Safe Handling of Chemotherapy in the Perioperative Setting

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ABSTRACT

Safe handling of chemotherapeutic agents during administration and disposal is critical. Most antineoplastic agents are toxic compounds that are carcinogenic, mutagenic, or teratogenic. Direct contact may cause irritation of the skin, eyes, and mucous membranes. Perioperative personnel should know how to handle hazardous materials safely to protect the patient, other staff members, and themselves. These safety precautions include appropriately identifying the patient; correctly preparing, verifying, and documenting the chemotherapeutic agents being administered; consistently wearing personal protective equipment; transporting the chemotherapeutic agent in a puncture-resistant container labeled “chemotherapy”; properly disposing of the chemotherapeutic agent and supplies; and handling a spill if one occurs. AORN J 91 (April 2010) 435-450. © AORN, Inc, 2010. doi: 10.1016/j.aorn.2009.09.030

Key words: chemotherapy administration, chemotherapy disposal, antineoplastic agents, hazardous materials.

The four cancers most common in the United States are prostate, breast, lung, and colorectal cancers. Fortunately, according to the National Cancer Institute (NCI), deaths from these cancers are declining. Conversely, the incidence rates of many other cancers are rising, including cancers of the bladder, brain, esophagus, kidney, liver, and pancreas, as well as non-Hodgkin’s lymphoma, leukemia, and childhood cancers. Perioperative nurses care for patients with cancer throughout the continuum of their treatments. In addition to participating in surgical procedures for diagnosis, treatment, and complications of cancer, perioperative nurses also may need to handle the chemotherapeutic agents that are administered in the perioperative environment. The Oncology Nursing Society (ONS), the Association of Pediatric Oncology Nurses, the International Society of Nurses in Cancer Care, and the American Society of Clinical Oncology are examples of professional organizations that provide...
extensive educational materials for nurses. Oncology nurses are specifically trained to care for patients receiving chemotherapy, but perioperative nurses may have little or no formalized training when it comes to working with patients who will be receiving chemotherapy.

It is important to note that, in the perioperative setting, it is not typical for an RN to administer IV chemotherapy; only a physician (eg, surgeon, oncologist) administers chemotherapy in the perioperative services department. The surgeon or the oncologist can administer chemotherapy in the OR during or after a surgical procedure, in a minor procedure area, or in a physician’s office. Chemotherapy is also administered as a treatment for non-cancer-related medical conditions.

The Occupational Safety and Health Administration’s (OSHA) Toxic and Hazardous Communication Standard, also referred to as the “Right to Know,” mandates that every employee be informed of the many potential hazards in a work setting where chemotherapeutic agents are handled and administered.\(^3\) Chemotherapeutic agents may pose a hazard to patients and staff members because these antineoplastic agents are toxic compounds (eg, carcinogenic, mutagenic, teratogenic). The Resource Conservation and Recovery Act of 1976 gave the Environmental Protection Agency the authority to control hazardous waste from “cradle to grave.”\(^4,5\)

Some chemotherapeutic agents are included in the list of pharmaceuticals that require additional special disposal, so they are identified as “P list” or “U list.” The lists designate certain commercial chemical products as “hazardous” when disposed of unused. For a waste to be designated as P or U, three criteria must be met:

- The formulation must contain at least one chemical on the P or U list.
- The chemical in the waste must be unused.
- The chemical in the waste must be the sole active ingredient.

Agents on the P and U lists are extremely hazardous and have specific disposal criteria.\(^4\)

Mitomycin is an example of a U-list chemotherapeutic agent that may be administered in the perioperative setting. Many other chemotherapeutic agents that have not yet been designated as P or U are extremely hazardous as well, and the disposal guidelines vary from state to state. Chemotherapeutic agents not yet designated as P- or U-listed waste should be assessed to determine whether they possess any or all of the four characteristics of a hazardous waste: ignitibility, corrosivity, reactivity, or toxicity, and should be handled as hazardous waste. It is essential to seek guidance from the pharmacists and environmental services officer at the health care facility for any additional disposal requirements.\(^6\)

It is important to develop evidence-based recommended practices for safe handling of chemotherapeutic agents in a perioperative setting. The formation of an interdisciplinary committee, including perioperative nurses, pharmacists, surgeons, oncologists, the director of surgery, the clinical educator, and the environmental services officer is an effective approach to begin this process. Nurses and ancillary staff members may have questions about chemotherapy. An environmental services officer may ask, “How should chemotherapeutic agents be transported and disposed?” A perioperative nurse may wonder, “Why is the surgeon not wearing eye protection when he administers chemotherapy into the bladder?” A postanesthesia care unit (PACU) nurse, patient care technician, or nursing assistant may inquire, “How do I dispose of the urine and the catheter bag if a patient has had a chemotherapeutic agent instilled into the bladder?” The intent of this article is to

- explain guidelines for safe handling of chemotherapy for all staff members;
- differentiate among procedures to clean up chemotherapy spills on the patient, personnel, and inanimate objects;
- discuss education for staff members caring for patients receiving chemotherapy in the
perioperative environment and education for the patients themselves; and

- identify common chemotherapeutic agents and routes of administration used in the perioperative setting.

