

# LAB NOTES

A NEWSLETTER FROM BECTON DICKINSON VACUTAINER SYSTEMS

## Phlebotomists at Risk

Ron B. Schifman, M.D., Department of Pathology and Laboratory Medicine, Tucson Veterans Affairs Medical Center and College of Medicine, University of Arizona, Tucson, Arizona

Among the various types of occupational exposures to blood-borne pathogens, accidental needlestick injuries constitute the single greatest risk to healthcare workers.<sup>1</sup> This problem is especially perilous for phlebotomists. The frequency of exposure from percutaneous injuries during collection of blood specimens is actually lower than accidents arising from other procedures involving the use of needles or other sharps. The absolute number of percutaneous needlestick injuries associated with phlebotomy, however, is relatively high simply because of the sizable number of venipunctures performed. Between 13 and 62% of all accidents reported to hospital employee health services are associated with needlestick injuries that occur during the process of blood collection.<sup>2,3</sup> Although transmission of hepatitis B virus can be almost completely prevented by vaccination, the risk of viral hepatitis C infection from needlestick injuries is still a major concern. Furthermore, of the 51 well-documented cases of human immunodeficiency virus (HIV) infections transmitted from patients to healthcare workers, 20 (39%) have been associated with phlebotomy.<sup>4</sup> Thus, although venipuncture is relatively harmless for the patient, it can be hazardous to the phlebotomist. Exposure to potentially life-threatening infectious agents is frightening and stressful for the employee and costly for the institution. Reducing the danger of needlestick accidents during collection of blood specimens should be among the highest of infection control priorities.<sup>5</sup>

### Rates of Injuries

Results from a retrospective study involving 683 healthcare facilities demonstrated that the median rate of needlestick injuries associated with phlebotomy was slightly less than 1 per 10,000 venipunctures.<sup>6</sup> Among the institutions studied, however, the frequency varied by more than 100-fold. Sources of variation were not examined, but the data illustrate that the broad differences in practices affect the risk of accidental needlestick injuries. The same report indicated that the incidence of phlebotomists' needlestick injuries did not change during the 3-year study period (1990 through 1992). The high

level of variations in needlestick injuries suggest a state of complacency toward this problem. Perhaps the relatively low rate of needlestick accidents among phlebotomists has led to the mistaken conclusion that advances in current practices have reached a point of diminishing returns. This false sense of security may be further compounded by the low estimates of injuries from underreporting.

### Mayo Experience

In *Mayo Clinic Proceedings*, July 1998, Vol. 73, (pages 611 to 615), Dale and associates describe how accidental needlestick injuries were reduced among members of the Phlebotomy Service at Mayo Clinical Rochester. What we learn from their experience with tackling this problem is that no single or simple solution is available. Numerous practice changes were implemented, including use of the one-handed recapping block, automatic disposal of plastic tube holders after each use, modification of phlebotomy chairs, intensive safety training, elimination of a double-needle technique for collecting blood culture specimens, and optional use of resheathing needles. This effort led to a remarkable decline in accidental injuries. It is not uncommon for a busy phlebotomist to collect blood from more than 50 patients per day. Thus, during the course of the year, a hard-working phlebotomist may perform as many as 10,000 venipunctures. With the assumption that the median needlestick injury rate is about 1 per 10,000 venipunctures, then, on the average, a phlebotomist will have about 1 accidental percutaneous blood exposure per year. Reducing the incidence to just 0.2 per 10,000, as accomplished in the study by Dale and associates, would put even the busiest phlebotomist at risk of only about 1 exposure every 5 years, an extraordinary accomplishment. As a result, phlebotomists at the Mayo Clinic now enjoy a safer work environment, and the institution avoids thousands of dollars in recurring costs from reduction in exposure-related expenditures. Best of all, the authors claim that no one on the phlebotomy team has ever acquired an infection despite the large number of phlebotomies performed.

### Safety Devices and Practices

Occupational exposure to infectious agents associated with phlebotomy is an important risk-management issue that affects

*Continued on page 2*

## Also in this issue

Editorial Commentary .....	2
IN CONTROL: Postexposure Prophylaxis .....	3
Medical Lore: Hemophilia — A Look Back.....	5
Feature: An Overview of the Infectious Substance Transport Requirements .....	6
Technical Exchange.....	7
BDVS New Product News:	
Reducing Exposure to Latex.....	Back Cover
Upcoming Events .....	Back Cover

