AANA Journal Course

Update for nurse anesthetists

2

6 CE Credits*

Anesthetic implications for cancer chemotherapy

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Cancer is one of the most prevalent disease processes affecting people of all ages. Cancer is the second most common cause of death in the United States, exceeded only by heart disease. Cancer survival is dependent on treatment options that may include surgery, radiation, and chemotherapy. Chemotherapy, or systemic cancer therapy, is designed to promote cell death during different phases of cell growth and division. Unfortunately, chemotherapeutic agents cannot differentiate between malignant and normal cells. Therefore, the toxic effects of chemotherapy are also seen in healthy organs and tissues. In addition, chemotherapeutic agents can interact with other medications.

The effects of chemotherapy may be acute and self-limiting or chronic and present long after treatment has been completed. Patients who have had chemotherapy often undergo surgery that may or may not be related to their cancer. Chemotherapy administration can have a profound influence on anesthetic management. Safe administration of anesthesia includes knowledge of chemotherapeutic agents and their toxic effects. This course discusses the anatomic and physiologic effects of cancer chemotherapeutic agents and how they specifically affect patients receiving anesthesia.

Key words: **Anesthesia, cancer, chemotherapy, toxicity.**

Objectives

At the completion of this course, the reader should be able to:

1. Describe the classes of chemotherapeutic agents and their mechanisms of action.
2. Understand the importance of the preoperative evaluation as it relates to patients who have received or are receiving chemotherapy.
3. Associate chemotherapeutic agents with their related toxic effects.
4. Differentiate between acute and long-term toxic effects seen with chemotherapeutic agents.
5. Refine the anesthetic management of patients who have received or are receiving chemotherapy.

Introduction

Oncological patients are seen by anesthesia providers at multiple phases of the disease process. Patients who have received chemotherapy may demonstrate clinically relevant physical alterations that can affect perioperative anesthetic management. Alterations may include deviations in bone marrow production and immunity and renal, lung, and cardiac dysfunction. This course discusses the anatomic and physiologic effects of cancer chemotherapeutic agents and how they specifically affect patients receiving anesthesia. Understanding the anesthetic implications of chemotherapeutic agents and their sequelae is essential in providing quality patient care.[1]

Cancer statistics

The American Cancer Society's annual estimate of new cancer cases in the United States for the year 2007 is 1,444,920. Deaths attributable to cancer will be 559,650, or more than 1,500 people a day. It is the second most common cause of death in the United States, exceeded only by heart disease. When aggregated by age, death due to cancer has surpassed death due to heart disease in people younger than 85 years.[2,3]

The most commonly diagnosed cancer in men is prostate cancer, and it alone will account for 29% of cancers in men in the coming year. Breast cancer is the most frequently diagnosed cancer in women and will account for 26% of total newly diagnosed cancer cases for women in 2007. Lung cancer continues to be the leading cause of cancer death in men and women.[3]

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Table 1. Top 10 cancers in men and women and common chemotherapy treatments