PATIENT AND STAFF MEMBER SAFETY

Advocating for patient safety is an ethical obligation for nurses. In addition, federal laws and regulatory agencies mandate appropriate practices to protect patients and health care workers. These regulatory agencies include but are not limited to OSHA; the Center for Medicare and Medicaid Services; state boards of health; and state boards of nursing, medicine, and pharmacy. The Joint Commission publishes annual National Patient Safety Goals that include medication safety requirements. Professional nursing, medical, and pharmacy organizations, such as the ONS, the American Society of Clinical Oncology (ASCO), and the American Society of Hospital Pharmacists (ASHP), have published guidelines and recommendations for appropriate handling of chemotherapeutic agents.

Professional staff members must be knowledgeable regarding safe practices to ensure that all patients and all health care workers are aware of the hazards associated with chemotherapy. In addition, allied health personnel caring for patients undergoing chemotherapy or working near or on units with those patients must be given appropriate information. Training is necessary to communicate the appropriate procedures, and someone must be assigned the responsibility for managing the chemotherapy and dealing with situations that arise. Key strategies to ensure patient and staff member safety in the perioperative environment include developing recommended practices, policies, and procedures to address the

- physician orders for chemotherapy,
- appropriate environment for preparing chemotherapeutic agents,
- documentation of chemotherapy,
- medication safety and chemotherapy time out,
- appropriate use of personal protective equipment (PPE),
- transportation and disposal procedures, and
- sterile processing department (SPD) issues.

Physician Orders for Chemotherapy

According to the ASHP and ASCO-ONS “Standards for safe chemotherapy administration,” verbal orders should never be accepted for the administration of chemotherapy. It is important that the physician’s order be processed on a designated chemotherapy order form, either written or electronic, and that it be used in all areas of the health care facility.

Appropriate Environment for Preparation

The ASHP and OSHA have strict guidelines for pharmacists for the preparation of chemotherapeutic agents. Basic requirements include establishing a designated area in the pharmacy to prepare chemotherapeutic agents by using a biological safety cabinet (BSC) and by using PPE during chemotherapy preparation, including double gloving with powder-free latex gloves and wearing a disposable gown. The guidelines recommend the use of powder-free surgical latex gloves for handling chemotherapeutic agents because powder on the gloves may absorb contamination. Furthermore, the National Institutes of Health strongly recommends double gloving for handling of chemotherapeutic agents. If the facility does not have a BSC, then the ASHP recommends sending the patient to an alternate facility that does have a BSC.

When the written or electronic physician order for chemotherapy is received, the chemotherapeutic agent must be prepared by a pharmacist using the BSC. A pharmacist is required to place the chemotherapeutic agent in a properly labeled container (eg, vial, syringe). The pharmacist documents and records the numbers of vials of the chemotherapeutic agent as part of record-keeping; he or she must account for all empty containers.
Documentation of Chemotherapy

Documentation by the perioperative nurse should include the names of the physician and the RN checking the chemotherapeutic agent as well as the medication, dose, route of administration, date and time that the medication is administered, and name of the physician administering the chemotherapy.

Medication Safety and the Chemotherapy Time Out

Medication safety is important in all circumstances but never more so than with toxic agents of chemotherapy. Patients in the perioperative setting often receive medications by a variety of routes and by more than one member of the perioperative team, all during one visit. Medications may be prepared by pharmacists, nurses, anesthesia care providers, and surgical technologists. Medications are administered by nurses and physicians. Surgeons administer chemotherapy to the patient at the sterile field according to specific chemotherapy protocol. In addition, an oncologist can perform an intrathecal injection and administer chemotherapy after a surgical procedure while the patient is still under anesthesia. A perioperative nurse must pay meticulous attention to all of the physician medication order sets and all safe medication practices to provide appropriate and safe patient care. Developing a nursing care plan specific to the type of cancer being treated and the route of administration is a perioperative nursing responsibility (Table 1).

It is imperative to check the chemotherapeutic agents before they are taken from the pharmacy. The perioperative RN and the pharmacist should pause for a chemotherapy time out to jointly review the signed physician order for chemotherapy and to verify the five “rights” of medication administration safety: the right patient, right route, right time, right dose, and right medication. The surgeon and the nurse may ask and answer additional questions to ensure the patient’s safety:

- Is this the right medication based on the patient’s diagnosis?
- Is this the right dose based on the patient’s weight or body surface area?

Appropriate Use of PPE

Staff members and physicians must wear appropriate PPE for all chemotherapy procedures in the perioperative setting. This includes double gloving when handling the chemotherapeutic agents, using mask and eye protection if the potential for a splash exists, and wearing an impervious gown. The OR manager should ask the suppliers of the PPE in advance whether the equipment is appropriate for use during chemotherapy.

Transportation and Disposal Procedures

After the chemotherapeutic agent is prepared by the pharmacist and verified with the RN, it is transported to the OR, by the RN, in a puncture-resistant container labeled “chemotherapy.” If at all possible, disposable instruments and equipment should be used for the chemotherapy portion of the procedure to avoid the need to process instruments that were exposed to the chemotherapeutic agent.

