Nausea and vomiting (N&V) is one of the most distressing and potentially serious side effects of chemotherapy, with physical, psychological, emotional, and treatment-related consequences.

N&V may be classified as anticipatory, acute, delayed, or persistent; each category requires a different approach to treatment.

Because N&V can be triggered by multiple pathways, selection of the most appropriate antiemetic medication and route of administration is extremely important.

Nurses are in a unique position to assess the potential for N&V, its effects on patients, and the effectiveness of antiemetic therapy.

Purpose/Objectives: To examine the currently available antiemetic medications and review their uses in the treatment of chemotherapy-induced nausea and vomiting (N&V).

Data Sources: Published articles and book chapters.

Data Synthesis: N&V is a common yet potentially serious side effect of chemotherapy. Nurses must understand the physiology of N&V, its impact on patients, and the proper use of antiemetic medications to effectively manage this problem. Antiemetic medications vary in mechanism of action, indications for use, and adverse effects.

Conclusions: Nurses are in a position to identify patients who are at risk for N&V and to manage their care using accepted practice guidelines.

Implications for Nursing: Although practice guidelines have been established, the nurse’s role in assessment and implementation of care is critical in the prevention and management of chemotherapy-induced N&V.

Key Points . . .

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➤ Nurses are in a unique position to assess the potential for N&V, its effects on patients, and the effectiveness of antiemetic therapy.

CONTINUING EDUCATION

Antiemetic Therapy in Patients Receiving Cancer Chemotherapy

Cassandra Marek, RN, BSN, OCN®

Purpose/Objectives: To examine the currently available antiemetic medications and review their uses in the treatment of chemotherapy-induced nausea and vomiting (N&V).

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➤ Nurses are in a unique position to assess the potential for N&V, its effects on patients, and the effectiveness of antiemetic therapy.

Goal for CE Enrollees:

To further enhance nurses’ knowledge regarding antiemetic therapy in patients receiving cancer chemotherapy.

Objectives for CE Enrollees:

On completion of this CE, the participant will be able to
1. Describe the risk factors and the four classifications of nausea and vomiting with chemotherapy.
2. Discuss the treatment options available for nausea and vomiting with chemotherapy.
3. Discuss the nursing implications in the care of patients who experience nausea and vomiting with chemotherapy.

Cassandra Marek, RN, BSN, OCN®, is a graduate student and clinical associate in the School of Nursing at the University of Maine in Orono. (Submitted April 2002. Accepted for publication July 15, 2002.)

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Impact on Patients

The effects of N&V are multidimensional. The physical sequelae perhaps are the most easily recognized. N&V can, in a short time, lead to nutritional deficiencies, dehydration, and electrolyte imbalances. Patients’ fear that eating or drinking will trigger another bout of N&V can reduce their intake and result in cachexia and dehydration. Dehydration can be exacerbated by severe or prolonged vomiting resulting in loss of fluid volume and is associated with electrolyte imbalances, including hypokalemia, hyponatremia, hypomagnesemia, and hypochloremia (Bender et al., 2002). The combination of inadequate intake and excessive output from vomiting in patients who already are compromised by cancer or its treatment puts patients at an even higher risk for life-threatening complications.

N&V also has a psychological impact on patients. Fear of N&V has been shown by researchers to be a major concern for patients with cancer (Kraut & Fauser, 2001). This fear has been associated with patient distress, disruption of normal social and work routines, and impaired quality of life (Rittenberg, 2002). Other studies have demonstrated that patients who experience N&V report increased anxiety and depression, as well as lower levels of cognitive functioning (Kraut & Fauser).

Poorly controlled N&V also can cost patients and the healthcare system money and other resources. Patients who experience N&V lose time at work, reducing their income. Those who suffer from the effects of dehydration and cachexia often require hospitalization to manage these complications, resulting in increased costs for drug therapy and nursing care (Pendergrass, 1998).

The complications related to nutritional deficiencies, electrolyte imbalances, and dehydration can result in reduced doses of chemotherapy medications, making them less effective. These complications may cause treatment to be delayed, thus reducing the likelihood that the cancer can be brought under control. Fear of N&V may be so extreme that patients may refuse further, potentially lifesaving treatments (Campos et al., 2001; Pendergrass, 1998).

