FBI

Violent Crime Against the Aging

Inactivation of Human Immunodeficiency Virus (Aids Virus) by Gamma and X-Ray Irradiation in Body Fluids and Forensic Evidence

By
PAUL D. BIGBEE, M.S.
Special Agent
Forensic Science Research and Training Center
FBI Academy
Quantico, VA

In the July 1987, issue of the *FBI Law Enforcement Bulletin*, an article entitled "Collecting and Handling Evidence Infected with Human Disease-Causing Organisms" was published. In that article, it was mentioned that the FBI Laboratory, in conjunction with the National Institutes of Health and the National Bureau of Standards, was conducting research into the feasibility of using gamma radiation to inactivate the AIDS virus (HIV) in body fluids and forensic evidence. The research had two goals: (1) To determine the dosage of radiation that was lethal to HIV, and (2) to determine if this dosage was deleterious to the biological substances routinely sought in forensic serology analyses. This research as now been successfully completed.

Previous research has shown that the AIDS virus, in concentrated amounts, can survive in dried stains for several days at room temperature.[1] However, in concentrations which would normally be found in persons with AIDS, leading experts generally agree that the possibility of the virus surviving beyond a maximum of 72 hours in a dried state is highly improbable.[2] But, Resnick and associates reported in the April 1986, *Journal of the American Medical Association* that the virus can survive for prolonged periods of time in liquid body fluids (at least 15 days). Recently, several incidents have occurred where HIV-infected liquid blood has been absorbed through broken skin or through the eyes or mucous membranes of health care workers, transmitting the virus to these individuals.[3] While realizing that the possibility of transmitting HIV to forensic laboratory workers is remote, any available and reasonable means of reducing the risk of possible infection to laboratory workers should be considered.

Our research consisted of first performing all analyses currently conducted in the Serology Unit, FBI Laboratory, on selected samples of liquid and dried blood, semen, and saliva with appropriate controls. These sam-

ples were then subjected to varying levels of gamma radiation and reanalyzed. Using extremely high levels of gamma radiation (up to 1,000,000 rads), no detrimental effects of serological testing were observed, with the exception of one liquid blood sample which appeared hemolyzed. This sample, when dried and analyzed the same as any dried stain, showed no damage.

Because most forensic laboratories do not have the capability of using gamma radiation, the National Bureau of Standards calibrated an X-ray instrument at the FBI Laboratory, and usable amounts of gamma radiation were then converted to X-ray radiation. Following the calibration, the Laboratory of Tumor Cell Biology at the National Institutes of Health provided serial dilutions of the AIDS virus, and it was determined that approximately 25,000 rads of X-ray irradiation were required to completely inactivate the virus. It should be noted that this amount of radiation is used to sterilize food products and sera.[4] Samples of liquid and dried blood, semen, and saliva were then subjected to 25,000 rads of X-ray radiation, and no effects were seen in any protein of serological importance.

As a result of the development of this new technique, the FBI Laboratory has altered its policy on accepting evidence from persons with AIDS or exposed to HIV. The FBI Laboratory will accept known AIDS cases; however, the Scientific Analysis Section must be notified telephonically prior to submission when either a suspect or victim has AIDS or is suspected of having AIDS. The Laboratory has implemented a policy wherein liquid blood samples, or any other liquid body fluid from a person known or suspected of having been exposed to HIV, or liquid blood samples from persons in the traditional "high risk categories," such as male homosexuals, prostitutes, and intravenous drug users, will be irradiated by X-ray prior to analyses. Dried blood fluids which are less than 5 days old from either victims or suspects known to have AIDS will be air dried for a total of 5 days in a laminar-flow, biological containment cabinet prior to analyses. Contributors of evidence bearing HIV are reminded that the shipping of this type of evidence must be in accordance with Title 42, Code of Federal Regulations, Part 72, which requires the items to be triple wrapped and appropriate warning label applied.

Regardless of whether liquid blood samples have been irradiated or not, the FBI Laboratory's safety policy for handling any liquid body fluid will remain in force. These procedures include the wearing of latex surgical gloves, eye protection, surgical masks, and laboratory coats.

The detailed results of this research project are now being compiled and will be published in a scientific journal in the near future. The use of ionizing radiation is dangerous if not properly managed. Only qualified and trained/certified X-ray technicians may operate these devices with proper shielding, safety and radiation monitoring procedures in effect, and in accordance with Nuclear Regulatory Commission policies. Any other use of this technique may result in a lethal dosage of radiation to personnel (an absorbed dose of 1,000 rads or 1,000 REMS is lethal in humans).[5]

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Unfortunately, the development of this new technique cannot assist the law enforcement officer in the performance of his or her duties before evidence is sent to the laboratory. All safety precautions and care must always be taken when dealing with body fluids. The officer on the street has no way of knowing if a body fluid is infectious and should treat all body fluids accordingly.

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Footnotes

[1]Centers for Disease Control, "Survival of HIV in the environment," *Morbidity and Mortality Weekly Report*, vol. 36, 1987, supplement 10; L. Resnick et al., "Stability and inactivation of HTLV-III/LAV under clinical and laboratory environments," *Journal of the American Medical Association*, vol. 225, 1986, pp. 1887-1891; B. Spire et al., "Inactivation of lymphadenopathy-associated virus by heat, gamma rays and ultraviolet light, *Lancet*, vol. 1, 1984, pp. 188-189.

[2]Personal communications with W. Bond, F. Chermann, P. Markham, L. Resnick, and P. Sarin.

[3]Centers for Disease Control, update, "Human immunodeficiency virus infections in health care workers exposed to blood of infected patients," *Morbidity and Mortality Weekly Report*, vol. 36, No. 19, 1987, pp. 285-289.

[4]L. Resnick et al, Supra note 1.

[5]N. Tsoulfanidis, *Measurement of Detection of Radiation*, (Washington, DC: Hemisphere Publishing Corporation, 1983, pp. 502-503.