Potential chemotherapy treatments	
Men	
1. Prostate	Leuprolide, triptorelin, flutamide, doxorubicin, cyclophosphamide, cisplatin, vinblastine, etoposide
2. Lung and bronchus	Cisplatin, etoposide, carboplatin, docetaxel, gemcitabine, gefitinib, erlotinib, vinblastine, vinorelbine, cyclophosphamide, doxorubicin, vincristine
3. Colon and rectum	Fluorouracil, cetuximab, capecitabine, methotrexate, cisplatin
4. Urinary bladder	Methotrexate, vinblastine, doxorubicin, cisplatin, cyclophosphamide, fluorouracil, gemcitabine
5. Melanoma of the skin	Cisplatin, paclitaxel, tamoxifen, vincristine
6. Non-Hodgkin lymphoma	Doxorubicin, bleomycin, vinblastine, vincristine, etoposide, cyclophosphamide, methotrexate
7. Kidney and renal pelvis	Floxuridine, vinblastine, fluorouracil
8. Oral cavity	Cisplatin, fluorouracil, paclitaxel
9. Leukemia	Vincristine, daunorubicin, doxorubicin, cytarabine, cyclophosphamide, etoposide, methotrexate, busulfan
10. Pancreas	Fluorouracil, gemcitabine, carmustine, mitomycin, doxorubicin, methotrexate, cisplatin
Women	
1. Breast	Doxorubicin, epirubicin, cyclophosphamide, docetaxel, paclitaxel, methotrexate, tamoxifen, docetaxel, gemcitabine, thiotepa, vincristine, vinblastine, carboplatin, cisplatin
2. Lung and bronchus	Cisplatin, etoposide, carboplatin, docetaxel, gemcitabine, gefitinib, erlotinib, vinblastine, vinorelbine, cyclophosphamide, doxorubicin, vincristine
3. Colon and rectum	Fluorouracil, cetuximab, capecitabine, methotrexate, cisplatin
4. Uterus	Progestins, tamoxifen, doxorubicin, cisplatin, fluorouracil
5. Non-Hodgkin lymphoma	Doxorubicin, bleomycin, vinblastine, vincristine, etoposide, cyclophosphamide, methotrexate
6. Melanoma of the skin	Cisplatin, paclitaxel, tamoxifen, vincristine
7. Thyroid	Doxorubicin, cisplatin, bleomycin, melphalan
8. Ovary	Paclitaxel, cisplatin, carboplatin, docetaxel, doxorubicin, cyclophosphamide, etoposide, liposomal doxorubicin
9. Urinary bladder	Methotrexate, vinblastine, doxorubicin, cisplatin, cyclophosphamide, fluorouracil, gemcitabine
10. Pancreas	Fluorouracil, gemcitabine, carmustine, mitomycin, doxorubicin, methotrexate, cisplatin

Table 1 lists the top 10 diagnosed cancers in men and women along with common chemotherapeutic agents used to treat them.

Chemotherapy

Chemotherapeutic agents act by interfering with the cell cycle at different phases of cell replication. Unfortunately, because of this mode of action, there is no drug that can destroy cancer cells without also damaging normal healthy cells. In contrast with traditional cancer therapy, newer treatments are more cell-specific and less globally cytotoxic but are still associated with the potential for serious side effects.[4] Classifications of cytotoxic drugs are determined by their specificity in the cell cycle. Classes include alkylating agents, antimetabolites, antitumor antibiotics, and vinca alkaloids (Table 2). Some drugs are loosely classified as miscellaneous because their mechanism of action is not fully understood or their action does not conform to one of the more specific classifications.[5] Alkylating agents affect DNA, causing cross-linking and abnormal base pairing and resulting in intracellular imbalance and cell death. Antimetabolites or structural analogs interfere with cell replication by substitution of metabolites necessary for cell reproduction. Antitumor antibiotics act by inhibiting DNA and RNA synthesis. Vinca alkaloids are known to interact with the microtubular proteins needed for cell division.[5] Toxic effects are related to the type of drug, the cumulative dose, and the dosing schedule.[6,7]

In preparation for administering anesthesia to a patient receiving or who has received chemotherapy, a

