruments during the 2 weeks before the onset of clinical viral hepatitis, type B in their music teacher. Seven of the students played flute, two played saxophone, one played trumpet and two majorettes used whistles. Each of the students had at least one occasion during the 2-week period where the teacher played the student's instrument for demonstration purposes. He then returned it without cleaning or disinfecting it and the student played it. Upon visual inspection, saliva was present on mouth pieces of instruments on each occasion; however, the amount was not measured.

The music teacher had a possible exposure to type B hepatitis while residing in another community 3 months before onset of symptoms. His serum and saliva were positive for HBsAg at the time of illness by radioimmunoassay (Austria II, Abbott Laboratories). The radioimmunoassay ratios for the serum and saliva were 60.32 and 11.51 respectively. The serum was also positive for hepatitis e antigen (HBeAg) when tested by rheophoresis. The saliva had a trace (minimal response) of occult blood (Labstix; Ames Company). The teacher reported occasional bleeding from the lips after extended playing of instruments. It was determined that bleeding occurred on at least two occasions when student instruments were played.

The 12 exposed students and 18 students who served as age and sex matched controls were tested for HBsAg and anti-HBs at 2 weeks, 8 weeks and 6 months after the onset of the teacher's case (anti-HBs tested by AUSAB, Abbott Laboratories).

RESULTS

All students were negative for HBsAg and anti-HBs on all dates tested and none reported illness during that time suggestive of viral hepatitis.

DISCUSSION

It has been previously suggested that transmission of type B hepatitis might occur as a result of oral contact with HBsAg-positive saliva (Ward *et al.* 1972; Orga, 1973; Heathcote *et al.* 1974; Villarejos *et al.* 1974; Kistler *et al.* 1973; Irwin *et al.* 1975; Feinman *et al.* 1975). However, our data obtained from the 12 students orally exposed to HBsAg-positive saliva indicate that the oral transmission of viral hepatitis, type B from direct or fomites contact is unlikely. Possible explanations for the lack of viral hepatitis, type B transmission in this situation include an absence of HBsAg in the saliva of the music teacher at the time of the lessons, the low infectivity of the HBsAg-positive saliva or the relationship to the mode of transmission. HBsAg usually is found in blood several weeks before the onset

of clinical illness (W.H.O., 1977). It is most probable that the music teacher had HBsAg in his saliva in the 2 weeks before his onset. There was no attempt made to clean or disinfect the musical instruments between use by the students and the teacher; therefore, it appears the low infectivity of the teacher's saliva was responsible for the lack of transmission.

The music teacher's serum was positive for HBeAg and the saliva had a trace of occult blood at the time of testing. On at least two occasions, the teacher reported bleeding from the lips during music lessons. The titre of HBsAg is higher in serum when it is HBeAg-positive (Trepo *et al.* 1976; Gerin, Ford & Purcell, 1975). It has also been stated that HBsAg is most frequently found in saliva in the presence of occult blood and increasing titre of antigen in serum (Bancroft *et al.* 1977). However, the infectivity of a secretion cannot be determined by the presence of HBsAg since most of this antigen is associated with subviral particles of defective viral particles (Gerin *et al.* 1975; Purcell & Gerin, 1975).

The failure of saliva to infect the students may also be related to the mode of transmission. Bancroft *et al.* (1977) found when using the same HBsAg-positive saliva inoculum, gibbons could be infected by subcutaneous administration and not by intranasal or intraoral routes.

The students probably experienced the maximum possible oral exposure from direct or fomites contact, since there was no cleaning of the musical instruments between use by the students and teacher. Based on these results, transmission of viral hepatitis, type B by oral contact with fomites is unlikely.

REFERENCES

- ALTER, H. J., PURCELL, R. H., GERIN, J. L., LONDON, W. T., KAPLAN, P. M., MCAULIFFE, V. J., WAGNER, J. & HOLLAND, P. V. (1977). Transmission of hepatitis B to chimpanzees by hepatitis B surface antigen-positive saliva and semen. *Infection and Immunity* **16**, 928-33.
- BANCROFT, W. H., SNITBAHN, R., SCOTT, R. M., TINGPALAPONG, M., WATSON, W. T., TANTICHARONENYOS, P., KARWACKI, J. J. & SRIMARUT, S. (1977). Transmission of hepatitis B virus to gibbons by exposure to saliva containing hepatitis B surface antigen. *Journal of Infectious Diseases* **135**, 79-85.
- FEINMAN, S. V., KRASSNITSKI, O., SINCLAIR, J. C., WROBEL, D. M. & BERRIS, B. (1975). Hepatitis B surface antigen in saliva of HBsAg carriers. *Journal of Laboratory and Clinical Medicine* **85**, 1042-8.
- GERIN, J. L., FORD, E. C. & PURCELL, R. H. (1975). Biochemical characterization of Australia antigen. Evidence for defective particles of hepatitis B virus. *American Journal of Pathology* **81**, 651-68.
- HEATHCOTE, J., CAMERON, C. H. & DANE, D. S. (1974). Hepatitis B antigen in saliva and semen. *Lancet* *i*, 71-3.
- IRWIN, G. R., ALLEN, A. M., BANCROFT, W. H., KARWACKI, J. J., BROWN, H. L., PINKERTON, R. H., WILLHIGHT, M. & TOP, F. H., JR. (1975). Hepatitis B antigen in saliva, urine and stool. *Infection and Immunity*, **11**, 142-5.
- KISTLER, G. S., SONNABEND, W. & KRECH, V. (1973). Hepatitis B antigen (HB-Ag; Australia antigen) in mixed saliva of patients with HB antigenaemia. *Pathologia et microbiologia* **39**, 313-8.
- MACQUARRIE, M. D., FORGHANI, B. & WOLOCHOW, D. A. (1974). Hepatitis B transmitted by a human bite. *Journal of the American Medical Association* **230**, 723-4.
- ORGA, P. (1973). Immunologic aspects of hepatitis-associated antigen and antibody in human body fluids. *Journal of Immunology* **110**, 1197-205.

- PURCELL, R. H. & GERIN, J. L. (1975). Hepatitis B subunit vaccine. A preliminary report of safety and efficacy tests in chimpanzees. *American Journal of Medical Science* **270**, 395-9.
- TREPO, C. G., MAGNIUS, L. O., SCHAEFER, R. A. & PRINCE, A. M. (1976). Detection of e antigen and antibody; Correlations with hepatitis B surface and hepatitis B core antigens, liver disease, and outcome in hepatitis B infections. *Gastroenterology* **71**, 804-8.
- VILLAREJOS, V. M., KIRSTEN, P. H., VISONA, M. S., GUTIERREZ, D. & RODRIGUEZ, A. (1974). Role of saliva, urine and feces in transmission of type B hepatitis. *New England Journal of Medicine* **291**, 1375-8.
- WARD, R., BORCHERT, P., WRIGHT, A. & KLINE, E. (1972). Hepatitis B antigen in saliva and mouth washings. *Lancet* *ii*, 726-7.
- WORLD HEALTH ORGANIZATION (1977). Advances in viral hepatitis. *Technical Report Series* **602**, p. 29.