## Route to:

---



---



---



---



---



---



---



---

the safety and well-being of employees. Healthcare facilities should follow the lead of Dale and co-workers and consider every possible measure to eliminate the risk of needlestick injuries associated with phlebotomy. Newer safety devices for preventing percutaneous injuries are now available, including resheathable winged steel needles (Safety-Lok™ Becton Dickinson), bluntable collection needles (Puncture-Guard™ Bio-Plexus, Inc), and hinged recapping sheath needles (Smith Industries). These devices have been shown to decrease injury rates by about 70% but are more expensive and may be associated with greater technical difficulties and adverse patient effects in comparison with standard collection devices, as pointed out by Dale and colleagues. We need more experience with these devices, but the approach taken by the authors is prudent — make the newer safety devices available and let the phlebotomists decide which tools are more useful and effective for doing their job in the most cost-effective manner. Elimination of the double-needle technique for blood culture collection is another good idea. Although a meta-analysis has shown this method to have marginally significant influence on reducing blood culture contamination<sup>7</sup>, the benefits simply do not outweigh the risks incurred from having to change needles. Furthermore, safety guidelines issued by the Centers for Disease Control and Prevention recommended that needles should never be removed from disposable syringes.<sup>8</sup> Finally, the authors' recommendation to discard tube holders after each use may seem wasteful, but it does reduce the risk of needlestick injury. Consider the results of another study that showed that of 24,153 blood tube holders that were in current use, 9.6% were visibly contaminated with blood.<sup>6</sup> This finding should be reason enough to designate plastic blood tube holders as single-use items.

## Editorial

This issue of *Lab Notes* includes an excellent editorial regarding accidental needlesticks, "Phlebotomists at Risk" by Dr. R. B. Schiffman, from the July 1998 issue of the Mayo Clinic Proceedings. Dr. Schiffman, with Dr. Peter Howanitz, has been instrumental in developing a number of "Q-Probe" studies on blood collection problems for the College of American Pathologists.

Complementing this editorial is Dr. Murray Cohen's article, "Post-Exposure Prophylaxis: The Value of Needlestick Prevention is Going Up." Dr. Cohen reviews the latest Centers for Disease Control and Prevention (CDC) guidelines for the management of occupational exposures to blood and body fluids, published May 15, 1998. The new recommendations for post-exposure prophylaxis are important for all of us in the health care profession.

For those of you involved in transporting medical specimens, we have included an update on the ever-changing government regulations in "Overview of Infectious Substance Transport Requirements," by Glen Macri.

Jean Slockbower, Ph.D.  
Editor

## Advantages of Phlebotomy Services

Use of an experienced and well-trained phlebotomy service for all collection of blood specimens is important for many reasons, not the least of which is to minimize the risk of occupational exposures to needlestick injuries.<sup>9</sup> Blood collection by a phlebotomy team also results in fewer mislabeled or improperly collected specimens, greater protection of venous access, and enhanced patient satisfaction.<sup>10</sup> Unfortunately, phlebotomists have another risk — unemployment. In the drive to reduce healthcare costs, short-sighted administrators are eliminating comprehensive phlebotomy services in order to decrease payroll expenses. In many facilities, responsibility for inpatient blood collection has been assigned to nurses, patient-care technicians, or others who do not have the same high level of skill or commitment to training as does a specialized phlebotomy team. Consider the effect of a phlebotomy service on costs associated with excess charges of \$5,000 (adjusted for inflation since the study was published) from extra hospital days, additional laboratory testing, and more antibiotic usage.<sup>11</sup> If one generalizes from this estimate, a predicted \$5 per specimen in excess expenditures would be avoided for every 0.1% reduction in the frequency of false-positive blood culture results from contamination during the collection procedure. A large multi-institutional study found that the median blood culture contamination rate was 0.4% lower among facilities that used a phlebotomy team to collect blood culture specimens.<sup>12</sup> On the basis of this level of reduction in blood culture contamination rates, the typical savings associated with using a phlebotomy service can be predicted to be about \$20 per blood culture specimen collected. This is just one of the several examples that illustrate how comprehensive phlebotomy services decrease cost and improve quality.

## Outcome of Safety Efforts

Dale and associates provide insight into not only what can be done but also what must be done to reduce the danger of needlestick accidents among phlebotomists. The investigators had the advantage of managing these safety improvements with the help of members of a motivated phlebotomy team who are responsible for almost all venipunctures performed at the institution. I would predict, however, that implementing a similar safety program among a diverse group of healthcare workers at other facilities, that do not have equally well-managed and comprehensive phlebotomy services, will be much more challenging and less likely to be successful.

