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## Protecting the pharmacy tech from cytotoxic exposure

By Mari Mascioli

**Statement of objectives**

Upon successful completion of this lesson, the technician should be able to:

1. Recognize potential routes of exposure to cytotoxic drugs.
2. Understand how to prevent cytotoxic contamination through good aseptic technique.
3. Understand the procedure to follow when cleaning a cytotoxic spill.

**Introduction**

Cytotoxic drugs are defined as medications that may be carcinogenic (causing cancer), teratogenic (causing birth defects) or mutagenic (causing genetic changes) when used in animal models or therapeutically in humans.<sup>1</sup> Most cytotoxic drugs bind directly to genetic material in the cell nucleus or affect cellular protein synthesis; they may not distinguish between a cell that is normal and healthy and a cell that is cancerous. For this reason, normal cells of not only the cancer patient but also the healthcare worker handling these products are at risk.

The degree of exposure that takes place during work and the biological effects and changes cytotoxic agents have on healthcare workers are difficult to determine and vary depending on the agents used. It is difficult to define a safe level of exposure given current scientific data; however, accumulating evidence supports the potential toxicity of these drugs when handled

improperly.

For example, 5-Fluorouracil concentrations of 0.12 ng/m<sup>3</sup> to 82.2 ng/m<sup>3</sup> were found in a drug preparation area where a biological safety cabinet (BSC) was not used, suggesting the risk of respiratory exposure. Cyclophosphamide has been detected on the high efficiency particulate air (HEPA) filter cover of BSCs used to prepare this drug, demonstrating that aerosolization of drug is a reality.<sup>1</sup> Cyclophosphamide has also been detected on wipe samples from work station surfaces, indicating that there is also a risk for dermal exposure.<sup>1</sup> From these documented exposure risks it is clear that pharmacy technicians must learn how to protect themselves, their co-workers and their environment.

**Routes of exposure**

A pharmacy technician can be exposed to cytotoxic drugs through three routes:

- inhalation of drug aerosols or droplets;
- absorption of drugs through

direct skin contact, including needle sticks or contact directly with the eye; and

- ingestion through contact with contaminated food or food containers.<sup>3,6</sup>

These exposures can occur during aseptic technique manipulations such as:

- drawing solutions into a syringe;
- withdrawing needles from a vial;
- transferring drugs using syringes, needles or filter straws;
- breaking or leaking of bottles or bags;
- overfilling syringes; and
- expelling air from a syringe containing a cytotoxic drug.

All pharmacy personnel should be trained in the special handling procedures required for cytotoxic agents to minimize exposure.<sup>1</sup>

**Oral cytotoxic drugs**

It is often believed that only injectable drugs are a safety concern. However, handling oral cytotoxic drugs may also

pose a risk. There is a risk of aerosolization of powder when crushing or splitting tablets, while liquid or powder exposure may result from opening capsules. Although the risk associated with manipulating oral dosage forms of cytotoxic drugs appears to be low, the risk may increase with repeated exposure over several years.<sup>2</sup>

The Canadian Society of Hospital Pharmacists and the American Society of Health-Systems Pharmacists have developed guidelines that provide direction on the safe handling and labeling of cytotoxic drugs. The recommendations state that the crushing, splitting or pre-packaging of oral dosage forms of cytotoxic drugs should be performed in a safe environment such as a BSC. The label of the product should state that: the drug is cytotoxic material. Healthcare workers should wear gloves while handling these agents, and any waste should be disposed of in a cytotoxic waste container.<sup>2</sup>

When counting oral cytotoxic agents, workers should use a designated counting tray and spatula to ensure that cross contamination of other oral drugs does not occur. Wiping trays and spatulas with a small amount of detergent, such as Savlon, followed by alcohol ensures drug residues are not left in the work area. Waste materials (e.g. cotton from bottles, pads used to clean trays/spat-

ulas, gloves, bottles and vials) should be placed in a designated puncture proof cytotoxic waste container.

#### Personal Protective Apparel (PPA)

PPA consists of gloves, gowns, masks, eye protectors and caps. The thickness of gloves used in handling cytotoxic drugs is more important than the type of material used since all materials tested have been found to be permeable to some cytotoxic drugs after sufficient time of exposure. The lowest exposure has been seen with latex gloves.<sup>1,5,6</sup> Double gloving with thicker, longer gloves is recommended due to variability in permeability. The inner glove should be tucked inside, and the outer glove worn over the gown cuff. Gloves with no powder are preferred since powder may absorb contaminants. Gloves should be changed hourly or after a tear, spill or puncture, or whenever the operator is experiencing discomfort from sweating within the glove.

