Evaluation of a Finger-Stick Specimen Collection Method for Seroepidemiology of Antibody to Hepatitis A Virus

KAREN A. McCAUSTLAND,* WALTER W. BOND, DANIEL W. BRADLEY, MARTIN S. FAVERO, NORMAN J. PETERSEN, AND JAMES E. MAYNARD

Hepatitis Laboratories Division (World Health Organization Collaborating Centre for Reference and Research on Viral Hepatitis), Bureau of Epidemiology, Center for Disease Control, Phoenix, Arizona 85014

A finger-stick swab method of collecting blood specimens was shown to compare favorably with the conventional venipuncture method in serological determinations of antibody to hepatitis A virus by radioimmunooassay.

The detection of serological markers for defining the prevalence of and differentiating between viral hepatitis type A (HAV) and type B (HBV) in any outbreak of hepatitis is essential to the epidemiological study of these diseases. Specimen collection for large-scale seroepidemiological surveys of anti-HAV prevalence can be facilitated by using the finger-stick swab method of specimen collection. This sampling method has been shown to be rapid, economical, and efficient in seroepidemiological studies of HBV (1) and is acceptable to populations that do not generally accept the conventional venipuncture specimen collection methods.

The finger-stick swab technique involves a finger-stick with a blood lancet, collection of ca. 0.2 ml of blood with a cotton swab (the swab must be capable of absorbing at least 0.2 ml of blood), and elution of the blood into a 1-dram, screw-capped vial containing 1% (wt/vol) bovine serum albumin in normal saline (BSAS) with 0.1% sodium azide added as a preservative. Immediately after collection, the blood is eluted by vigorously swirling the cotton swab for 15 to 20 s in 1.0 ml of BSAS, and the fluid is then expressed from the swab by pressure and rotation on the inside lip of the vial. Visible clot formation is a useful indicator of the amount of blood collected in each vial. Less than 0.1 ml of blood does not yield a visible clot in 1 ml of the eluate, whereas a larger volume of blood will give a correspondingly larger clot.

The radioimmunoassay (RIA) used to detect anti-HAV in swab eluates was HAVAB (Abbott Laboratories, North Chicago, Illinois), a direct solid-phase competitive binding assay (2).

To evaluate the finger-stick method of serological specimen collection, a series of laboratory and field studies were conducted. Blood was collected from a chimpanzee seropositive for anti-HAV; paired serum and finger-stick specimens were collected for diagnostic purposes during routine epidemiological investigation of two separate disease outbreaks.

To simulate finger-stick specimen collection in the laboratory, 0.1-ml volumes of whole blood from the chimpanzee were applied to glass microscope slides, and samples were removed from the slides with sterile cotton swabs. Five swabs were eluted, each in 1.0-ml amounts of BSAS in 1-dram, screw-capped vials. To test the quantitative aspects of the assay, five 0.1-ml replicate portions of whole blood, serum, and plasma from the chimpanzee were added to separate vials containing 1.0 ml of BSAS. All specimens were then diluted serially 10-fold and assayed for anti-HAV by RIA.

Figure 1 shows results of the dilution series for swab eluates, whole blood, serum, and plasma assayed by the HAVAB RIA method. Each interval in the series represents the mean value of five replicate tests. The linear response of the assay is evident, and each dilution curve intercepted the positive-negative cutoff region of the test at approximately the same endpoint value. It appeared that the HAVAB assay was sensitive enough to be used with the finger-stick method of specimen collection.

In field trials I and II, 73 and 86 paired fingerstick and serum specimens were obtained, respectively, from children at a day school in Phoenix, Arizona, and from missionaries at a religious commune in Holbrook, Arizona. Table 1 shows the results of two field trials comparing specimen collection methods. In field trial I, 93% of the finger-stick (swab) specimens had visible clots, indicating that most swab eluates contained at least 0.1 ml of blood; i.e., the sampling method (saturation and elution of the swabs) was near its optimum level. The agreement between serum and swab eluate RIA results was 93%. In contrast, only 23% of the finger-stick specimens in trial II had visible clots, and the lower sampling efficiency was reflected in the lowered (82%) agreement between serum and swab eluate RIA results. Subsequent epidemi-
logical and laboratory investigation of the trial II population did not confirm the initially suspected HAV outbreak; in trial I, an outbreak of HAV was positively confirmed. These observations would suggest that the serum anti-HAV titers in trial II were lower than those in trial I, further accounting for the disparity between serum and swab eluate results.

The amount of blood collected with each swab in the finger-stick method of specimen collection is a critical factor in testing. The cotton swabs and sampling technique used should be capable of delivering at least 0.1 ml of blood to the elution vials, as evidenced by visible clot formation. The laboratory and field tests emphasized the quantitative responses of the RIA assay and the subsequent potential for underestimation of the anti-HAV positivity rates relative to those obtained with the conventional venipuncture specimens.

On the basis of our test results, we feel that the finger-stick swab method of specimen collection is of adequate sensitivity for seroepidemiological studies of HAV, if proper specimen collection methods are used in conjunction with the HAVAB RIA technique. The simple, portable, and comparatively inexpensive nature of the finger-stick swab method of specimen collection should make it useful in large-scale seroepidemiological studies, particularly in populations in which venipuncture is not an accepted technique.

We thank S. C. Hadler and R. Kantor for collecting field specimens.

LITERATURE CITED