Table 2. Classes of chemotherapy drugs

Alkylating agents	Antimetabolites	Antitumor antibiotics	Vinca alkaloids	Natural products and miscellaneous agents
Mechlorethamine	Methotrexate	Actinomycin D	Vinblastine	Paclitaxel
Chlorambucil	Pemetrexed	Adriamycin	Vincristine	Nab-paclitaxel
Cyclophosphamide	Mercaptopurine	Bleomycin	Vinorelbine	Docetaxel
Melphalan	Thioguanine	Doxorubicin		Etoposide
Busulfan	Fluorouracil	Idarubicin		Hydroxyurea
Estramustine	Capecitabine	Dactinomycin		Mitotane
Carmustine	Cytarabine	Daunorubicin		Topotecan
Lomustine	Temozolomide	Epirubicin		Irinotecan
Procarbazine	Clofarabine	Liposomal doxorubicin		Azacytidine
Dacarbazine	Gemcitabine	Liposomal daunorubicin		Thalidomide
Cisplatin	Fludarabine	Plicamycin		
Carboplatin	Cladribine	Mitomycin		
Oxaliplatin	Gemcitabine	Mitoxantrone		
Ifosfamide	Pentostatin			
Thiotepa				
Sermustine				

comprehensive preoperative history and physical examination are paramount. Full knowledge of all cancer treatment received by the patient, including surgery and radiation, may reveal potential operative complications such as exacerbation of surgical bleeding.[1] Information obtained by anesthesia providers about cancer treatment received by patients should be exhaustive and include type of chemotherapeutic agents, number of treatments, date of last treatment, and total amount of agent received.[6] Patients and family members are often unable to provide complete and accurate information pertaining to cancer treatment. Anesthesia providers may need to access other sources, such as charts from prior admissions, to obtain the necessary information.

Central nervous system effects

Central nervous system toxicity resulting in nausea and vomiting consistently ranks among the top 3 reported side effects of chemotherapy. Onset is usually acute, occurring within 12 to 24 hours after treatment. Delayed nausea and vomiting occurs after 24 hours and may last for 6 to 7 days.[8] Cisplatin in high doses will cause vomiting within 24 hours of administration in 90% of patients who are not taking prophylactic antiemetics.[8] Emetogenicity risk factors for patients receiving chemotherapy are the same as for patients who experience postoperative nausea and vomiting. These factors include young age, female gender, and history of motion sickness.

Vomiting patients are at risk for electrolyte imbalances, dehydration, weight loss, and malnutrition. Patients experiencing nausea alone may have flushing and tachycardia. Prevention of aspiration remains a primary concern to anesthesia providers, and this patient population presents an increased risk. A reliable and valid self-reporting instrument such as the Rhodes Index of Nausea, Vomiting, and Retching may be a valuable assessment tool. This information will provide a view of the patient's personal symptom experience, allowing the anesthesia provider to plan appropriate symptom management.

Other central nervous system effects include seizures, which may occur with busulfan treatment up to 24 hours after the last dose. Numbness and tingling of extremities, loss of deep tendon reflexes, and weakness of distal limb musculature are toxic signs of vincristine therapy.[9] Other chemotherapeutic agents associated with neuropathies include cisplatin, taxanes, and oxaliplatin.[10] Vinca alkaloids have been the causative agent in vocal cord paralysis and loss of extraocular muscle function. Central nervous system toxic reactions usually disappear after discontinuation or dosage adjustment.[9] Agents that may cause central nervous system toxicity are listed in Table 3.

Cardiac effects

Hemodynamic stability is an important aspect of anesthetic management and may be impaired by cardiotoxicity. Cytostatic anthracycline antibiotics are the chemotherapeutic agents most commonly associated with cardiotoxicity.[11] Anthracyclines are a subset of the antibiotic class of chemotherapeutic agents and include daunorubicin, doxorubicin, epirubicin, and idarubicin. Other agents that also induce this phenomenon are listed in Table 4. Because the myocar-

Table 3. Chemotherapeutic agents that cause central nervous system toxicity

Alkylating agents	Vinca alkaloids	Natural products and miscellaneous agents
Cisplatin	Vinblastine	Taxane
Busulfan	Vindesine	Docetaxel
Oxaliplatin	Vincristine	Nab-paclitaxel
	Vinorelbine	Paclitaxel