After the chemotherapeutic agent is administered, all personnel who came in contact with the chemotherapeutic agent must change their gloves before proceeding with the surgical procedure. The scrub person places any instruments that came in contact with the chemotherapeutic agent in a puncture-resistant container labeled “chemotherapy” and sends the container to the SPD for processing. The circulating nurse places all disposable items (eg, syringes, needles, gloves, syringe adaptors) that...
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<thead>
<tr>
<th>Diagnosis</th>
<th>Nursing interventions</th>
<th>Outcome indicator</th>
<th>Outcome statement</th>
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</table>
| Risk for imbalanced fluid volume | - Identifies baseline genitourinary status.  
- Identifies physiological status.  
- Reports deviation in diagnostic study results.  
- Identifies factors associated with an increased risk for hemorrhage or fluid and electrolyte imbalance.  
- Monitors physiological parameters.  
- Evaluates genitourinary status. | - The patient’s urinary output is within the expected range at discharge from the OR or procedure room or postanesthesia care unit (PACU).  
- The patient’s vital signs are within the expected range at discharge from the OR or procedure room or PACU. | - The patient’s genitourinary status is maintained at or improved from baseline levels. |
| Anxiety and ineffective coping | - Identifies psychosocial status.  
- Assesses coping mechanisms.  
- Assesses psychosocial issues specific to the patient’s medication management.  
- Identifies barriers to communication.  
- Identifies the patient’s and designated support person’s educational needs.  
- Identifies expectations of home care.  
- Implements measures to provide psychological support.  
- Includes the patient or designated support persons in perioperative teaching.  
- Explains the expected sequence of events.  
- Provides status reports to family members.  
- Evaluates the psychosocial response to the plan of care.  
- Evaluates the patient’s response to instructions. | - The patient verbalizes the sequence of events to expect before and immediately after surgery.  
- The patient states realistic expectations regarding recovery from the procedure.  
- The patient and family members identify signs and symptoms to report to the surgeon or health care provider.  
- The patient and family members describe the prescribed postoperative regimen accurately. | - The patient or designated support person demonstrates knowledge of the expected psychosocial responses to the procedure. |
| Acute pain | - Assesses pain control by using a validated pain scale.  
- Implements pain guidelines by providing care consistent with clinical practice guidelines related to pain assessment and management.  
- Reviewing patient assessment for the type of pain being treated, medical condition, and health status.  
- Administering medications as prescribed.  
- Implements alternative methods of pain control by using diversified activities, therapeutic touch, meditation, breathing, and positioning to augment pain control methods.  
- Assesses the patient’s responses to pain management interventions, including physiological parameters and subjective and objective findings. | - The patient verbalizes control of pain.  
- The patient’s vital signs at discharge from the OR are equal to or improved from preoperative values. | - The patient demonstrates adequate pain control throughout the perioperative period. |
came in contact with the chemotherapy into the appropriate puncture-proof biohazard bin according to federal guidelines. The biohazard bins should be placed in an immediately available area. If it is necessary to transport items to the bin, then all items must be placed in a puncture-resistant container labeled “chemotherapy.”

**SPD Issues**

If it was not possible to use disposable instruments and equipment, then the circulating nurse or scrub person should inform SPD personnel that they are delivering chemotherapy-contaminated instruments or equipment. The SPD staff members must use PPE and double glove when retrieving the items and when processing them. After the SPD technician retrieves the instruments, he or she places the container and bag in the chemotherapy biohazard bin.

The technician should soak the instruments in a facility-approved detergent for 10 minutes. After draining the detergent, the technician rinses the sink well with water. The technician then processes the instruments as usual through the washer-sterilizer.

**PROCEDURES FOR SPILLS AND EYE EXPOSURE**

Inadvertent spills of chemotherapeutic agent can occur on inanimate objects, such as hard surfaces, linens, and gowns. Chemotherapy can also be spilled on the patient and personnel. Specific written guidelines to follow and appropriate reporting mechanisms should be in place for any chemotherapy spill. The physician and the risk management department should be notified, and the appropriate documentation should be completed according to facility policy.

Commercially prepared chemotherapy spill kits that contain supplies necessary to clean up a chemotherapy spill safely are available. Items in the spill kit may include caution signs to mark the area, spill pillows to contain the spill, super-absorbent towels, a gown, a respirator mask, goggles, two pairs of gloves, waste bags, a small brush and pan to clean up glass fragments, and chemotherapy waste labels. It is a good idea to place the spill kits at a convenient location in the department and even on surgical case carts so they are readily available during the surgical procedure.

A professional staff member (eg, nurse, pharmacist) should be designated to coordinate the clean up. Housekeeping staff members should not be called and would not be expected to manage this type of clean up unless they have received additional training provided by the environmental services department.

The following recommendations should be followed for all chemotherapy spills regardless of whether the spill occurred on the patient, a staff member, or an inanimate object:

- PPE should be worn by all staff members involved with chemotherapy spill clean-up.
- Only designated, trained staff members should clean up chemotherapy spills.
- Staff members should
  - restrict the area of spill;
  - call for help if needed;
  - obtain an approved chemotherapy spill kit;
  - place absorbent pads and towels gently on the spill, being careful not to touch the spill or create splashes;
  - gather the pads and towel, and place them in a plastic bag;
  - clean the contaminated area carefully with additional absorbent pads and towels, and place these in the plastic bag;
  - place all items used for the cleanup and any contaminated linens, gowns, or objects into an approved biohazard bin;
  - dispose of the PPE in an approved biohazard bin;
  - perform thorough hand washing after the cleanup procedure; and
  - document and follow up by reporting as designated by facility policy and procedure.
Chemotherapy Spills on Hard Surfaces
All of the practices required for any chemotherapy spill are required for spills that occur on a hard surface, such as a tabletop or the floor. In addition to those practices, the staff member should clean the surface with a facility-approved disinfectant and rinse the area well with water at least twice. Most large spills (ie, more than 100 mL) can be cleaned up by using a chemotherapy spill kit. If the staff member is unable to manage a large spill, he or she should contact the environmental services department for help.