### References:

1. McCray E. Occupational risk of the acquired immunodeficiency syndrome among healthcare workers. *N Engl J Med* 1986;314:1127-1132.
2. McGeer A, Sidor AE, Low DE. Epidemiology of needlestick injuries in house officers. *J Infect Dis* 1990;162:961-964.
3. McCormick RD, Melsch MG, Ircink FG, Makl DG. Epidemiology of hospital sharps injuries: a 14 year prospective study in the pre-AIDS and AIDS eras. *Am J Med* 1991;91 (Suppl 3B):301s-307s.
4. Centers for Disease Control. Evaluation of safety devices for preventing percutaneous injuries among healthcare workers during phlebotomy procedures—Minneapolis, St. Paul, New York City, and San Francisco, 1993-1995. *MMWR Morb Mortal Weekly Rep* 1997;46:21-25.
5. Haldunen DJ, Phillips ES, Clemons KV, Stevens DA. Percutaneous injury analysis: consistent categorization, effective reduction methods, and future strategies. *Infection Control Hosp Epidemiol*. 1995;16:582-589.
6. Howanitz PJ, Schiffman RB. Phlebotomists' safety practices: a College of American Pathologists Q-Probes study of 683 Institutions. *Arch Pathol Lab Med* 1994; 118:957-962.
7. Spitalnik SJ, Woolard RH, Mermel LA. The significance of changing needles when inoculating blood cultures: a meta-analysis. *Clin Infect Dis* 1995;21:1103-1106.
8. Centers for Disease Control. Recommendations for prevention of HIV transmission in healthcare settings. *MMWR Morb Mortal Weekly Rep* 1987;36 (Suppl 2):1S-18S.
9. O'Neil TM, Abbott AV, Radecki SE. Risk of needlesticks and occupational exposures among residents and medical students. *Arch Intern Med* 1992;152:1451-1456.
10. McConnell AA, Mackay GM. Venipuncture: the medicolegal hazards. *Post Grad Med J* 1996;Jan:72:23-24.
11. Bates DW, Goldman L, Lee TH. Contaminant blood cultures and resource utilization: the true consequence of false-positive results. *JAMA* 1991;265:365-369.
12. Schiffman RB, Strand C, Meler FA, Howanitz PJ. Blood culture contamination: a College of American Pathologists Q-Probes Study involving 640 institutions and 497,194 specimens from adult patients. *Arch Pathol Lab Med* 1998;122:216-221.

## Postexposure Prophylaxis: The Value of Needlestick Prevention is Going Up!

by Murray L. Cohen, PhD, MPH, CIH;  
CAPTAIN, US Public Health Service (ret)

Dr. Cohen served 21 years with the Centers for Disease Control and Prevention in the National Institute for Occupational Safety and Health and the National Center for Infectious Diseases. He is now president of Consultants in Disease and Injury Control, CDIC Inc. in Atlanta, GA.

The Centers for Disease Control and Prevention (CDC) published "Public Health Service Guidelines for the Management of Healthcare Worker Exposures to HIV and Recommendations for Postexposure Prophylaxis" (PEP) on May 15, 1998.<sup>1</sup> This report should help greatly in clarifying implementation of previous Public Health Service (PHS) recommendations for the management of occupational exposures to blood and body fluids. It should also facilitate the promotion of reporting needlestick injuries that do occur and, ultimately, in preventing the occurrence of needlestick injuries altogether.

This report states unequivocally that occupational exposures to bloodborne pathogens are "urgent medical concerns," and clearly documents the underlying scientific evidence that "timely administration of postexposure prophylaxis" is necessary.

### Brief History of Guidelines

On June 7, 1996, the Centers for Disease Control and Prevention (CDC) published "Update: Provisional Public Health Service Recommendations For Chemoprophylaxis After Occupational Exposure to HIV."<sup>2</sup> This revised guideline offered new hope for preventing occupational transmission of HIV, dramatically changing both the standard of care for hospital employee health and the responsibility for payment. In effect, the guideline held promise for increasing injury reporting by having post-injury treatment available that could help prevent transmission of deadly bloodborne infections. Furthermore, the concomitant increased costs for follow-up care of needlestick injuries would be expected to continually drive the value of needlestick prevention higher.

The first guideline published by the PHS on this subject<sup>3</sup>, included the following significant points:

- Prompt evaluation, counseling, and follow-up to needlestick injuries was needed
- Necessary exposure record keeping was described
- Laboratory animal data were inadequate to conclude for or against zidovudine (ZDV) effectiveness for prophylaxis

- Data to assess efficacy of ZDV prophylaxis for humans after exposure to HIV was insufficient
- ZDV could not be considered a necessary component of post-exposure management of healthcare workers
- PHS could not recommend for or against ZDV as post-exposure prophylaxis (PEP)

This "no recommendation" was the only reasonable conclusion that could be reached with the data available at that time. The PHS had to balance a possible lower risk of HIV transmission against the use of drugs with uncertain efficacy and toxicity. The government health agency could hardly risk creating an epidemic of serious toxic side effects without reasonable data that the treatment would be safe and effective.