Table 4. Chemotherapeutic agents that cause cardiotoxicity

Alkylating agents	Antimetabolites	Antitumor antibiotics	Natural products and miscellaneous agents
Busulfan	Cladribine	Mitomycin	Etoposide
Carmustine	Cytarabine	Anthracycline	Paclitaxel
Cisplatin	Fluorouracil	Daunorubicin	Trastuzumab
Cyclophosphamide		Doxorubicin	Tretinoin
Ifosfamide		Epirubicin	
		Idarubicin	

dium consists of cells that have limited regenerative capability, the heart is susceptible to permanent damage.[12]

The 3 established forms of anthracycline-induced cardiotoxicity are separated into acute, chronic, and late onset. Acute cardiotoxicity pertains to an onset immediately after a single dose or course of therapy and is usually transient. It may involve abnormal electrocardiographic findings, including ST-T wave changes, QT-interval prolongation, and arrhythmias. Chronic toxic effects occur within 1 year of therapy, with rapid onset and progression. Manifestations include tachycardia, tachypnea, ventricular dilation, exercise intolerance, pulmonary and venous congestion, poor perfusion, and pleural effusion. This toxicity reflects progressive injury and loss of myocytes and will eventually lead to congestive heart failure and decreased left ventricular ejection fraction. Late-onset toxic effects occur several years or decades after therapy cessation. These effects include ventricular dysfunction, conduction disturbances and arrhythmias, and congestive heart failure as a consequence of myocyte damage. Late-onset toxic effects typically occur in patients who received anthracycline therapy as a child or adolescent and can occur even with low doses. Other clinical signs of cardiotoxicity include mild blood pressure changes, thrombosis, myocarditis, pericarditis, myocardial infarction, and cardiomyopathy.[13]

Risk factors that can increase the incidence of chemotherapy-related cardiotoxicity are history of radiation therapy to the mediastinum or left chest wall, age at treatment (higher incidence in younger patients), preexisting cardiac disease, obesity, and left ventricular ejection fraction of less than 50%.[14] These factors and the type of surgery must be considered when evaluating cardiac status before anesthesia. A chest radiograph, a 2-dimensional echocardiogram, an electrocardiogram, and the levels of lactate dehydrogenase and creatine phosphokinase enzymes can be indicative of altered myocardial function. Anesthesia providers must keep in mind that abnormalities in cardiac function can exist even in patients with normal resting cardiac function.[11] Patients who have received anthracycline therapy may have an enhanced cardiodepressive effect from anesthesia.[11] In a compromised patient, prolonged sympathetic hyperactivity maintains cardiac function and the number of β-adrenergic receptors may be decreased. Therefore, β-adrenergic agonists may be ineffective, and a nonadrenergic inotropic agent should be considered. Anesthetics with negative inotropic effects, such as halothane, should be avoided. Chronic sympathetic stimulation maintains cardiac function in compromised patients; therefore, ketamine may depress, rather than enhance, cardiac function.[1]

Pulmonary effects

When pulmonary toxic effects occur from cytotoxic agents, they involve a combination of direct lung damage and indirect inflammatory processes.[15] In general, the adverse respiratory effects from cytotoxic agents are composed of an early inflammatory interstitial pneumonitis, acute noncardiogenic pulmonary edema, bronchospasm, and pleural effusion.[11] Some

Table 5. Chemotherapeutic agents that cause lung toxicity

Alkylating agents	Antimetabolites	Antitumor antibiotics	Vinca alkaloids	Natural products and miscellaneous agents
Busulfan	Cytarabine	Bleomycin	Vinorelbine	Cetuximab
Carmustine	Fluorouracil	Mitomycin		Docetaxel
Chlorambucil	Fludarabine			Erlotinib
Cyclophosphamide	Gemcitabine			Gefitinib
Melphalan	Methotrexate			Irinotecan
Oxaliplatin				Paclitaxel
Procarbazine				