A large, international, multicenter study was conducted to determine the monetary value that patients place on improved quality of life and control of N&V (Dranitsaris et al., 2001). The researchers surveyed 245 patients with cancer in seven cancer centers to rate the value they placed on medications that would reduce their risk for N&V in incremental levels. They found that patients were willing to pay for a medication that would reduce their risk for N&V by even 5%, indicating that they placed a high value on avoiding these incidents as a major factor in quality of life. They also found that these patients would be willing to pay more money for a medication that would reduce their risk for vomiting from a baseline risk of 30% to 0% than for one that would reduce their risk from the baseline to 10%. Although the researchers measured several variables, including a history of emesis and previous uncontrolled N&V associated with chemotherapy, they found that the only variable that affected the patients’ willingness to pay for an effective antiemetic was income. Patients with higher incomes were willing to pay more for the medication than those with lower incomes.

Physiology

Several researchers have suggested that the mechanisms behind N&V may be different (Campos et al., 2001; Dranitsaris et al., 2001; Eckert, 2001; Roscoe, Morrow, Hickok, & Stern, 2000). Nausea is a subjective sensation in the back of the throat or the stomach that is accompanied by changes in the parasympathetic nervous system; it may or may not result in vomiting. Vomiting, in contrast, is the forceful ejection of the contents of the stomach, duodenum, and jejunum through the mouth. Whereas nausea is subjective, vomiting is completely objective and observable. Control of nausea usually is considered by patients to be far more important than control of vomiting, in contrast to the usual perception of physicians and nurses (Roscoe et al.).

The physiology of N&V has been examined by numerous researchers. The primary mediator of chemotherapy-induced N&V is believed to be the chemoreceptor trigger zone (CTZ), located on the floor of the fourth ventricle of the brain. The CTZ lies outside the blood-brain barrier, and therefore can be stimulated by serotonin and other neurotransmitters in the blood and cerebrospinal fluid. Once it is stimulated, the CTZ acts on the vomiting center in the lateral reticular formation of the medulla oblongata. The vomiting center also may be triggered by vagal nerve stimulation from the pharynx and gastrointestinal tract, the vestibular apparatus, or the cerebral cortex (Bender et al., 2002; Itano & Taoka, 1998; Pendergrass, 1998).

When chemotherapy agents are administered, they are believed to affect the CTZ and vomiting center via multiple pathways. They may stimulate the CTZ directly through blood transmission, which, in turn, releases neurotransmitters (primarily dopamine) that stimulate the vomiting center. Chemotherapy agents also may damage the enterochromaffin cells in the small intestinal mucosa, which triggers the release of serotonin, believed to be one of the principal mediators of the vomiting reflex (Gralla et al., 1998; Wilkes, Ingwersen, & Barton-Burke, 2000). Serotonin binds to receptors in the gut, which stimulates vagal nerve impulses to the CTZ. The CTZ, in turn, stimulates the vomiting center, which activates a number of responses that manifest as N&V, such as decreased gastric motility and tone, increased salivation, light-headedness, difficulty swallowing, and rhythmic retching that usually precedes vomiting (National Comprehensive Cancer Network [NCCN], 2001; Pendergrass, 1998). More recent research is examining the role of substance P, a tachykinin found in the neurons of the area of the brain surrounding the CTZ and the vomiting center, in the physiology of N&V (Campos et al., 2001).

Contributing Factors

Risk factors for N&V may be related to patients’ diseases, their treatments, or specific situations (Itano & Taoka, 1998). Disease-related factors include tumors of the central nervous system that stimulate the CTZ or vomiting center; gastrointestinal obstruction; infection; food toxins; metabolic imbalances, including hyperglycemia, hypercalcemia and hyperonatremia; and renal and hepatic dysfunction.

Treatment-related risk factors include the emetic potential of the chemotherapy agent (see Table 1), damage to the enterochromaffin cells of the gastrointestinal tract by treatment agents (e.g., chemotherapy, radiation therapy, surgery), stimulation of the CTZ by treatment agents, and medication and nutritional supplement side effects (Itano & Taoka, 1998).

Combination chemotherapy administration presents a particular challenge to the management of N&V. Few studies
Types

N&V may be classified as anticipatory, acute, delayed, or persistent (Otto, 2001). Each of these classifications is associated with distinct characteristics that influence the ways they are treated.