### Recent Developments

The revised guidelines<sup>1,2</sup> summarize two very important epidemiology studies. A case control study of HIV seroconversions in healthcare workers who sustained percutaneous exposure to HIV-contaminated blood showed PEP with ZDV was associated with a 79% reduction of risk for HIV infection.<sup>4</sup> The second study, a prospective trial of ZDV treatment for HIV-infected pregnant women and their infants pointed to a 67% reduction in perinatal transmission of HIV.<sup>5</sup> Additionally, laboratory animal data suggested that PEP may prevent or ameliorate retroviral infections.<sup>6,7,8,9</sup>

The 1996 revised guidelines were most notably different in that they drew two specific conclusions:

- Chemoprophylaxis should be recommended after occupational exposures associated with the highest risk for HIV transmission.
- Combination therapies should include ZDV with lamivudine and a protease inhibitor such as zidovudine.

### Why Is There New Hope?

Action can now be taken following a needlestick injury. PEP serves as a medical treatment in response to a physical injury. Furthermore, rapid response is essential for PEP to be effective. These factors should increase rates of reporting when percutaneous injuries occur.

The revised guidelines<sup>1,2</sup> provide data to demonstrate what we intuitively expected all along; that is, all needlesticks are not created equal. The data presented allow a stratification of risk that replaces the concept of average risk of seroconversion that was previously published by CDC and others. PEP can now be based on better informed decisions than previously possible. The risk factors cited<sup>2</sup> include:

- Exposure to concentrated HIV
- Exposure to source patients with end-stage disease (high HIV titer)
- Exposures that involve a deep injury

- Exposures that involve large diameter hollow needles
- Exposures that involve visible blood on the device causing injury
- Exposures that involve devices used for intravenous procedures

The latest Guideline<sup>1</sup> does an excellent job of presenting a decision algorithm that is understandable and makes PEP decisions easier to implement by and for healthcare workers. It takes advantage of several new antiretroviral drugs approved by the FDA, and carefully delineates the exposure circumstances and levels of risk, where “basic” versus “more highly potent” regimens of PEP are justified.

#### Who Pays?

Since the 1990 guidelines<sup>3</sup> specifically stated that PEP could not be recommended, many employers, insurance companies, and health plans deemed PEP to be an uncovered experimental procedure. Costs of prophylaxis were often borne by the attending hospital or the injured workers.

The latest guideline<sup>1</sup>, however, clearly recommends PEP and includes the user-friendly decision table for various injury circumstances and various combination drug therapies. This, in effect, changes the standard of care for needlestick injuries by making it necessary to evaluate the circumstances of all such injuries. It requires specific decisions on whether or not to use PEP drug therapies and, if so, which drug regimens. Furthermore, each worker who undergoes PEP will require more sophisticated medical monitoring than with the previous ZDV-only therapy, and will more likely require time off from work due to PEP side effects. In fact, this latest Guideline<sup>1</sup> includes the following specific recommendations for the management of potentially exposed healthcare workers:

- a. Written protocols for prompt reporting, evaluation, counseling, treatment, and medical follow-up
- b. Access to clinicians to provide postexposure care during all working hours, including nights and weekends
- c. Availability of antiretroviral agents for PEP for timely administration
- d. Evaluation of exposed worker medical conditions, and possible interactions with concurrent prescription drugs
- e. Detailed recording of the circumstances of occupational exposures as well as postexposure treatment and management
- f. Evaluation and testing of the exposure source, when known
- g. Clinical evaluation and baseline testing of exposed healthcare workers
- h. Postexposure testing and follow-up counseling
- i. Monitoring and management of PEP toxicity

Unfortunately, these factors are likely to increase the costs for managing percutaneous injuries. They also increase the probability that insurance plans and worker compensation will cover the costs associated with more of these injuries in the future.

#### The Consequences of Failure to Provide PEP

The frequency of all types of percutaneous injuries must decline. This is not just necessary to prevent cases of occupational transmission of HIV. The emotional impact of these exposures is often substantial to the healthcare worker, the entire organization, work force, and community. HCV is emerging as a bloodborne pathogen of equal cost and concern for occupational transmission. We can reasonably expect a higher rate of reporting such injuries, and steadily increasing financial costs of managing every one of them.

The price of prevention is, therefore, only one figure in the total equation of cost. All of this adds up to expectations of increasing value for prevention of percutaneous exposures to blood.

#### Is Help Available?

New data was available for consideration in revising the guidelines<sup>1</sup> due to the record keeping recommendations called for in the previous guidelines.<sup>2,3</sup> Similarly, as more workers who receive PEP are enrolled in the anonymous CDC registry to assess toxicity, additional data will allow for continued and more precise updates of guidelines and PEP regimens.

