

COMMENTARY

**CLUSTERED HEPATITIS B OR HUMAN IMMUNODEFICIENCY
VIRUS TRANSMISSION IN OFFICE SETTINGS**

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BACKGROUND

In 1991 Cluster #1, consisting of 6 persons, was retrospectively found transfected with Human Immunodeficiency Virus, Type 1 (HIV-1) in the office of a HIV-1-positive (HIV-1+) Florida dentist (1). In 1993 Cluster #2, including four women, was found to have been transfected with HIV-1 in the office of a HIV-1-negative (HIV-1-) Australian surgeon (2). During the years 1982-1992, Cluster #3 consisting of 33 different groups comprising 333 patients was found to have been transfected with Hepatitis B Virus (HBV) in the offices of 9 HBV-seropositive (HBV+) dentists and 20 HBV+ surgeons (2). The precise mechanisms of HIV-1 or HBV transfection from each dentist or surgeon to most of these persons remains to be settled. However, Clusters #1-3 possibly share a single feature, i.e., the employment of a needle, syringe or multi-dose vial used more than once for giving local anesthetics prior to an invasive surgical procedure (3-5).

Analyzing Cluster #1

The HIV-1+ Florida dentist, like other dentists in most nations, customarily used a cartridge aspirating syringe (CAS) into which one to four 1.8 ml. vials, called "carpules®" or "cartridges," were serially inserted and used

more than once to shoot local anesthetics via a hollow-bore steel needle into more than one site in the mouth before performing a painful dental procedure (3,4). In the case of a young woman (Case A in reports published by the U.S. Centers for Disease Control), two wisdom teeth were extracted on December 17, 1987 (2,6). Four weeks later she developed signs of an AIDS prodrome. Two years later she developed pneumocystis pneumonia. Three years later, she died of AIDS. In the case of an older woman (Case B in the CDC files), many anesthetic injections were required on a day in 1988 during which she had a difficult extraction of a broken-off eye tooth (6). In the instances of four other patients subsequently found by polymerase chain reaction (PCR) technology to be infected with HIV-1 having nucleotide sequences in their lymphocyte DNA diagnostically similar to those in the Florida dentist, the CAS was the only "invasive instrument" used on all HIV-transfected patients (1,7).

It should be mentioned that the CAS is an extremely hazardous device because the hollow-bore needle sharp on each end is designed to aspirate blood or tissue fluid into the inserted vial before giving each injection (3,4). Therefore, if the dentist accidentally sticks his own finger, after aspirating to be sure the leading tip of the needle is placed accurately, he/she gets stuck with potentially

contaminated body fluids from the patient. Moreover, if the dentist gets needle-stuck accidentally, his/her blood or body fluid will be aspirated into the vial via the trailing end of the sharp needle. Unless the dentist discards the CAS immediately, the patient will subsequently get stuck with potentially contaminated anesthetic solution in the vial (3-4). The HIV-1+ dentist, who had Kaposi sarcoma during 1987-1989 and died of AIDS on September 3, 1989, recalled no personal needle-sticks after 1986 (1,6). However, the average New York City dentist recalled a mean of 2-3 accidental needle sticks per annum (range 1-600), thus partially accounting for evidence of exposure to HBV in 20% of those not vaccinated (8). Thus, if the HIV-1+ dentist recalled no personal needle sticks (1) and his office staff recalled no instances wherein the dentist discarded a CAS during the process of giving dental anesthesia (6), the absence of such events might be considered unusual.

Analyzing Cluster #2

The HIV-1- Australian surgeon claimed he used only single-dose vials for giving anesthetic injections prior to performing invasive procedures (2). However, as opposed to dentists, surgeons are prone to use multi-dose vials containing 30-50 ml. of anesthetic solution. Such vials are customarily labeled as single dose, if they contain no preservative for the solution, or multi-dose with a named preservative, such as methylparaben (5). Customarily, the surgeon uses a fresh sterile syringe/needle to aspirate a single dose from either kind of vial. Like the dentist, the surgeon planning to infiltrate a large subcutaneous area, or to use a nerve block, normally aspirates to be sure the needle-tip is not inserted into a blood vessel for fear of causing an anaphylactic reaction. Usually no visible blood comes back through the needle, although lymph or tissue fluid is aspirated or attracted by the force of capillary attraction in a small-bore needle, e.g. 27 or 30 gauge.

However, if the surgeon inadvertently uses the same needle twice to aspirate from the same vial, the solution within the vial can be contaminated with whatever fluid was aspirated or extracted from the patient. Thus, if the HIV-1- Australian surgeon happened to use the same syringe/needle more than once to aspirate from a "single dose" vial on a day in November 1989, he might have HIV-1-transfected more than one patient (5). As it turned out, one of his first patients that day was an HIV-1+ male who required local anesthesia for removal of a skin lesion (2).