Chemotherapy Spills on a Patient or Staff Member
All of the practices required for any chemotherapy spill are also applicable for a spill that occurs on a patient or staff member. In addition to those practices, the person should wash the affected skin with soap and water. If the spill occurs on a patient, then the staff member should notify the patient’s physician of the spill and document the spill according to facility policy. When a staff member has been contaminated, he or she should follow appropriate employee health guidelines after washing the affected skin.

Eye Exposure
The use of PPE (eg, a mask, eye protection) is key in preventing an eye exposure. All staff members should know the location of the nearest eye-wash station and eye-wash supplies, and the procedure to be followed if an eye is splashed with a chemotherapy agent. For an eye exposure, the affected eye should be flooded immediately with water or an isotonic eye wash for at least 15 minutes, and medical attention should be sought immediately according to facility policy.

Staff member education should be specific to the chemotherapy procedures performed at the health care facility.

Staff Member and Patient Education
It is important to provide staff member training and competency verification in safe handling of chemotherapy agents to ensure that safe, quality care is provided. Patient populations vary among health care facilities. For instance, a teaching facility associated with a cancer center may provide a variety of cancer therapies that include the administration of a variety of chemotherapy agents in the perioperative setting. In contrast, only one type of chemotherapy may be administered in a physician’s office. Staff member education and training should be specific to the chemotherapy procedures performed at the health care facility and should include a basic overview of the chemotherapy related to the specific surgical or invasive procedures performed at the facility as well as patient and staff safety measures.

The patient and his or her family members may be extremely anxious when coping with the diagnosis of cancer. Their comprehension and recall when discussing education and instructions may be limited, particularly during the preoperative period. Patients may appreciate and benefit from a variety of educational materials, such as informational pamphlets, videotapes, and appropriate web sites.

Postoperative instructions should include education regarding activity limitations, potential adverse effects, and safe handling of the patient’s body fluids because variable amounts of chemotherapy agents and metabolites are excreted in the urine and the stool (Patient Education Sheet). Every patient should be instructed to use good hand-washing techniques and pay attention to personal hygiene.

Patients and family members with access to computers and the Internet should be directed to
What is bladder chemotherapy?
Medicine that kills cancer cells (chemotherapy) can be used to treat certain types of bladder cancer. The medicine is put through a catheter (tube) into the bladder.

How do I get ready for the procedure?
- It is important to arrive on time for the procedure.
- Your doctor may tell you not to eat or drink anything after a certain time, depending on what time of day your surgery is scheduled. It is very important to follow these instructions to prevent complications with anesthesia.
- Be sure to tell your doctor if you feel like you have a cold or a fever or are urinating bright red blood before the procedure.
- You will be instructed to empty your bladder before the procedure.

What happens during the procedure?
- After cleaning your genital area, the surgeon puts a catheter into your bladder. Then your surgeon puts the chemotherapy medicine into your bladder.
- The medication is left in your bladder for a specific amount of time. Your surgeon decides how much time is needed.
- Your surgeon might ask you to change positions from side to side and back to front every 15 minutes while the medication is working in your bladder. This allows the medicine time to make contact with your bladder walls.
- Your surgeon may take out the urinary catheter after the procedure is complete.

What are the risks of chemotherapy?
It is important for you and your doctor to have a conversation about the risks and benefits of chemotherapy. Always ask questions when you do not understand the information.

What should I do after the chemotherapy treatment?
- Drink plenty of fluids to help flush the medicine out of your bladder.
- Try to urinate about one to two hours after the procedure is done.
- Use the regular home toilet and completely empty your bladder when urinating.
- Do not flush the toilet right away; pour two cups of household bleach into the toilet after urinating every time. Let it sit for about 20 minutes then flush the toilet twice. This helps to deactivate (neutralize) the medication in your urine.
- Do this every time you urinate for six hours after the treatment.
- Remind other members in the household to use a different toilet or to wait until the toilet has been flushed twice before using it.
- Wash your hands and your genital area every time after you urinate. Use soap and warm water to clean your genital area to get rid of any chemotherapy medicine to avoid skin irritation.

Call your doctor immediately if you experience any of the following complications:
- urgent and frequent urination,
- inability to urinate,
- bright red blood or blood clots in your urine,
- pain with urination or pain and discomfort all over,
- skin rash or skin irritation, or
- fever and chills.

Patient Resource
the NCI at the US National Institutes of Health web site at http://www.cancer.gov. Health care professionals can benefit from using this web site as well. The NCI provides information on an extensive variety of cancer topics and provides the ability to search for specific information. Cancer topics, clinical trials, cancer statistics, research, and funding are examples of links on this web page. The NCI provides both a patient version and a health professional version, which are also translated into Spanish.