Additional information can be obtained from the following sources:

CDC Internet home page ([www.cdc.gov](http://www.cdc.gov))

National Clinicians PEP Hotline (888-448-4911)

HIV PEP Registry (888-737-4448 = 888-PEP-4HIV)

Report unusual or severe toxicity from PEP to the Food and Drug Administration (800-332-1088), and to the drug manufacturer

Report HIV seroconversions in healthcare workers who receive PEP to CDC (404-639-6425)

Antiretroviral Pregnancy Registry (800-258-4263)

#### References:

1. Centers for Disease Control and Prevention. Public Health Service Guidelines for the Management of Healthcare Worker Exposures to HIV and Recommendations for Postexposure Prophylaxis. *MMWR* 1998;47(No. RR-7).
2. Centers for Disease Control and Prevention. Update: Provisional Public Health Service recommendations for Chemoprophylaxis after Occupational Exposure to HIV. *MMWR* 1996;45(2):468-472.
3. Centers for Disease Control and Prevention. Public Health Service Statement on Management of Occupational Exposure to Human Immunodeficiency Virus, Including Considerations Regarding Zidovudine Postexposure Use. *MMWR* 1990;39(no. RR-1, January 26): 1-14.
4. Centers for Disease Control. Case-control Study of HIV Seroconversion in healthcare workers after percutaneous exposure to HIV-infected blood — France, United Kingdom, and United States, January 1988-August 1994. *MMWR* 1995;44:929-933.
5. Connor EM, Sperling RS, Gelber R, et al. Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with zidovudine treatment. *N Engl J Med* 1994;331:1173-1180.
6. Van Rompay KKA, Otsyula MG, Marthas ML, Miller CJ, McChesney MB, Pedersen NC. Immediate zidovudine treatment protects simian immunodeficiency virus-infected newborn macaques against rapid onset of AIDS. *Antimicrob Agents and Chemother* 1995;39:125-31.
7. Shih C-C, Kaneshima H, Rabin L, et al. Postexposure prophylaxis with zidovudine suppresses human immunodeficiency virus type 1 infection in SCID-hu mice in a time-dependent manner. *J Infect Dis* 1991;163:625-7.
8. Martin LN, Murphy-Corb M, Soike KF, Davison-Fairburn B, Baskin GB. Effects of initiation of zidovudine treatment at different times after infection of rhesus monkeys with simian immunodeficiency virus. *J Infect Dis* 1993;168:825-35.
9. Sinet M, Desforges B, Launay O, Colin JN, Pocardalo JJ. Factors influencing zidovudine efficacy when administered at early stages of Friend virus infection in mice. *Antiviral Res* 1991;16:163-71.

## Medical Lore Hemophilia – A Look Back

Hemophilia is a rare hereditary bleeding disorder in which clotting factor VIII (hemophilia A) or factor IX (hemophilia B) is missing. Both hemophilia A (classic hemophilia) and hemophilia B (Christmas Disease) are caused by a defect on the X-chromosome. This implies that, with few exceptions, all patients are male, but the defect is transmitted as a sex-linked recessive gene by the female. The prevalence of hemophilia in industrialized countries has been reported at 13-18 per 100,000 males with hemophilia A, which is five to six times as common as hemophilia B.<sup>1</sup>

Although hemophilia as a laboratory diagnosis was not recognized until the 1940's, it was clinically described nearly two thousand years ago in the Talmud. It was written in the Babylonian Talmud that, if a woman circumcised her first son and he died as a result of exsanguination and a second died similarly, she must not circumcise her third son. The Talmud continues with an explanation for post-circumcision exsanguination when it states that the members of some families have "loose blood," whereas those of other families have blood which is "held fast," i.e., coagulates.<sup>2</sup>

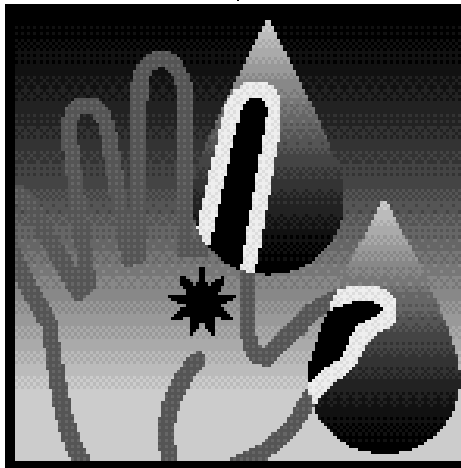
In the tenth century, early references to hemophilia are found in the medical handbook, *Al-Tasrif*, by the Moorish physician, Khalaf ibn Abbas Abwal Kasim, and in the codification of Talmudic laws by Maimonides. Further references to hemophilia are scarce until 1803, when the first accurate description of hemophilia was specified by John Conrad Otto of Philadelphia in his publication, "An Account Of A Haemorrhagic Disposition Existing In Certain Families." In 1820, Nasse formulated the genetic transmission of this disease and the name hemophilia was given to this disease by Schoenfein in 1839.<sup>2</sup>

Hemophilia became widely known to layman as the "Royal Disease." Historians have dramatized this by detailing the large family of Queen Victoria of Great Britain, and by writing about the impact this disease had on the English, Prussian, Spanish, and Russian royal houses.