Cluster #3

The precise details concerning 9 dentists and 20 surgeons are varied (1). However, it should be noted with respect to the 9 dentists, that dentists seldom do invasive procedures under general anesthesia. Conversely, surgeons are generally prone to do major procedures under general anesthesia in the hospital, and some minor procedures under local anesthesia in the office without the aid of a skilled anesthetist. Nevertheless, it should be emphasized that no cluster or individual case report of HBV or HIV transfection has been well documented following a major surgical procedure, unless the patient was transfused with blood or blood products before, during or after the skin was incised.

Cluster #4

In 1991 a cluster consisting of 678 Romanian children was reported to have been HIV-1-transfected through reuse of needles and syringes in short supply, and not properly sterilized before use for giving injections or transfusions (9,10).

Cluster #5

In the U.S. on 1 January 1994, adult persons with AIDS (APWA) officially numbered 87,259 acquired through intentional sharing or reuse of unsterile needles and

syringes to “shoot” intravenous drugs, especially heroin or cocaine (11).

Cluster #6

Another 23,630 male homosexual APWA intentionally shared or used unsterile syringes and needles to “shoot” drugs (11).

Cluster #7

Another 3,133 hemophiliac APWA and 6,181 APWA got infected through intentional use of needles to give life-saving transfusions in medical facilities (11).

Cluster #8

Another 5,228 children had AIDS. Most of them acquired HIV-1 infection from a mother who shot drugs or from transfusions of blood or blood products via needles in medical facilities (11).

Cluster #9

In medical facilities we found 12 APWA — health care workers (HCW) who got AIDS and another 109 who became HIV-1+ as a result of accidental exposures to the blood of HIV-1-infected adults or children (11). Out of the first 39 HCW closely observed to sero-convert after a definitive exposure, 33 (85%) of the exposures were accidental needle sticks with a hollow-bore steel needle containing HIV-infected blood, and one was injury from a broken glass vial (11). It should be added the numbers in Cluster #9 may be significantly under-reported, because HCW are aware of the stigmata associated with being HIV-1+ and cannot pursue their profession in good conscience if they must use needles, syringes or vials to do so (12).

Cluster #10

Among HCW the mortality rate from occupation acquired HBV and Hepatitis C

Virus (HCV) infections is now 200-300 per annum. Most of these infections are acquired through accidental needle-sticks. As previously noted with respect to Clusters #1 and #3, dentists are at especially high risk for getting stuck and for acquiring hepatitis virus infections in their offices.

Cluster #11

No case of HIV-1 infection has so far been reported to have arisen from giving preventive vaccines. However, despite “universal precautions” well-advertised since 1987, in 1993 two employee vaccination programs have been identified where physicians used needles, syringes or multi-dose vials more than once to give influenza or pneumococcus vaccines (13). Therefore, the potential for transmission of HIV-1 through reuse of needles, syringes or vials for giving vaccines was re-emphasized recently (13-16).

COMMENTS

Out of 361,164 U.S. cases on 1/1/94, we count 19,722 APWA and 53 children with AIDS where the risk factor was not reported or identified as owing to IV drug abuse, transfusion or sexual intercourse (11). We can estimate that there exist in the U.S. 3-10 times as many persons in each category who are HIV-1+, but not yet sick with an AIDS-definable illness (15). Such people may continue to serve as infectious carriers for \pm 12 years before they get symptoms. The situation is similar in more than 150 other nations, except that the percentages of APWA categorized as due to male homosexual transmission of HIV are generally less than in the U.S.; and greater percentages are categorized as owing to needle abuse or heterosexual transmission (15). Comparison between the U.S. year-end counts in 1992 and in 1993 reveals that the rate of AIDS transmission by means of men who have sex with men is now approached by the rate of transmission through needles and syringes (15).

Therefore, if we apply the information gained from studying Clusters #1-11 to the 19,722 APWA where a risk factor has not been identified, it is conceivable that most of these cases resulted from misuse or reuse of a "sterile" needle, syringe or a multi-dose vial. Moreover, if we rule out intravenous drug abuse, sexual transmission and transfusion in these 19,722 individual "unclustered" cases, we might guess that $\pm 85\%$ resulted from accidental, rather than intentional misuse or reuse of a needle, syringe or multi-dose vial (11).