Anticipatory N&V: Anticipatory N&V occurs prior to the administration of chemotherapy, and about 25% of patients receiving chemotherapy experience this type (Itano & Taoka, 1998). Anticipatory N&V is defined most often in terms of classical conditioning and is linked to the association of the unpleasant side effects of chemotherapy with neutral stimuli (Bender et al., 2002).

Several risk factors have been associated with the development of anticipatory N&V (Eckert, 2001). Patients with four or more of these risk factors were found to be significantly more likely to experience anticipatory N&V after the first cycle of chemotherapy than those with fewer risk factors. The researchers found that no single risk factor was as clearly associated with anticipatory N&V as the combination of two or more risk factors. These risk factors included severe post-treatment nausea, a history of motion sickness, and completion of more than one chemotherapy cycle. Factors with a lesser association included age less than 45 years, female gender, and a history of low chronic alcohol use. Some studies have found that a high level of anxiety promoted the development of anticipatory N&V (Bauduer, 1999; Eckert, 2001), whereas others found no such link (Hickok, Roscoe, & Morrow, 2001). The type of cancer being treated was found to have no association with the occurrence of anticipatory N&V (Eckert).

Hickok et al. (2001) studied 63 female patients with cancer undergoing chemotherapy to determine how pretreatment expectations regarding N&V influenced the development of anticipatory N&V. They found that 32% of the subjects expected to feel nausea after their chemotherapy. After the first cycle of chemotherapy treatment, 55% of the women who expected to experience nausea did so, whereas none of those who were certain that they would not feel nausea experienced it. These findings suggest that the expectations may play a larger role than classical conditioning in the development of anticipatory N&V.

Prevention of post-therapy N&V is the most effective way to deter anticipatory N&V (Gralla et al., 1999). As demonstrated by Hickok et al. (2001), patients’ expectations play a significant role in anticipatory N&V; therefore, education, including a realistic yet optimistic overview of possible side effects of chemotherapy, may be the best nursing intervention for this problem.

Once it occurs, anticipatory N&V usually is unresponsive to current antiemetic agents and therefore is very difficult to treat (Eckert, 2001). Behavioral modification therapy and systematic desensitization to the triggering stimuli may be required to manage this type of N&V (Gralla et al., 1999) but may not be available widely in most clinical or hospital settings (Hickok et al., 2001).

Acute N&V: Acute N&V occurs within 24 hours of chemotherapy administration and is mediated through the autonomic nervous system, which triggers the release of neurotransmitters in the gastrointestinal tract, the CTZ, and the vomiting center (Itano & Taoka, 1998). It usually peaks five to six hours after the administration of the treatment agent (NCCN, 2001).

Although the emetogenic potential of the chemotherapy agent is the primary risk factor for acute N&V, other factors have examined the use of antiemetic medications in this situation. Although some evidence supports the suggestion that combinations of chemotherapy of the same emetogenic potential category have an additive effect that would warrant use of a higher level of antiemetic therapy, results of studies have not been consistent (Gralla et al., 1999; Pendergrass, 1998). Currently, experts suggest using the antiemetic medication regimen appropriate for the chemotherapy agent with the highest emetogenic potential, although the number of treatment days may be reduced (Gralla et al., 1999).

Factors related to patients’ situations may be more difficult to quantify. Tension, stress, and anxiety related to the disease and its treatment are expected responses but can provoke N&V. Noxious stimuli, such as strong odors, also may trigger this response. Conditioned responses may occur, leading to the development of anticipatory N&V (Gralla et al., 1999; Itano & Taoka, 1998).