It was Victoria's mother who carried the hemophilia trait. She was from the ruling family of the duchy of Saxe-Colburg, a small dukedom of the first German Reich. Members of the Colburg family made a definite effort to marry above themselves, pursuing the marriage brokerage business relentlessly. The Colburg family reached its zenith of power in 1901, when

it had provided nine contemporaneous sovereigns in Europe. Unfortunately, the family also passed on the recessive hemophilia gene with these marriages.

Victoria's mother (a Colburg), married the Duke of Kent, the fourth son of George III. Victoria was the only child of this marriage. She arrived at the throne in a circuitous fashion. Her father's three older brothers did not have heirs, thus the succession went to him, and then, to Victoria. Queen Victoria married Prince Albert, who was from Saxe-Colburg. They had nine children between 1840 and 1857, five daughters and four sons. Two daughters were known to be carriers and one son had hemophilia, from which he died. Later, as Victoria's grandchildren became of marriageable age, she became interested in the quest for suitable partners. Royal lines were established with Germany, Norway, Sweden, Spain, Greece, and Russia. Individuals in Great Britain, Germany, Russia and Spain had either the trait or the disease as a result of the arranged marriages.<sup>3</sup>



The most tragic story is of the Romanov family. Alix, a granddaughter of Victoria, married Nicolas, who became the Tsar of Russia. They had four daughters and then a son, Alexis, who had hemophilia. In 1917, on the brink of the communist revolution, Nicolas was asked to abdicate and name Alexis, his severely ill son, as his successor. Nicolas refused, and the Romanov dynasty was ended with the murder of the whole family.

Until only recently, hemophilia remained a crippling disease with a low life expectancy. Most bleedings in severe hemophilia occur spontaneously in the larger joints and muscles. In mild hemophilia,

bleeding usually does not occur except after trauma. Repeated bleeding in joints causes arthropathy, the major chronic complication of hemophilia.

The bleak outlook for the hemophilia patients was dramatically improved with the introduction of purified clotting factors. In 1964, Judith Pool and co-workers reported a simple and reliable method to purify factor VIII as a cryoprecipitate from human plasma. Other factors become available and these developments opened the possibility of modern hemophilia treatment by adequate replacement therapy.<sup>4</sup>

#### References:

1. Rosendaal FR, Smit C, Briet E. Hemophilia treatment in historical perspective: a review of medical and social developments. *Ann Hematol* 62(1):5-15, 1991 Feb.
2. Rosner F. Hemophilia in Classic Rabbinic Texts. *J Hist Med Allied Sci* 49(2):240-50, 1994 Apr.
3. Miller JM, Miller KS. Vignette of medical history: Queen Victoria and hemophilia. *Maryland Med Journal*, June 1993, 581-583.
4. Aledort LM. Hemophilia: Yesterday, today and tomorrow. *Mt. Sinai J Med* 63(3-4):225-35, 1996, May-Sept.

# Overview of the Infectious Substance Transport Requirements

by Glen J. Macri, Safety and Environmental Engineer

The task of transporting biological specimens is, at a minimum, considered costly and burdensome, if you are familiar with the requirements. However, keeping up with the ever-changing governmental regulations, conflicting supplier recommendations, and the host of commercially available packages (all claiming they meet the necessary requirements), leaves many feeling confused and over-burdened.

If you fall into the category of “confused,” read on. The person responsible for offering the specimens for transport is ultimately accountable for assuring that the shipment is properly classified, packed, labeled, marked, and documented in accordance with the regulations. As with any shipment of a hazardous substance, there are significant liabilities (civil and criminal) that are accepted just by offering a specimen for transport. These risks can be limited through proper packing and shipping.

The following summary of the transportation (any mode) requirements is intended to help identify the major responsibilities for shippers of biological specimens. The elements discussed below are based on the requirements of 49 Code of Federal Regulation (49 CFR) - Transportation, which incorporates the United Nations (UN) Recommendations on the Transport of Dangerous Goods. Please note that, under these regulations, anyone offering a hazardous substance for transport must receive adequate training and demonstrate competency in the subject matter.

## Classification and Declaration

There are 9 classes of dangerous goods, each class signifying a different type of hazard associated with the regulated material. Biological specimens fall into Class 6, division 2 - Infectious Substances (Class 6.2).

In order to properly pack, label and mark the specimen for transport, it must be categorized in one of the groups identified below. Correct categorization of the specimen is the most important step the shipper must complete. Every other step in the shipping process is contingent on the classification so it is imperative that the grouping be accurate. A word of warning: to err on the side of caution is still an error. Materials classified as being more hazardous than they truly are is considered as serious a violation as mistakenly classifying the material as non-hazardous.

The various specimen groups included in Hazard Class 6.2 are defined as follows:

### Group 1 - Infectious Substance

Substances known to contain, or reasonably expected to contain, a viable microorganism, or its toxin, that causes or may cause disease in humans or animals.