of the signs and symptoms associated with these effects include dyspnea, cough, tachypnea, bibasilar rales, and, occasionally, fever. Pneumonitis occurs gradually in the first few months of treatment but can occur as long as 6 months after treatment.[16] Pneumonitis is accompanied by an increase in fibroblast activity. Fibroblast activity is then followed by collagen synthesis and decreased collagen degradation, leading to pulmonary fibrosis.[17] There is a wide range of cytotoxic chemotherapy agents that have been implicated in pulmonary fibrosis and are listed in Table 5. Bleomycin is the chemotherapeutic agent most associated with toxicity that can lead to pulmonary fibrosis.[11] Fibrosis is accompanied by dyspnea, hacking cough, fatigue, chest discomfort, and rapid weight loss. Up to 25% of patients with previous bleomycin therapy may develop postoperative respiratory insufficiency, necessitating prolonged postoperative intubation.[11] Preoperative assessment should include questions that focus on accompanying risk factors that may increase the likelihood of postoperative respiratory insufficiency. Risk factors for pulmonary toxicity from chemotherapeutic agents include age older than 70 years, genetic predisposition, existing pulmonary disease, smoking history, and thoracic radiation therapy. Pulmonary function tests, such as vital capacity and diffusion capacity for carbon monoxide, are commonly monitored to detect chemotherapy-induced pulmonary toxicity.[15] Measurement of diffusion capacity of carbon monoxide (>10%-15% from baseline) has been found to be the most sensitive indicator of subclinical pulmonary damage from chemotherapeutics.[15] The 2 main concerns for anesthesia providers are the administration of intraoperative oxygen and fluid management.

High oxygen concentrations have been implicated in potentiating lung damage in patients who received bleomycin. Hyperoxia is the delivery of inspired oxygen concentrations equal to or greater than 30%. Previous bleomycin treatment sensitizes the lung to concentrations of oxygen that are not usually damaging.[18] Recommendations are to use less than 30% inspired oxygen or the lowest inspiratory oxygen fraction compatible with adequate tissue oxygenation. Arterial blood gases and pulse oximetry can be used to determine adequate oxygenation. In surgical procedures in which inspired oxygen of more than 30% is warranted, more invasive monitoring, such as mixed venous oximetry, may allow anesthetists to minimize oxygen concentrations safely. Treatment with corticosteroids before surgery has shown positive results with improvements in vital capacity and diffusion capacity and no postoperative respiratory complications.[17] Equally important as the use of low oxygen concentrations is the careful management of intravenous fluid administration. The restriction of fluids to the minimum necessary to maintain hemodynamic stability and adequate renal output is advised.[11] There is a high percentage of subclinical bleomycin-induced pulmonary damage compromising the ability of the lungs to handle large volumes of fluids.[11] With proper assessment and management, the probability of postoperative respiratory complications related to prior chemotherapy-induced lung toxicity should be reduced.

Nephrotoxicity

Administration of anticancer chemotherapy can cause drug-induced nephrotoxicity and can lead to acute or chronic renal damage.[19] Approximately 20% of cardiac output perfuses the kidneys, exposing these organs extensively to systemic chemotherapeutic agents.[20] Mechanisms of renal dysfunction generally include damage to structures of the kidneys necessitating evaluation of glomerular filtration, proximal tubular function, and distal tubular function. Hemolytic uremic syndrome and prerenal perfusion deficits are also observed in patients treated with cancer chemotherapy.[20] Patients typically experience nonoliguric renal failure.[9] Nephrotoxic cancer chemotherapeutic agents include methotrexate, cisplatin, and ifosfamide (Table 6). Chemotherapy dose–related degrees of nephrotoxicity are experi-

Table 6. Chemotherapeutic agents that cause nephrotoxicity, hepatotoxicity, and gastrointestinal toxicity