COMMON CHEMOTHERAPEUTIC AGENTS USED IN THE PERIOPERATIVE SETTING AND ROUTES OF ADMINISTRATION

Common chemotherapeutic agents used in the perioperative setting are described in Table 2, which is designed to be used as a reference tool for perioperative nurses. This list is not intended to be all inclusive. The table includes the chemotherapeutic medication class, mechanism of action, route of administration in the perioperative setting, common doses, and the surgical or invasive procedure associated with the administration. These chemotherapeutic agents may be used in a variety of surgical or invasive procedures. The chemotherapeutic agent can be administered by the physician into or onto a body cavity or administered via a catheter. The patient population and treatment will vary from one perioperative setting to another, depending on the patient mix and treatments offered at each health care facility. Routes of administration include, but are not limited to,

- intravesical (eg, bladder) administration,
- intracranial administration,
- intraventricular brain injection, and
- intrathecal administration.

Intravesical Administration

The majority of diagnosed bladder cancers are superficial and often respond favorably to a localized chemotherapy treatment. The response to chemotherapy is proportional to the medication concentration and duration in the bladder. Doxorubicin, mitomycin, and epirubicin are all vesicants that can cause tissue necrosis with extravasation. If there is risk for extravasation, such as a bladder perforation, then the patient is at risk for peritonitis. The greatest benefit is received when the first treatment is given within six hours of tumor resection to prevent seeding. Chemotherapy treatments may be continued weekly for four to six weeks, depending on the patient’s cancer.

After a resection of the bladder tumor, the urologist administers the chemotherapeutic agent into the bladder via the bladder catheter. After preparing the chemotherapeutic agent, the pharmacist usually places the medication into a 60-mL syringe. The surgeon must wear PPE during administration of the medication. The chemotherapeutic agent should not be transferred into a catheter-tipped irrigation syringe, which may have been a common practice in the past. To administer the chemotherapeutic agent into the bladder, the surgeon can place an adaptor onto the original syringe to prevent an inadvertent spill or splash during transfer. After instilling the chemotherapeutic agent into the bladder, the surgeon puts a catheter plug onto the end of the catheter so that the chemotherapeutic agent remains in the bladder for a specified amount of time, usually one to two hours.

After surgery, the physician orders include a patient positioning routine. The PACU nurse places the patient prone, lateral, and supine, usually for 15 minutes in each position, to allow the chemotherapeutic agent to dwell on (ie, contact) all areas of the bladder. After the prescribed dwell time of the chemotherapeutic agent in the bladder, typically, the procedure has been completed and the patient is in the PACU. The nursing staff should use PPE (eg, double gloves, goggles, gown) when emptying or removing the bladder catheter. It is important to place an absorbent pad under the patient before removing the bladder catheter. Physicians may send patients home with the indwelling bladder catheter in
TABLE 2. Common Chemotherapy Agents Used in the Perioperative Setting\(^{1-6}\)

<table>
<thead>
<tr>
<th>Chemotherapy agent</th>
<th>Medication class</th>
<th>Mechanism of action</th>
<th>Common route of administration in perioperative services</th>
<th>Common dose</th>
<th>Surgical procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitomycin(^4)</td>
<td>Antineoplastic antibiotic</td>
<td>Inhibits DNA-dependent RNA synthesis; delays or inhibits mitosis</td>
<td>Intravesical (ie, bladder) instillation</td>
<td>40 mg in 40 mL of sterile water</td>
<td>After transurethral resection of bladder tumors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Topical ophthalmic</td>
<td>Concentration = 1 mg/mL</td>
<td>After trabeculectomy</td>
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<td></td>
<td></td>
<td></td>
<td>Topical tracheal</td>
<td>In preservative free, normal saline solution</td>
<td>After excision of pterygium</td>
</tr>
<tr>
<td>Biodegradable polymers (eg, polifeprosan 20 with carmustine implant, thiotepa)(^5)</td>
<td>Alkylating agent</td>
<td>The wafers are hydrolyzed and the chemotherapy agent diffuses into the surrounding brain tissue, reaching residual tumor cells and causing cell death by alkylating DNA and RNA</td>
<td>Intracavitary/intracranial (ie, wafers are placed by the neurosurgeon in the brain resection cavity before closure)</td>
<td>Each wafer contains 7.7 mg carmustine</td>
<td>As an adjunct therapy to surgery and radiation for newly diagnosed high-grade malignant gliomas or recurrent glioblastoma multiforme (eg, craniotomy for tumor resection)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Recommended dose is 8 wafers</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Total dose: 61.6 mg</td>
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<tr>
<td>Methotrexate</td>
<td>Antimetabolite</td>
<td>Interferes with cellular replication and DNA synthesis and repair</td>
<td>Intrathecal</td>
<td>In Lactated Ringer’s solution</td>
<td>Administered by the oncologist while the patient is still under anesthesia after a surgical procedure in the OR (eg, a central line placement)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dose is dependent on the patient’s chemotherapy protocol</td>
<td>Administered in a minor procedure room under anesthesia (eg, lumbar puncture for chemotherapy)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Total volume: 3 mL</td>
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</tr>
<tr>
<td>Cytarabine</td>
<td>Antimetabolite</td>
<td>Incorporated into DNA, slowing its synthesis and causing defects in the linkages to new DNA fragments; most effective when the cells are undergoing rapid DNA synthesis</td>
<td>Intrathecal</td>
<td>In lactated Ringer’s solution</td>
<td>Dose is dependent on the patient’s chemotherapy protocol</td>
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<tr>
<td>Pegaspargase</td>
<td>Enzyme</td>
<td>Breaks down amino acid asparagine and may block the growth of tumor cells that need asparagine to grow</td>
<td>Intramuscular injection into a large muscle mass (eg, the anterior thigh)</td>
<td>2,500 units/m²</td>
<td></td>
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</tbody>
</table>

place. Before the patient leaves the facility, the PACU nurse should empty the drainage bag and attach a new sterile drainage bag to the catheter. All staff members should follow the guidelines for safe handling of the catheter bag and contents and all disposables items that come in contact with the chemotherapeutic agent and should dispose of these items in an appropriate biohazard bin.