## Table 1. Emetogenic Potential of Chemotherapy Agents

<table>
<thead>
<tr>
<th>Emetogenic Potential</th>
<th>Drug Name</th>
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</thead>
<tbody>
<tr>
<td>Very high (&gt; 90%)</td>
<td>Cisplatin</td>
</tr>
<tr>
<td></td>
<td>Cytarabine&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Dacarbazine</td>
</tr>
<tr>
<td>High (60%–90%)</td>
<td>Actinomycin-D</td>
</tr>
<tr>
<td></td>
<td>Busulfan&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Carboplatin&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Carmustine</td>
</tr>
<tr>
<td></td>
<td>Cyclophosphamide</td>
</tr>
<tr>
<td></td>
<td>Daunorubicin&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Denileukin diftitox</td>
</tr>
<tr>
<td></td>
<td>Doxorubicin&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Epirubicin&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Hexamethyl-melamine&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Moderate (30%–60%)</td>
<td>5-Fluorouracil&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>11-Irinotecan</td>
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<tr>
<td></td>
<td>Asparaginase</td>
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<tr>
<td></td>
<td>Docetaxel</td>
</tr>
<tr>
<td></td>
<td>Etoposide&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Gemcitabine&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Gemtuzumab</td>
</tr>
<tr>
<td></td>
<td>Interferons</td>
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<tr>
<td>Low (10%–30%)</td>
<td>2-Chlorodeoxy-adenosine&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>6-Mercaptopurine</td>
</tr>
<tr>
<td></td>
<td>Bacillus Calmette-Guerin</td>
</tr>
<tr>
<td></td>
<td>Bleomycin&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Capecitabine</td>
</tr>
<tr>
<td></td>
<td>Chlorambucil&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Doxorubicin liposomal</td>
</tr>
<tr>
<td></td>
<td>Fludarabine&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Flutamide</td>
</tr>
<tr>
<td></td>
<td>Hydroxyurea</td>
</tr>
<tr>
<td>Very low (&lt; 10%)</td>
<td>Daclizumab</td>
</tr>
<tr>
<td></td>
<td>L-Phenylalanine musturd</td>
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</tbody>
</table>

<sup>a</sup> Emetogenic potential of drugs depends on the dose and the route of administration. In general, higher doses are more emetogenic than lower doses.

may play a role. These include a history of poor control of N&V with previous chemotherapy administrations, female gender, a history of motion sickness, age under 50 years, and low chronic alcohol intake (Gralla et al., 1999; Hickok et al., 2001). Chronic alcohol intake of less than 100 grams per day (100 grams is equivalent to approximately six ounces of hard liquor, 30 ounces of wine, or six to seven beers) for a period of years has been associated with a significantly lower risk of acute N&V, although the mechanism of this is not fully understood (Gralla et al., 1999).

The currently accepted standard treatment regimen for acute N&V is a serotonin receptor antagonist combined with a corticosteroid (Campos et al., 2001); these drugs will be discussed more fully later in this article.

Delayed N&V: Delayed N&V occurs in about 40%–50% of patients receiving chemotherapy (Dranitsaris et al., 2001). The symptoms occur 24–48 hours after chemotherapy has been administered but may persist up to seven days (NCCN, 2001); delayed N&V tends to be less intense than acute N&V (Eckert, 2001). The risk factors for developing delayed N&V are the same as those for acute N&V but also include poor control of acute N&V (Gralla et al., 1999). Although some chemotherapy agents, such as cyclophosphamide, epirubicin, and carboplatin, are known to cause delayed emesis, many agents have not been studied for this side effect (Gralla et al., 1999; Italian Group for Antiemetic Research, 2000).

Treatment for delayed N&V currently includes the combination of a corticosteroid with a serotonin receptor antagonist or metoclopramide (Campos et al., 2001); however, this therapy is controversial because of the high cost of the drugs and the lack of consistently proven benefits (Valley, 2000). Although serotonin receptor antagonists combined with a corticosteroid protect up to 90% of patients from acute emesis, this treatment is less effective in delayed emesis, with only a 40%–60% response rate (Italian Group for Antiemetic Research, 2000).

A large, multicenter, randomized study of 705 patients with cancer receiving moderately emetogenic chemotherapy examined the efficacy of dexamethasone (a corticosteroid) versus ondansetron (a serotonin receptor antagonist) combined with dexamethasone in the treatment of delayed N&V (Italian Group for Antiemetic Research, 2000). Subjects were divided into groups according to risk. Those in the low-risk group had experienced no vomiting and no moderate-to-severe nausea in the 24 hours after chemotherapy administration and were given either a placebo, dexamethasone, or dexamethasone plus ondansetron. Patients in the high-risk group had experienced symptoms in the 24 hours after chemotherapy administration and were given either dexamethasone or dexamethasone plus ondansetron.