Articles in the Journal of the American Medical Association (JAMA) have suggested that malevolence might have been a major factor in Cluster #1, i.e. that the HIV-1+ Florida dentist intentionally contaminated his anesthetic vials with his own blood or semen (16,17). Malevolence is not currently considered to be an important factor in Clusters #2-10. Clusters #5-6 and potential Cluster #11 reflect ignorance of sterile precautions with respect to usage of needles, syringes or vials more than once. A brief survey of the office settings of most U.S. surgeons, dermatologists and general practitioners who perform minor surgical procedures under local anesthesia is likely to reveal at least one uncapped multiple dose vial containing a Novocain derivative sitting on a shelf, a countertop, a tray, in a drawer, or in the refrigerator. Closer inspection also is likely to reveal most of the vials originally contained 30-50 ml. of Xylocaine®, Lidocaine, Marcaine® or other anesthetic agent in percentages ranging from 0.5 to 2%, along with a preservative for preventing fungal infection of the contents. The physician cost of such 50 ml. vials ranges from \$0.67 to \$2.50, or 1.34 to 5.0 cents per ml. The usual dose given via a single-use sterile syringe and needle is 0.2 to 10 ml., or 5 to 100 doses per vial. However, if the same syringe and needle is inadvertently used more than once in a given vial or used again for another patient, the cost can be AIDS, Hepatitis B or C, or another serious form of blood-borne disease. Moreover, if a disgruntled health care worker or lay person were to maliciously

contaminate a vial or cluster of unattended vials, the toll in terms of severe morbidity, wrongful death or malpractice might be measured in terms of millions of dollars, especially if another Cluster is traced to the office of a surgeon, as in Cluster #2.

The situation in dental office settings is analogous, except dental anesthetic vials customarily contain only 1.8 ml. and are practically never used on more than one patient. However, as opposed to standard 20, 30 or 50 ml. vials used in surgical or medical office settings, the dental "Carpules®" or cartridges are supplied in boxes or cans containing 50 to 100 cartridges costing ± 20 cents per cartridge. The dental cartridges are not supplied with sterile covers or tamper-proof caps covering the silicone rubber caps through which the dental health care worker must insert the trailing end of the double-ended needle in order to deliver the contents, usually into more than one site in the mouth. The loaded cartridges are usually found on the counter top or in a drawer in most U.S. dental offices. Thus, if a malevolent dental health care worker or a vicious lay person wanted to contaminate such a cartridge with infected blood or semen (16,17), it might be difficult, but not impossible, to do so without knowledge on the part of the dentist or the patient. Moreover, owing to the fact that the dental cartridges are commonly supplied in boxes of 50-100, the silicone rubber cap through which the dental health care worker must insert the trailing end of a hollow-bore steel needle to deliver anesthesia is seldom sterile. Thus, microorganisms commonly found on skin and unsterile surfaces, such as strepto- and staphylococci, can be aspirated and injected via the needle.

Last, but not least, it should be emphasized that for bringing tragic Clusters #1 and #2 to our attention, we are deeply indebted to a young Florida woman, Kimberly Bergalis, who had an unusually short AIDS incubation period following a complex dental procedure (6); and to two unidentified young women in Sydney, Australia, who became HIV-1-

infected on a single day in November 1989 in the office of a surgeon (2). Were it not for some astute physicians and public health officials in Palm Beach and in Sydney, these tragedies would remain cloistered. Cluster #1 came to light when it was discovered that the HIV-1+ Florida dentist was practicing dentistry under one name, but under treatment for Kaposi sarcoma under an altered surname (6). Cluster #2 came to light partly because the two young Sydney women habitually and proudly donated blood to local banks regularly for the benefit of fellow Australians. Both were identified as HIV-1+ for no good reason within a few months after their visit for minor surgery in the office of a surgeon on a fateful day in November 1989. Using these three young women as "signals," the remaining cases in Clusters #1 and #2 were identified through careful review of office records and timely follow-up of other patients who had visited the Florida dentist and the Australian surgeon.

Of note is the increase in children with AIDS without known risk factor. Homosexual sex, heterosexual coitus, injecting drug use, hemophilia, transfusions, maternal HIV infection, and accidental needle sticks in health care settings were each excluded after thorough evaluation. Nonetheless, dental care, often with anesthesia, and routine immunizations, often from multiple dose vials, are commonplace during infancy and childhood.

CONCLUSION

To prevent HIV, HBV or other interstitial-lymph or blood-borne pathogen transmission in isolated instances, as well as in clusters, we should eliminate multi-dose vials; make dental cartridge caps tamper-proof and sterile; insist on safer needles, syringes and labeling of single-dose vials; and learn to use each and all of these with more care in health care office settings, as well as outside of medical-dental facilities.

TABLE 1
Updated AIDS Statistics in the USA as Reported by the
Centers for Disease Control (CDC)

	1 Jan 1994	1 Jan 1995
Total AIDS cases reported in U.S.	361,464	441,528
Children with AIDS	5,228	6,209
AIDS-Injecting drug use	87,259	109,393
AIDS-Injecting drug use + homosexual	23,630	28,521
AIDS-Hemophiliac	3,133	3,642
AIDS-Injection of blood or blood products	6,181	6,866
HCW-accidental blood exposure + AIDS	12	17
HCW-seroconversion without AIDS yet	109	106
Adult AIDS w/o known risk factor	722	792
Child AIDS w/o known risk factor	53	90

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