**Intracranial Administration**

A malignant glioma is the most common primary brain tumor, and the outlook for patients with these tumors is poor. For patients with the most severe, aggressive form of malignant glioma (ie, grade IV glioma or glioblastoma multiforme), the median survival time is less than a year. Surgery is recommended for all operable brain tumors and is usually followed by radiation therapy. Several studies have shown that adding a chemotherapeutic agent to radiation can improve the patient’s chance of survival. Interstitial chemotherapy absorption in the brain provides a higher concentration of chemotherapy and minimizes systemic toxicity.

The application of a biodegradable polymer of chemotherapy (eg, carmustine wafers) into the resection cavity after brain tumor removal is an adjunct therapy to surgery and radiation for newly diagnosed high-grade malignant glioma or recurrent glioblastoma multiforme. These wafers are placed by the neurosurgeon into the resected area before closure.

According to manufacturer’s recommendations, carmustine wafers should be stored frozen at or below −20°C (−4°F). Unopened foil packages may be kept at ambient room temperature for no more than six hours. It is imperative to double glove when working with the chemotherapeutic agents. Carmustine exposure can cause severe burning and hyperpigmentation of the skin. The scrub person should set up a separate area with dedicated forceps, Mayo scissors, and a sterile plastic bowl. The circulating nurse, while wearing PPE, should open the wafers when instructed by the surgeon, using care not to break the wafers. Wafers that are broken in half may be used but the manufacturer recommends discarding wafers that are broken into more than two pieces. Carmustine wafers are a time-released chemotherapeutic agent, and the distribution of the agent can be disrupted if the wafer is broken into several pieces. Eight wafers, the maximum number allowed, should be used to cover as much of the resected cavity as possible. Oxidized regenerated cellulose may be placed over the wafers to secure them against the cavity surface.

After the wafers are placed in the cavity by the neurosurgeon, everyone who handled the wafers should change gloves. The scrub person should follow the guidelines for safe handling of chemotherapeutic agents by placing the instruments that have come in contact with the chemotherapy wafers in a puncture-resistant container labeled “chemotherapy” and sending the container to the SPD for processing. The circulating nurse should ensure that all disposables items that have come in contact with the chemotherapeutic agent are placed in the puncture-resistant biohazard bin labeled “chemotherapy.”

**Intraventricular Brain Injection**

Chemotherapy can be administered by intraventricular brain injection via an Ommaya reservoir. The Ommaya reservoir is a surgically implanted device that provides permanent intra-
ventricular access. Perioperative nurses participate in placement of the device, but the chemotherapy is administered after the incision has healed. It is important to emphasize that the device is surgically implanted but, typically, the chemotherapy is not administered at this time.

Perioperative nurses also may be involved with these devices when the patient returns to the OR for adjustment of the reservoir or tubing.

Cancer cells can cross the blood-brain barrier into the cerebrospinal fluid (CSF). Primary central nervous system lymphomas, such as aggressive non-Hodgkin’s lymphoma, are often associated with acquired or congenital immunosuppression. The highest incidence of these types of cancers is found in patients with AIDS. These cancers do not respond well to standard chemotherapy treatments. One option for treatment is radiation therapy and central instillation of high doses of chemotherapy via an Ommaya reservoir directly into the lateral ventricle of the brain. After the incision has healed, the chemotherapy is administered while the patient is on a nursing unit at a health care facility or in a physician’s office. Physicians and RNs specially trained in chemotherapy can obtain a sample of the patient’s CSF, monitor CSF pressures, and administer chemotherapy via the Ommaya reservoir.

Intrathecal Administration
Chemotherapy can be administered via a lumbar puncture directly into the intrathecal space of the spinal canal that holds CSF. An advantage to the intrathecal route is that it is believed to provide more consistent medication levels in the CSF. Although “IT” is an approved abbreviation for the intrathecal route of administration, some facilities do not use this abbreviation when discussing intrathecal administration of chemotherapy because of the potentially fatal medication error if the abbreviation is misinterpreted to mean “intravenous.” To help prevent a fatal error, any patient who is receiving both IV chemotherapy and an intrathecal chemotherapy during the same hospital stay should not have the IV and intrathecal chemotherapy administered in the same physical location.

Two chemotherapeutic agents indicated for the intrathecal route of administration are methotrexate and cytarabine. Patient safety cannot be emphasized enough to avoid fatal outcomes. The circulating nurse must ensure that all medications are physically separated and are labeled appropriately to avoid potentially fatal medication errors. A Joint Commission Sentinel Event Alert and the “ASCO-ONS standards for safe chemotherapy administration” provide health care practitioners and health care facilities with recommendations for medications that are intended for intrathecal administration.

- Each health care facility should establish a list of medications that can be administered intrathecally.
- The medication should be prepared in the pharmacy as close as possible to the time of administration and, after preparation, should be stored in an isolated location.
- The medication should be labeled “For intrathecal use only” and placed in an appropriate bag labeled “chemotherapy.”
- The medication should be delivered and administered in a designated location, ideally one that is separate from other areas where IV chemotherapy is administered.
- Two licensed providers should perform a chemotherapy time out to independently verify and document the medication, dose, and route.