As with gloves, there is no perfect fabric for the gown. After four hours of exposure to cytotoxic drugs, non-porous Tyvek or Kaycel gowns are more permeable than Saranex Laminated Tyvek or Polyethylene-coated Tyvek. The Saranex-laminated or polyethylene-coated gowns allow for little airflow and can become uncomfortable for the technician.<sup>1,5</sup> Gowns should be dis-

posable, lint free and of low permeability and have long sleeves, a closed front and elastic or knit cuffs.<sup>6</sup>

When splashes, sprays or aerosols of cytotoxic drugs are generated, the result may be eye, nose or mouth contamination. The plexiglass view screen on the BSC provides sufficient face protection for the operator; a plastic face shield or splash goggles and a mask may be worn if the technician desires, however.<sup>4</sup>

Gowns and gloves used within the cytotoxic drug preparation area should not leave this area.<sup>4</sup> All gowns, gloves and disposable materials used in the preparation of cytotoxic drugs should be disposed of according to the institution's hazardous waste procedure.

#### Needles and syringes

It is recommended that leurolock fitting needles and syringes be used for the preparation of cytotoxic drugs to prevent needle separation. Used needles should not be crushed or clipped but placed in puncture/leak-proof containers designated for cytotoxic waste.<sup>4,6</sup> Some institutions will tip cap syringes with a leuro tip before disposal to ensure that any drug droplets or residue left in the syringe barrel or tip is contained.<sup>4</sup>

To avoid trace amounts of contaminants being passed along outside the BSC when syringes are prepared for administration, the outside of

the syringe should be wiped with detergent then alcohol before being labeled. Syringes should not be filled past their maximum fill volume (for example, no more than 50 mL in a 60 mL syringe) in order to deter healthcare workers from using high pressure syringing techniques, which can cause spillage.<sup>4</sup>

#### Injectable drugs

The best practice against spills and sprays when drawing up solutions or reconstituting powders is to avoid extremes of positive or negative pressure in medication vials. Using the milking technique to draw up solutions facilitates this practice. The milking technique involves injecting small amounts of air into a vial and allowing solution to flow into the syringe then repeating this technique until the desired amount of drug is in the syringe.<sup>4</sup>

Use of a venting pin or device with a hydrophobic filter that allows outside air to replace withdrawn liquid is sometimes appropriate. When reconstituting powdered injectables, using a filtered venting needle and pointing it toward the back air intake grill of the BSC helps avoid contamination of the work surface tray and the technician's gown.

Technicians should adjust the volume while the needle is in the vial. Volume adjustments outside of the vial should be avoided; if it becomes necessary, however, the technician should ensure that the needle cap is on the needle to avoid spilling and spraying throughout the BSC.

All areas where cytotoxic drugs are handled should have specific cytotoxic disposal containers close at hand for easy and safe disposal.<sup>4</sup> Needles and syringes should be disposed intact as crushing or breaking creates

## CE Faculty

**CE Coordinator:**  
Margaret Woodruff  
B.Sc.Pharm., MBA;  
Professor, Pharmacy Technician Program  
Humber College, Etobicoke, Ontario

**Author:**  
Mari Mascioli  
Pharmacy Technician  
Co-ordinator I.V. Training and Certification

Toronto Sunnybrook Regional Cancer Centre Pharmacy at Sunnybrook and Women's College Health Sciences Centre, Toronto, Ontario

**Reviewer:**  
Sharon L. Lee, B.Sc.Pharm.  
Staff Pharmacist - William Osler Health Centre  
Program Advisor, Community Pharmacy Assistant (Self-Study) Program - Humber College  
Etobicoke, Ontario

**Clincial Editor:**  
Lu-Ann Murdoch, B.Sc.Pharm.

For information about CE marking, please contact Mayra Ramos at (416) 764-3879 or mramos@rmpublishing.com.  
All other inquires about Tech Talk CE should be directed to Karen Welds at (416) 764-3922 or kwelds@rmpublishing.com.

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an exposure risk. All sharps and breakable items (e.g. needles, glass ampoules and glass fragments) should be disposed of in leak-proof, puncture-proof containers that are labeled as cytotoxic waste. When transporting cytotoxic waste containers from the BSC to an outside disposal container, PPA should be worn.<sup>4</sup> All cytotoxic waste should be picked up by a hazardous drug disposal company.