### Group 2 - Biological Products

Products derived from living organisms, that are manufactured and distributed in accordance with the requirements of national governmental authorities, which may have special licensing requirements and are used either for prevention, treatment, or diagnosis of disease in humans or animals.

### Group 3 - Diagnostic Specimens

Any human or animal material including, but not limited to, excreta, secreta, blood, blood components, tissue, and tissue fluids, being shipped for purposes of diagnosis.

Biological Products and Diagnostic Specimens are further divided into three categories for the purpose of shipping:

- a) Those reasonably expected to contain pathogens that cause or may cause disease in humans or animals.
- b) Those where a relatively low probability exists that pathogens are present that cause or may cause disease in humans or animals.
- c) Those known, as determined by specific testing, not to contain pathogens that cause or may cause disease in humans or animals.

Once the specimen has been properly grouped in one of the above-referenced categories, the appropriate packing, markings, labels and documentation can be determined through the use of the packaging instructions cited in Table 1.

Table 1

Hazard Class 6.2 Grouping	Packing Instructions
Group 1	602
Group 2 or 3, Category “a”	602
Group 2 or 3, Category “b”	650
Group 2 or 3, Category “c”	Not regulated

The above-cited packaging instructions reference the International Air Transport Association (IATA) requirements. The IATA Dangerous Goods Regulations are in complete compliance with the International Air Transport Association’s (ICAO) Technical Instructions. ICAO is the body of the UN that governs international civil aviation. Since the UN requirements are incorporated into 49 CFR, compliance with the packaging instructions assures compliance with U.S. transport requirements. Table 2 provides a comparative summary of the packaging instructions as well as other related shipping requirements.

Table 2

Summary of Packaging Instruction 602 and Related Requirements	Summary of Packaging Instruction 650 and Related Requirements
<p>1. Packaging</p> <p>a) Inner packaging comprising of</p> <ul style="list-style-type: none"> <li>• A watertight primary receptacle(s). Primary receptacle may only be glass, metal or plastic. Positive means of ensuring leakproof seal must be provided such as heat seal, skirted stopper or metal crimp seal. Screw caps must be reinforced with adhesive tape.</li> <li>• A watertight secondary packaging</li> <li>• An absorbent material placed between the primary receptacle(s) and the secondary packages.</li> </ul> <p>b) Outer packaging of sufficient strength to pass the performance oriented packaging standards for etiologic specimens. The outer package must be at least 100mm (4 inches) in the smallest dimension.</p> <p>2. Packaging Performance Summary</p> <p>Leakproof - Both the primary and the secondary packages must be watertight.</p>	<p>1. Packaging</p> <p>a) Inner packaging comprising of</p> <ul style="list-style-type: none"> <li>• A watertight primary receptacle(s). Primary receptacle may only be glass, metal or plastic. Positive means of ensuring leakproof seal must be provided such as heat seal, skirted stopper or metal crimp seal. Screw caps must be reinforced with adhesive tape.</li> <li>• A watertight secondary packaging</li> <li>• An absorbent material placed between the primary receptacle(s) and the secondary packages.</li> </ul> <p>b) Outer packaging of sufficient strength to pass the performance oriented packaging standards for etiologic specimens. The outer package must be at least 100mm (4 inches) in the smallest dimension.</p> <p>2. Packaging Performance Summary</p> <p>Leakproof - Both the primary and the secondary packages must be watertight.</p>

Continued on page 7

Table 2

Summary of Packaging Instruction 602 and Related Requirements	Summary of Packaging Instruction 650 and Related Requirements
Absorbent - The material must be sufficient to absorb the entire content of all primary receptacles. Pressure Test - The primary receptacle or the secondary package must be capable of withstanding, without leakage, an internal pressure differential of not less than 14 psi in the range of -40F to 130F.	Absorbent - The material must be sufficient to absorb the entire content of all primary receptacles. Pressure Test - The primary receptacle or the secondary package must be capable of withstanding, without leakage, an internal pressure differential of not less than 14 psi in the range of -40F to 130F.
Drop Test - The complete package must be capable of withstanding a drop from a distance of 27ft onto a rigid resilient, flat, horizontal surface.	Drop Test - The complete package must be capable of withstanding a drop from a distance of 27ft onto a rigid resilient, flat, horizontal surface.
Impact Test - A steel rod with a mass of 15 lbs. must be dropped from a height of 3ft onto completed package.	Impact Test - A steel rod with a mass of 15 lbs. must be dropped from a height of 3ft onto completed package.
3. Markings a) Name and telephone number of a person responsible for the shipment	3. Markings a) Name and telephone number of a person responsible for the shipment
b) Proper Shipping Name (in bold face) and UN Identification Number. The available choices are: • Infectious substance, affecting humans, UN2814 • Infectious substance, affecting animals, UN2900	b) Not required
c) "Ship to" Name and Address d) "Ship from" Name and Address	c) "Ship to" Name and Address d) "Ship from" Name and Address
4. Label A diamond shaped "Infectious Substance" (class 6.2) label measuring 4" x 4" must be affixed to a single surface. The label should be placed adjacent to the Proper Shipping Name and the UN Identification Number.	4. Label Not required
5. Shipping Documents A Shipper's Declaration for Dangerous Goods must be completed in triplicate and signed by the person responsible for the shipment. The shipper retains one copy and the remaining two must be presented to the carrier.	5. Shipping Documents Not required
6. General Requirements a) Advance arrangements must be made with the transporter and the receiver to ensure the shipment can be transported and delivered without unnecessary delay. b) An itemized list of contents must be enclosed between the secondary packaging and the outer packaging.	6. General Requirements a) Not required  b) An itemized list of contents must be enclosed between the secondary packaging and the outer packaging.