The researchers found that, in the low-risk group, dexamethasone alone and the combination of dexamethasone plus ondansetron were significantly better than the placebo in controlling delayed N&V. They found no statistically significant differences between patients who received dexamethasone alone and those who were given dexamethasone plus ondansetron in protection from moderate-to-severe nausea, vomiting, or both. In the high-risk group, the combination of dexamethasone plus ondansetron was not significantly more effective in preventing these symptoms than dexamethasone alone (Italian Group for Antiemetic Research, 2000).

In a similar study, researchers examined the use of dexamethasone in combination with granisetron (a serotonin receptor antagonist) to prevent delayed N&V (Latreille et al., 1998). This multicenter, blinded study randomized 447 patients receiving highly emetogenic chemotherapy to receive either dexamethasone and granisetron for seven days or dexamethasone and granisetron on day one followed by placebo for days two through seven. Latreille et al. found no significant differences in the two study arms, suggesting that the use of these agents for delayed N&V may not be warranted.

Persistent N&V: Persistent N&V occurs despite efforts to control acute and delayed episodes (Itano & Taoka, 1998). With this type of N&V, the treatment regimen should be reviewed to ensure that the best medications available for the particular situation are being used, based on evaluation of each patient’s risk factors for N&V, the emetogenic potential of the chemotherapy agent, and concurrent medication use (Gralla et al., 1999). Patients at risk for breakthrough or persistent N&V should be provided with antiemetics on an as-needed basis (American Society of Health-System Pharmacists [ASHP], 1999). Increasing the dose of the current antiemetic agent to the maximum accepted level may be indicated. The addition of an antianxiety agent or combining a dopamine receptor antagonist with a serotonin receptor antagonist also may be recommended (ASHP).

**Antiemetic Therapy**

Because N&V can be triggered by multiple pathways, effective antiemetic therapy requires medications that work by different mechanisms. Current recommendations suggest that combinations of medications work better than monotherapy and scheduled dosing is superior to as-needed administration. Selection of an appropriate medication, dosing schedule, and route of administration is determined by thorough assessments of patients. Table 2 summarizes the classes and types of antiemetic medications currently used for the treatment of chemotherapy-induced N&V.

**Serotonin Receptor Antagonists**

In 1991, when serotonin receptor antagonists were introduced for the treatment of chemotherapy-induced N&V, about half of patients receiving chemotherapy also were administered these drugs; by 1995, they were used in 90% of patients receiving chemotherapy (Roscoe et al., 2000). These medications, especially when used in combination with corticosteroids, significantly reduced the severity of N&V in patients who received moderately or highly emetogenic chemotherapy (Gralla et al., 1998; Pendergrass, 1998), resulting in fewer complications of uncontrolled N&V and improved quality of life (Valley, 2000). However, some researchers suggested that the frequency of N&V is not significantly reduced by serotonin receptor antagonists (Eckert, 2001).

In general, serotonin receptor antagonists exert their activity by preventing the serotonin released by the enterochromaffin cells in the gastrointestinal tract from binding to receptors in the gut and the CTZ (Anastasia, 2000; Gralla et al., 1999). Because these medications are well absorbed in the intestines and begin to immediately affect the serotonin receptors there, researchers suggested that the oral route of administration is equal or superior to the IV route in effectiveness (Gralla et al., 1999).

Serotonin receptor antagonists currently available in the United States include ondansetron hydrochloride, granisetron hydrochloride, and dolasetron mesylate. Ondansetron was the first of these agents approved for use in the treatment of chemotherapy-induced vomiting (Dranitsaris et al., 2001). This drug...
Table 2. Antiemetic Agents