### Transporting cytotoxics

Manufacturers often ship cytotoxic drugs in boxes, some of which are slightly padded but many are not. If drugs are received from the manufacturer in an area other than the pharmacy, staff within the receiving area should be aware of special handling procedures. PPA (at least gloves) should be worn when receiving cytotoxic drugs, and the drugs should be kept separate from other drugs received. When being delivered to pharmacy areas, cytotoxic drugs should be placed in a container lined with absorbent padding and labeled as cytotoxic.<sup>4</sup>

When transporting prepared chemotherapy admixtures or syringes to patient care areas, staff should place the finished products in labeled, sealable containers. Large durable zip-closure bags are strong enough to contain a spill from a punctured I.V. bag provided the zip-closure bag itself is intact. If the bag does contain a spill, the whole unit (bag) should remain sealed and be placed into another zip-closure bag, then placed immediately into a puncture-proof disposable unit.<sup>4,6</sup>

### Chemo spills

The areas in which the spill occurred should be cleared and sealed off from all personnel except the technician

cleaning the spill. The technician must don all components of PPA from the spill kit, which is kept in all pharmacies that prepare or store chemotherapy. The spill kit should contain sealable plastic disposal bags, absorbent sheets, pads or powders, disposable toweling, goggles, two pairs of latex or heavy-duty gloves, and a small scoop or dustpan with a brush.<sup>4,6</sup>

### Liquid spills

Liquid spills of less than 25 mL inside or outside the BSC should be wiped up with gauze soaked in alcohol, then wiped with gauze soaked with a detergent such as Savlon, then again with alcohol. Alcohol alone is not sufficient to deactivate and remove cytotoxic drugs from surfaces. The gauze and outer gloves should be placed in a sealable plastic bag then placed in the designated cytotoxic leak-proof container. After clean up is complete, the second pair of gloves should be disposed of in the puncture-proof container outside the BSC, and the technician should wash his or her hands thoroughly. If the spill occurred within the BSC but is not contained on the work surface tray, a thorough decontamination will be necessary. This requires taking the components of the BSC apart and cleaning beneath the work surface tray. If the HEPA filter is contaminated by a spill, use of the BSC should be suspended until the filter is replaced.<sup>4</sup>

When spills are larger than 25 mL within the BSC, toweling from the spill kit may be necessary to mop up the spill before detergent is used to clean the area. If the larger spill is outside the BSC, the use of absorbent or clumping powder is necessary to minimize aerosolization. Sprinkle the powder

around and on top of the liquid spill, wait 15 to 20 seconds for clumping to occur, then sweep up the contaminated material with the dustpan and brush provided in the spill kit. Place the contaminated material, dustpan, brush, shoe covers, gown and outer gloves in the zip-closure bag provided in the spill kit and then into the puncture-proof container. Remove the inner gloves and hair cap last and also place them in the puncture-proof container.

Once the technician has completely cleaned up the spill, the institution's housekeeping or environmental services staff should be called to damp mop the area.<sup>4</sup>

### Powder spills

When spills of powders occur, the powder must be liquefied to decrease aerosolization before clean up can occur. The spill can then be treated as a liquid spill and cleaned up accordingly.

### Work area

The preparation or work area where cytotoxic drugs are stored and prepared should be a restricted area for authorized personnel only. Eating, drinking, storing food and applying cosmetics in the area should be prohibited. Procedures and equipment for spills, exposures and emergencies should be readily available. A sink with running water and/or an eyewash station should also be available.<sup>1,6</sup>

A class II or III BSC with vertical airflow through a HEPA filter and minimal or no re-circulation of air into the preparation room should be used to prepare cytotoxic drugs. The exhaust fan or blower of the BSC should be kept on at all times, except when the BSC is being mechanically repaired or moved. Turning the BSC off allows traces of aerosols to

settle on the work surface tray, and turning it on may then cause these aerosols to become airborne. If the BSC is turned off, staff wearing PPA should decontaminate it before re-use.

The BSC should be cleaned according to the manufacturer's instructions. Some manufacturers recommend weekly decontaminations as well as cleaning whenever a chemo spill occurs or whenever the cabinet needs to be moved, serviced or certified. Decontamination should consist of surface cleaning with water and a detergent (such as Savlon) followed by a thorough rinsing with alcohol. The use of a detergent is recommended since there is no single accepted method of chemical de-activation for all cytotoxic agents. Any removable work trays should be removed, and the BSC should be cleaned underneath the work tray according to a schedule set up by the pharmacy department.

The BSC should be serviced and recertified every six months or anytime it is moved or repaired. Certification of the BSC includes performance testing and changing of the HEPA filter if it has been contaminated by an accidental spill.

Your co-workers occupational environment is also your own. Procedures and equipment for the safe handling of cytotoxic drugs may vary slightly from institution to institution, but the mandate for safe handling of cytotoxic agents remains the same. The expertise of the technician is the most important tool to ensure safe handling of cytotoxic drugs in the pharmacy.