An itemized list of contents must be enclosed between the secondary packaging and the outer packaging. The information contained in this publication is only an overview of the requirements and refers specifically to samples being shipped at ambient temperature. Since dry ice is also a hazardous substance, additional packing, marking, and labeling requirements apply to the shipment of frozen specimens. A shipper of biological specimens should never act solely on this material without first referring to the applicable regulations. As mentioned previously, the regulations require any person responsible for offering a hazardous substance for transport, to first receive the appropriate training. Considering the liability associated with transporting specimens, shippers should be sure to comply with this requirement. ■

## Technical Exchange

As promised in the Winter/Spring 1997 issue (Vol. 7 No. 2), *Lab Notes* would like to make you aware of the recently published order of draw from the National Committee for Clinical Laboratory Standards (NCCLS). From the newly revised document, "Procedures for the Collection of Diagnostic Blood Specimens by Venipuncture; Approved Standard—Fourth Edition," H3-A4, June 1998, Vol. 18 No. 7, the NCCLS order of draw is as follows:

- 1) Blood culture tube
- 2) Plain tube, nonadditive (e.g., red stopper)
- 3) Coagulation tube (e.g., blue stopper)
- 4) Additive tubes:
  - Gel separator tube
  - Heparin (e.g., green stopper)
  - EDTA (e.g., lavender stopper)
  - Oxalate/fluoride (e.g., gray stopper)

The order-of-draw, which is recommended when drawing several specimens during a single venipuncture, is based on pragmatism. Its purpose is to avoid possible test result error due to cross contamination from tube additives. This procedure should be followed for both evacuated tubes, and syringe transfer of blood to multiple tubes.

Reference:  
Calam RR, Cooper MH. Recommended "order of draw" for collecting blood specimens into additive-containing tubes. *Clin. Chem.* 1982;28:1399

Correction: In the Volume 8, Number 2 issue of *Lab Notes*, the concentration of EDTA was stated to be 1.5 mg EDTA per milliliter of blood. The correct concentration of EDTA in the VACUTAINER® Brand Blood Collection Tubes is 1.8 mg EDTA per milliliter of blood. ■

**Becton Dickinson  
VACUTAINER Systems  
New Product News**



- ♥ Latex Free
- ♥ Same Elasticity as Latex
- ♥ Standard Tourniquet Size
- ♥ Convenient Dispenser Box
- ♥ Vanilla Scented

**ORDERING INFORMATION:**

25 tourniquets per box  
20 boxes per case  
Reorder No. 367203

For More Information call your Becton Dickinson VACUTAINER Systems Sales Representative or our Customer Service Department at 1(888)237-2762 or visit us at [www.bd.com](http://www.bd.com)

**NOW ON THE WEB!!!**

**HELP US, HELP YOU!**

IT'S AS EASY AS 1,2,3.



*The information you provide will be used to further develop the site to suit your needs.*

**Thank You for Your Cards and Letters**

If you want specific information about products, or if you are not on the LAB NOTES subscription list and would like to be added to it, please fill out and return the enclosed reply card. If the reply card is missing, you can write to:

Leslie Magee, Managing Editor  
LAB NOTES, Becton Dickinson VACUTAINER Systems, Franklin Lakes, NJ 07417-1885

LAB NOTES is published by Becton Dickinson VACUTAINER Systems, Franklin Lakes, NJ, providing the laboratory community with laboratory products including the VACUTAINER® Brand System, the UNOPETTE® Brand System, MICROTAINER® Brand Tubes, MICROTAINER® Brand Safety Flow Lancets, VACUTAINER® Brand SAFETY-LOK™ Needle Holder, VACUTAINER® Brand SAFETY-LOK™ Blood Collection Set and VACUTAINER® Brand Needle Disposal Container.



VACUTAINER, MICROTAINER, HEMOGARD, SST, PST, SAFETY-LOK, and UNOPETTE are trademarks, and Vacutainer Safety Institute is a service mark, of Becton Dickinson and Company, Franklin Lakes, NJ 07417-1885.

©1998

Printed in U.S.A.