Nephrotoxicity	Hepatotoxicity	Gastrointestinal toxicity
Alkylating agents		
Carboplatin		Cisplatin
Carmustine		
Cisplatin		
Ifosfamide		
Sermustine		
Antimetabolites		
Gemcitabine	Clofarabine	Cytarabine
Methotrexate	Fludarabine	Fluorouracil
Pentostatin	Methotrexate	Methotrexate
Antitumor antibiotics		
Mitomycin	Plicamycin	Anthracyclines
Plicamycin		Daunorubicin
		Doxorubicin
		Epirubicin
		Idarubicin
Natural products and miscellaneous agents		
Azacytidine	Azacytidine	Etoposide
		Irinotecan
		Taxanes
		Docetaxel
		Nab-paclitaxel
		Paclitaxel

enced with the platinating agents cisplatin and carboplatin. Electrolyte abnormalities subsequent to cisplatin administration occur acutely and may persist for years following cessation of therapy. Hypomagnesemia occurs more commonly than hypokalemia, other electrolyte abnormalities, or acid-base disorders. Cisplatin administration is also responsible for acute proximal tubular damage followed by a progressive loss of filtration capability. Transient renal dysfunction occurs frequently and irreversible renal dysfunction occurs infrequently following administration of carboplatin.[20] Common signs of platinum-induced nephrotoxicity include increased serum creatinine level, uremia, and electrolyte abnormalities.

Estimation of glomerular filtration rate using creatinine clearance is used to assess renal function.[20] Maintaining fluid and electrolyte balance and adequate renal perfusion are the critical factors in treating patients at risk for nephrotoxic effects.[1] Nonsteroidal anti-inflammatory drugs should be avoided in patients receiving nephrotoxic chemotherapy because they may precipitate acute renal failure.[11] Dosages of drugs that undergo renal clearance, such as pancuronium, should be decreased. Isoflurane and desflurane are the volatile agents of choice due to the association of sevoflurane with nephrotoxic compound A.

Hepatic implications

Hepatic dysfunctions, such as cirrhosis and coagulation disorders, are frequently reversible effects of cancer chemotherapy. Methotrexate may induce the development of hepatic cirrhosis and fibrosis. Although rare, flutamide causes severe hepatotoxicity with associated jaundice and dark urine.[9] Other hepatotoxic chemotherapeutic agents are listed in Table 6. Hepatocellular damage may be exacerbated in patients undergoing anesthesia.[1] Hepatic metabolism must be considered, and isoflurane is the preferred volatile agent.[6] Halothane has been implicated in hepatotoxicity and should be avoided. Vecuronium and rocuronium should be used judiciously and closely monitored. Liver function tests may be useful in monitoring patients who have received a hepatotoxic chemotherapy regimen.

Gastrointestinal effects

Effects of chemotherapy are manifested in the rapidly dividing cells of the entire gastrointestinal tract, and the potential for substantial mucosal tissue injury exists throughout the length of the tract.[21] Gastrointestinal disorders may include oral mucositis or diarrhea and are limited to patients actively receiving chemotherapy. Chemotherapeutic regimens containing fluorouracil and irinotecan have been associated

with a significantly higher risk of chemotherapy-induced diarrhea (see Table 6).[22] Perioperative evaluation of urine osmolarity, specific gravity, and serum electrolytes will provide information for managing fluid and electrolyte losses associated with diarrhea.

Oral mucositis is defined as oral mucosal change secondary to cancer therapy. Ulceration eventually occurs in concurrence with severe, debilitating oral pain, usually requiring narcotic analgesia. Signs may include mucosal whitening followed by erythema and bleeding. Healing will occur within 2 to 3 weeks after chemotherapy is ended. Oral inflammation and ulceration may present concerns to anesthetists when attempting endotracheal intubation. Patients are at a greatly increased risk for the spread of oral organisms, through oral ulceration, into the systemic circulation. Friable mucosa may be subject to bleeding. Pain may limit the patients' intake, culminating in dehydration and nutritional deficits. Occurrence is 1% to 10% and is seen in anthracycline-, taxane-, and platinum-based regimens. Incidence increases when treatments are combined with fluorouracil.[23]