## References

1. OSHA Technical manual. Occupational Safety and Health Administration. U.S. Department of Labor. Section VI. Chapter 2. www.osha-slc.gov/dts/osta/otm/otm\_vi/otm\_vi\_2.html (accessed 08/10/02)
2. Pierce S, Hiltz A. Rx-RN. The Distillate. Safe Handling of Oral Cytotoxic Agents. 1998: 24(2).
3. Valanis B, Vollmer W, Labuhn K, et al. Association of antineoplastic drug handling with acute adverse effects in pharmacy personnel. Am J Hosp Pharm. Vol 50 Mar 1993.
4. Department of Pharmacy, Sunnybrook and Women's College Health Sciences Centre. Aseptic technique training and certification manual. Chapter 7. Chemotherapy preparation. 1998.
5. Harrison B. The Chemotherapy Sourcebook. M.C. Perry. Safe handling of cytotoxic drugs, a review. Section 5. Drug Administration. Chapter 46 1992.
6. Bleches C, Cullen D, Glynn-Tucker E. Safe handling of cytotoxic drugs, 2nd edition. Oncology Nursing Society. Oncology Nursing Press Inc. 1997.

## QUESTIONS

**1. Cytotoxic drugs can best be defined as drugs that:**

- a) Are carcinogenic, teratogenic or mutagenic in animal models or when used therapeutically in humans.
- b) Cause few serious side effects.
- c) Pose no health threat to those who prepare and administer these drugs.

**2. Recommendations for handling oral cytotoxic drugs state that:**

- a) Minimally, gloves should be worn.
- b) Cytotoxic tablets and capsules should be split or opened in the pharmacy on the dispensary counter.
- c) Cytotoxic tablets and capsules should not be split, opened or crushed.
- d) Should be labeled as cytotoxic material.
- e) All of the above are correct.
- f) A,C and D are correct.

**3. Sharp and nonsharp waste materials generated during preparation of cytotoxic drugs should be disposed of:**

- a) In a normal garbage

receptacle within the drug preparation area.

- b) In a plastic bag picked up by the housekeeping department.
- c) In a puncture-proof, leak-proof designated cytotoxic waste receptacle.
- d) None of the above.

**4. Cytotoxic exposure can occur through:**

- a) Inhalation, absorption and ingestion.
- b) Walking past the chemo room in the pharmacy.
- c) Living next door to a facility that administers or prepares cytotoxic drugs.
- d) Casual contact with a person who prepared chemotherapy.

**5. Pharmacy technicians can best protect themselves from cytotoxic drugs by:**

- a) Using a class II or III BSC.
- b) Ensuring full PPA is worn during drug preparation.
- c) Practising good aseptic technique.
- d) All of the above are correct.

**6. When cleaning a chemo**

**spill of powdered drug, the operator should:**

- a) Sweep the powder onto a dustpan and discard into a cytotoxic waste container.
- b) Call the institution's housekeeping department to clean up the spill.
- c) Use paper towels or absorbent padding to clean the spill.
- d) Liquefy the powder then clean up as per liquid spill.

**7. The preparation area for cytotoxic drugs should:**

- a) Be a restricted area.
- b) Have procedures and equipment for spills and exposures readily available.
- c) Have a sink with running water and/or eye wash station within it.
- d) All of the above are correct.
- e) None of the above is correct.

**8. The use of detergent followed by alcohol is recommended for cleaning the BSC because:**

- a) There is no better cleaner than soap.
- b) Other agents may scratch the surface of the work tray.

- c) There is no single accepted method of chemical deactivation for all cytotoxic agents.
- d) Detergents are gentle on the technician's hands.

**9. The H-E-P-A in HEPA filter is the abbreviation for:**

- a) High efficiency particulate air.
- b) Highly effective particle air.
- c) Heat effected pocked air.
- d) None of the above is correct.

**10. The milking technique involves:**

- a) Removing cytotoxic drugs from a vial using a transfer set.
- b) Injecting small amounts of air into a vial and removing small amounts of solution from the vial in order to avoid extremes of pressure within the vial.
- c) Pointing a filtered venting device toward the back air intake grill in the BSC.
- d) Injecting large amounts of air into a vial.



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JULY/AUGUST 2003

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**Protecting the pharmacy tech  
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**Please help ensure this program continues to be useful to you, by answering these questions.**

- Do you now feel more informed about issues related to cytotoxic exposure?  Yes  No
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Mayra Ramos  
Fax: (416) 764-3937 or  
email: [mayra.ramos@rci.rogers.com](mailto:mayra.ramos@rci.rogers.com)

Quebec Pharmacie and L'actualite Pharmaceutique  
Stephane Paradis  
Fax: (514) 843-2183  
email: [stephane.paradis@rci.rogers.com](mailto:stephane.paradis@rci.rogers.com)