<table>
<thead>
<tr>
<th>Agent</th>
<th>Indications</th>
<th>Mechanism of Action</th>
<th>Pharmacokinetics</th>
<th>Nursing Considerations</th>
<th>Recommended Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serotonin receptor antagonists: ondansetron, granisetron, dolasetron</td>
<td>Acute nausea related to moderately to highly emetogenic chemotherapy</td>
<td>Selectively block the stimulation of serotonin release and the effects of serotonin, both centrally (in the chemoreceptor trigger zone [CTZ] and vomiting center) and peripherally (in the gastrointestinal [GI] tract)</td>
<td><strong>Peak plasma levels:</strong> given orally (PO), 1–2.1 hours; given via IV, immediate&lt;br&gt;<strong>Half-life:</strong> given PO, 3.1–8.1 hours; given via IV, 3.5–4.7 hours</td>
<td>Side effects include headache, diarrhea, and hypotension. Occasionally, dolasetron and ondansetron may cause acute, usually reversible, echocardiogram changes.</td>
<td><strong>Ondansetron hydrochloride (HCl):</strong> 8 mg PO 30 minutes before chemotherapy, then 4 and 8 hours after chemotherapy; then 8 mg PO three times a day for 1–2 days&lt;br&gt;<strong>Granisetron HCl:</strong> 10 mcg/kg via IV (over five minutes) 30 minutes before chemotherapy; or 1 mg PO twice a day given 1 hour before chemotherapy, then 12 hours later; or 2 mg PO every day 1 hour before chemotherapy&lt;br&gt;<strong>Dolasetron mesylate:</strong> 100 mg PO 1 hour before chemotherapy; or 1.8 mg/kg via IV 30 minutes before chemotherapy; or 100 mg via IV (over 30 seconds) 30 minutes before chemotherapy</td>
</tr>
<tr>
<td>Corticosteroids: dexamethasone, methylprednisolone</td>
<td>In combination with serotonin receptor antagonists for acute and delayed emesis associated with moderately to highly emetogenic chemotherapy; OR in combination with a substituted benzamide or phenothiazine for moderately emetogenic chemotherapy; OR alone in patients receiving moderately emetogenic chemotherapy</td>
<td>Unclear; may be because of the release of endorphins or to prostaglandin antagonism</td>
<td><strong>Onset:</strong> 12–27 hours given PO; within minutes given via IV&lt;br&gt;<strong>Duration:</strong> up to 1 week&lt;br&gt;<strong>Half-life:</strong> 78–210 minutes</td>
<td>Usually is contraindicated in patients receiving biotherapy. Dose should be tapered if used for more than several days. Careful monitoring is required in patients with diabetes mellitus. Dexamethasone is the corticosteroid most often used for control of delayed nausea and vomiting. Side effects include anxiety, insomnia, acne, and appetite changes. Long-term use may result in Cushingoid syndrome, psychosis, seizure, and other adverse effects.</td>
<td><strong>Dexamethasone:</strong> 20 mg via IV or PO before chemotherapy for prevention of acute nausea and vomiting; for delayed nausea and vomiting, 8 mg twice a day for 2–3 days, then 4 mg twice a day for 1–2 days, then discontinue&lt;br&gt;<strong>Methylprednisolone:</strong> 40 mg–125 mg IV before chemotherapy</td>
</tr>
<tr>
<td>Substituted benzamides: metoclopramide</td>
<td>Alone OR in combination with a corticosteroid for control of acute nausea and vomiting caused by moderately emetogenic chemotherapy; OR alone for delayed nausea and vomiting</td>
<td>At lower doses, antagonizes the dopamine receptors in the CTZ and the GI tract; at higher doses, also acts as a serotonin receptor antagonist</td>
<td><strong>Onset:</strong> Given PO, 30–60 minutes; given via IV, 1–3 minutes&lt;br&gt;<strong>Duration:</strong> 1–2 hours&lt;br&gt;<strong>Half-life:</strong> 5–6 hours</td>
<td>Associated with a high incidence of extrapyramidal effects, especially in younger patients; should be given with diphenhydramine to minimize these effects. IV administration is associated with significant cardiovascular side effects, including hypotension, bradycardia, and tachycardia. Side effects include dystonia, akathisia, diarrhea, sedation, and dry mouth.</td>
<td><strong>Metoclopramide:</strong> 10–20 mg PO or 2–3 mg/kg via IV before chemotherapy and 2 hours after chemotherapy.</td>
</tr>
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</table>

Note. All doses listed are for adults. Based on information from American Society of Health-System Pharmacists, 1999; Brown et al., 2001; Gralla et al., 1999; Skidmore-Roth, 2002; Spratto & Woods, 2002.
Table 2. Antiemetic Agents (Continued)