The circulating nurse and the oncologist perform a chemotherapy time out before administration of the intrathecal injection. The RN must verify with the oncologist that there is a signed order and that it is the right patient and the right medication based on the patient’s diagnosis, the right dose based on the patient’s weight or body...
surface area, the right route, and the right date of administration.

**Pediatric Patients Undergoing Intrathecal Chemotherapy Administration**

Pediatric patients with leukemia who require lumbar puncture and intrathecal chemotherapy often have their procedure performed in a minor procedure area adjacent to the PACU. The children receive general anesthesia for this uncomfortable and frightening procedure. Perioperative nurses should be aware of the needs (eg, physical, emotional, spiritual) of pediatric patients and their families. Caring for a child with leukemia can pose a multitude of challenges, and, by understanding the child’s needs, a nurse can compassionately provide the care needed through every stage of treatment. For example, it is important to allow the parents or caregivers to stay as long as possible in the preoperative areas with their child.

Intrathecal chemotherapy is administered via the lumbar puncture route by a hematology oncologist to pediatric patients under general anesthesia. Typically, the oncologist makes the puncture at the junction of the third and fourth lumbar vertebrae while the patient is in the lateral position with his or her knees pulled up toward the chest. Pediatric patients on a specific chemotherapy protocol require intrathecal methotrexate or cytarabine, or both medications, at specified intervals to prevent or treat central nervous system metastasis.

Because of the extensive length of time required for treatment, pediatric patients with leukemia often have a consent on file that is valid for one year for lumbar puncture and intrathecal chemotherapy. The consent must be available to the perioperative nurse and physicians before the procedure. Before the procedure starts, the circulating nurse should print a pediatric code sheet of emergency medications based on the patient’s weight.

If the child is already in the OR for another surgical procedure (eg, insertion of an implanted port, a central line placement), then the pediatric surgeon and the oncologist may collaborate so the child can undergo the lumbar puncture and receive intrathecal chemotherapy while already under general anesthesia.

Pediatric patients on these specific chemotherapy protocols present unique challenges. For the safety of the patient, it is imperative that health care providers be mentally prepared for the complexity of the chemotherapy treatment. A pediatric patient with leukemia is immunocompromised because of the disease process or the treatment. Patients can be neutropenic (ie, have a low white blood cell count) and must be vigilantly protected from infection. In fact, they may not be eligible for chemotherapy until their white blood cell count rises. The patient may be thrombocytopenic (ie, low platelets), so the oncologist may order a platelet transfusion before chemotherapy. The oncologist also may perform a bone marrow core and aspirate collection before the intrathecal administration of the chemotherapy.

**Non-Cancer-Related Treatments**

Chemotherapy also may be administered in the perioperative setting for non-cancer-related treatments. For instance, mitomycin may be administered topically after these ophthalmic procedures:

- excision of pterygium, an adjunct therapy to prevent recurrence of a primary pterygium, and
- trabeculectomy (ie, filtering procedure), an adjunct therapy to prevent trabecular tissue from growing back.

The perioperative team follows the same safe handling guidelines as discussed previously. While wearing eye protection and gloves, the circulating nurse transfers the chemotherapeutic agent from the syringe to a labeled sterile medication cup onto the sterile field. The scrub person adds several small pieces of the eye sponges to the medication cup. The surgeon applies the chemotherapy-soaked sponge to the eye for the...
prescribed amount of time, usually two minutes. The surgeon then irrigates the eye with balanced salt ophthalmic solution.18

Mitomycin also may be administered topically for patients who have a long-term tracheostomy and are experiencing problems with extra tissue growth on the trachea.18 The same safe handling guidelines apply for this use of a chemotherapeutic medication.

SUMMARY

Perioperative nurses must remain current with emerging trends in the use of chemotherapy in the perioperative setting. Understanding the potential and real hazards of chemotherapy and remaining competent in safe handling methods allows perioperative nurses to provide appropriate nursing care. Specialized education is necessary, therefore, for nurses and other perioperative personnel who participate in these procedures. Perioperative nurses also must be prepared to provide preoperative and postoperative education for the patient and his or her family members.

It is essential to develop evidence-based, recommended practices for the safe handling of chemotherapy in the perioperative practice setting. By partnering with oncology colleagues, perioperative nurses are in a good position to help develop best practices for perioperative personnel. Promoting an interdisciplinary team approach to meet these challenges has the potential to promote positive patient outcomes.

References


Resources


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Safe Handling of Chemotherapy in the Perioperative Setting

PURPOSE/GOAL

To educate perioperative nurses about safe perioperative administration and disposal of the chemotherapeutic agents.

OBJECTIVES

1. Discuss guidelines for safe handling of chemotherapeutic agents for all staff members.
2. Explain hazards related to chemotherapeutic agents.
3. Describe procedures to clean up chemotherapy spills.
4. Identify routes of administration of common chemotherapeutic agents.
5. Discuss nursing care of patients undergoing perioperative chemotherapy.