Myelosuppression

Myelosuppression is the toxic effect most frequently encountered with chemotherapy. Tissues in the body that divide rapidly are the most susceptible to the toxic side effects including hematopoietic cells.[24] Interruption in hematopoiesis causes residual anemia, thrombocytopenia, and leukopenia. Production of leukocytes and platelets is inhibited to different degrees depending on the type of therapy administered.[6] The severity of neutropenia and thrombocytopenia is variable and often requires intervention.[6] Patients who become anemic from chemotherapeutic erythroid marrow suppression have decreased oxygen transport related to an absolute deficiency in hemoglobin.[24] Myelosuppressive chemotherapy can have a profound effect on the perioperative treatment of the patient.[6] Surgeon, anesthetist, and hematologist must remain in close communication to ensure safe, effective care.

Coagulation mechanisms may be dysfunctional because of impaired production or abnormal consumption of blood elements.[6] Defects in coagulation often result from the use of anthracyclines, actinomycin, or plicamycin. Before surgery, the platelet count and coagulation profiles should be obtained so that appropriate blood products can be readily available. Platelets in excess of 100,000/mm^3 are considered adequate for essentially any surgical procedure.[24] A window for performing surgery exists 2 weeks after therapy when marrow function has returned and new formed elements can be expected to be synthesized.[24] Chemotherapeutic agents that produce myelosuppression—and destroy the cellular components of the inflammatory response—depress the immune system function, predisposing patients to infection.[25] The duration of neutropenia is typically 8 to 10 days. Variations exist related to the nature and intensity of the chemotherapeutic treatment.[26] Infection control practices require strict aseptic technique when anesthesia providers are asked to insert central lines, arterial lines, or peripheral intravenous lines. A septic patient may have hypovolemia, hypotension, increased metabolic rate, and fever.

Drug interactions

Cytochrome P-450 enzymes function in the biotransformation of cytotoxic and intravenous anesthetic agents, including opioids, benzodiazepines, and local anesthetics. A large number of P-450 enzymes are selectively induced by chemotherapeutic agents enhancing the rate of P-450 synthesis or reducing the rate of degradation.[9] Therefore, enzyme induction may result in the acceleration of metabolism and may decrease the pharmacologic action. This induction of enzymes by cytotoxic agents is dose-dependent and reversible and leads to drug intolerance and clinically significant drug interactions.[9] In the case of drugs metabolically transformed to reactive metabolites, enzyme induction may exacerbate metabolite-mediated tissue toxicity.

Thiotepa and cyclophosphamide produce a significant reduction in pseudocholinesterase activity, affecting the duration of action of drugs such as succinylcholine. Appropriate precautions such as avoidance of depolarizing relaxant agents should be taken with patients receiving cyclophosphamide and requiring general anesthesia. Plasma cholinesterase levels may take weeks to return to normal after being suppressed by drugs.[27] Prolonged apnea after anesthesia in patients receiving cyclophosphamide may be treated with ventilatory support.[28] Patients receiving chemotherapy, when exposed to anesthetic agents, are susceptible to a wide array of clinical drug interactions, necessitating vigilance by anesthesia providers.

Conclusion

In the role of anesthesia provider, distinguishing the anatomic and physiologic effects that occur with cancer chemotherapeutic treatment is paramount. Because of the high prevalence of cancer, anesthetists will frequently encounter patients receiving chemotherapy in their practice. It is crucial for anesthetists to understand how cytotoxic agents affect this population acutely and long-term. Understanding of the toxic effects of chemotherapy on different organ systems and their anesthetic drug interactions is vital for developing perioperative management strategies in anesthesia.

Creating a tool, such as a preassessment form, focused on gathering cancer-specific treatment data would further refine patient-specific care. Accurate knowledge will assist in customizing provision of anesthesia to ensure a reduced risk of perioperative morbidity and mortality.

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