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QUESTIONS

1. Chemotherapeutic agents may pose a hazard to patients and staff members because they are
   1. carcinogenic.
   2. eugenic.
   3. mutagenic.
   4. teratogenic.
   a. 1 and 2          b. 2 and 3
   c. 1, 3, and 4      d. 1, 2, 3, and 4

2. Physician orders for chemotherapy can be written, verbal, or electronic.
   a. true          b. false

3. Strict regulatory guidelines require pharmacists to prepare chemotherapeutic agents
   1. in a designated area in the pharmacy.
   2. by using a biological safety cabinet.
   3. while wearing personal protective equipment (PPE).
   4. while wearing a double set of powder-free latex gloves.
   a. 1 and 2          b. 3 and 4
   c. 2, 3, and 4      d. 1, 2, 3, and 4

4. The “chemotherapy time out” that the perioperative RN and the pharmacist perform includes verification of ____________________________ as well as verification of the patient’s allergies and the five “rights” of medication administration safety.
   a. the signed physician order for chemotherapy
   b. the professional credentials of the nurse and pharmacist
   c. the operating room suite number where the chemotherapy agent should be delivered
   d. the length of the surgical procedure
5. To avoid having to process instruments that were exposed to the chemotherapeutic agent, disposable instruments and equipment should be used for the chemotherapy portion of the procedure if at all possible.
   a. true  
   b. false

6. Regardless of whether a spill occurs on a patient, a staff member, or an inanimate object, personnel should
   1. wear PPE when involved with chemotherapy spill clean-up.
   2. only clean up spills if they are trained and designated to do so.
   3. restrict the area of the spill with absorbent pads and towels.
   4. dispose of the pads, towels, and PPE in an approved biohazard bin.
   5. perform thorough hand washing after the clean-up procedure.
   6. document and follow-up reporting as designated by facility policy and procedure.
   a. 1, 2, and 4  
   b. 3, 5, and 6  
   c. 2, 3, 4, 5, and 6  
   d. 1, 2, 3, 4, 5, and 6

7. A patient’s postoperative instructions may include education regarding
   1. activity limitations.
   2. good hand-washing techniques and personal hygiene.
   3. potential adverse effects.
   4. safe handling of his or her body fluids.
   a. 1 and 3  
   b. 2 and 4  
   c. 1, 2, and 3  
   d. 1, 2, 3, 4, and 4

8. Which of these chemotherapeutic agents is instilled into the bladder?
   a. methotrexate  
   b. carmustine  
   c. mitomycin  
   d. pegasparase

9. When handling carmustine wafers, it is imperative to
   1. double glove because of the risk of severe burning and hyperpigmentation of the skin.
   2. ensure that the unopened package remains at room temperature for no more than six hours.
   3. set up a separate area with dedicated forceps, Mayo scissors, and a sterile plastic bowl in which to place and handle the wafers on the sterile field.
   4. carefully break the wafers into at least three pieces.
   5. use as many as eight wafers to cover as much of the resected cavity as possible.
   a. 2 and 3  
   b. 1, 4, and 5  
   c. 1, 2, 3, and 5  
   d. 1, 2, 3, 4, and 5

10. In the perioperative setting, chemotherapeutic agents indicated for the intrathecal route of administration are
   a. cytarabine and mitomycin.
   b. methotrexate and cytarabine.
   c. mitomycin and methotrexate.

The behavioral objectives and examination for this program were prepared by Rebecca Holm, RN, MSN, CNOR, clinical editor, with consultation from Susan Bakewell, RN, MS, BC, director, Center for Perioperative Education. Ms Holm and Ms Bakewell have no declared affiliations that could be perceived as posing potential conflicts of interest in the publication of this article.
Safe Handling of Chemotherapy in the Perioperative Setting

This evaluation is used to determine the extent to which this continuing education program met your learning needs. Rate the items as described below.

OBJECTIVES
To what extent were the following objectives of this continuing education program achieved?

1. Discuss guidelines for safe handling of chemotherapeutic agents for all staff members.
   Low 1. 2. 3. 4. 5. High
2. Explain hazards related to chemotherapeutic agents. Low 1. 2. 3. 4. 5. High
3. Describe procedures to clean up chemotherapy spills. Low 1. 2. 3. 4. 5. High
4. Identify routes of administration of common chemotherapeutic agents. Low 1. 2. 3. 4. 5. High
5. Discuss nursing care of patients undergoing perioperative chemotherapy. Low 1. 2. 3. 4. 5. High

CONTENT

6. To what extent did this article increase your knowledge of the subject matter? Low 1. 2. 3. 4. 5. High
7. To what extent were your individual objectives met? Low 1. 2. 3. 4. 5. High
8. Will you be able to use the information from this article in your work setting? Yes 2. No

9. Will you change your practice as a result of reading this article? (If yes, answer question 9A. If no, answer question 9B.)

9A. How will you change your practice? (Select all that apply)
1. I will provide education to my team regarding why change is needed.
2. I will work with management to change/implement a policy and procedure.
3. I will plan an informational meeting with physicians to seek their input and acceptance of the need for change.
4. I will implement change and evaluate the effect of the change at regular intervals until the change is incorporated as best practice.
5. Other: __________________________

9B. If you will not change your practice as a result of reading this article, why? (Select all that apply)
1. The content of the article is not relevant to my practice.
2. I do not have enough time to teach others about the purpose of the needed change.
3. I do not have management support to make a change.
4. Other: __________________________

10. Our accrediting body requires that we verify the time you needed to complete the 3.6 continuing education contact hour (216-minute) program: ___