<table>
<thead>
<tr>
<th>Agent</th>
<th>Indications</th>
<th>Mechanism of Action</th>
<th>Pharmacokinetics</th>
<th>Nursing Considerations</th>
<th>Recommended Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenothiazines: prochlorperazine, perphenazine</td>
<td>Acute nausea and vomiting associated with moderately emetogenic chemotherapy; OR in combination with a corticosteroid for delayed nausea and vomiting; OR in combination with other agents in persistent nausea and vomiting</td>
<td>Acts primarily in the CTZ as a dopamine receptor antagonist; also decreases vagal nerve stimulation of the vomiting center.</td>
<td>Onset: given PO, 30–40 minutes; given rectally (PR), 60 minutes; given IV, 3–5 minutes. Duration: 3–4 hours for immediate release dose; 10–13 hours for extended release dose.</td>
<td>Associated with a high risk of extrapyramidal symptoms, especially in younger patients; may be given with diphenhydramine to minimize these effects. Side effects include dystonia, sedation, photosensitivity, postural hypotension, and akathisia.</td>
<td>Prochlorperazine: 10–20 mg PO every 3–4 hours; 15–30 mg extended release spanule PO every 12 hours; 25 mg PR every 4–6 hours; 10–30 mg via IV every 3–4 hours. Perphenazine: 1–5 mg via IV every 4–6 hours; may be given as a continuous IV infusion at a rate not greater than 1 mg/minute; 4 mg PO every 4–6 hours; maximum of 15 mg per 24 hours (outpatient) or 30 mg per 24 hours (inpatient)</td>
</tr>
<tr>
<td>Butyrophenones: droperidol, haloperidol</td>
<td>Acute and delayed nausea and vomiting associated with moderately emetogenic chemotherapy</td>
<td>Blocks dopamine receptors in the CTZ and vomiting center; also decreases stimulation of the vomiting center via the vestibular pathway.</td>
<td>Onset: given PO 30–60 minutes; given IV or IM (intramuscularly), 3–10 minutes. Half-life: 12–38 hours.</td>
<td>Associated with extrapyramidal symptoms, especially in younger patients; may give with diphenhydramine to minimize these effects. Use with caution in patients with cardiac disorders. Side effects include dystonia, akathisia, sedation, tachycardia, and hypotension.</td>
<td>Droperidol: 2.5–10 mg via IV every 3–4 hours; 0.5–2.5 mg via IV every 3–4 hours. Haloperidol: 2–5 mg PO every 4 hours; 0.5–2 mg via IV or IM every 2–6 hours</td>
</tr>
<tr>
<td>Cannabinoids: dronabinol</td>
<td>Moderately emetogenic chemotherapy Not a first-line antiemetic medication</td>
<td>Unclear; the active ingredient in cannabis may inhibit prostaglandin synthesis or indirectly block the vomiting center.</td>
<td>Onset: 30–60 minutes. Duration: 4–6 hours. Half-life: 25–36 hours.</td>
<td>Can produce physical and psychological dependency. Side effects include mood changes; drowsiness; impaired perception, sensory function, and coordination; tachycardia; hypotension; and appetite stimulation.</td>
<td>Dronabinol: 2.5–10 mg PO two or three times a day</td>
</tr>
<tr>
<td>Benzodiazepines: alprazolam, lorazepam</td>
<td>Anticipatory nausea and vomiting; in addition to other agents to treat persistent nausea and vomiting Not a true antiemetic, but may be useful as an adjunct to antiemetic medications</td>
<td>Antiemetic activity unclear; reduce anxiety by potentiating the activity of gamma-aminobutyric acid in the brain</td>
<td>Onset: given PO, 30 minutes; given IM, 15–30 minutes; given IV, 5–15 minutes. Duration: 24–48 hours. Half-life: 12–15 hours.</td>
<td>Side effects include sedation, dizziness, and orthostatic hypotension.</td>
<td>Alprazolam: 0.25–0.5 mg PO two or three times a day. Lorazepam: 1–3 mg PO or sublingually every 4–6 hours; 0.5–2.5 mg IV or IM every 4–6 hours</td>
</tr>
</tbody>
</table>

Note. All doses listed are for adults. Based on information from American Society of Health-System Pharmacists, 1999; Brown et al., 2001; Gralla et al., 1999; Skidmore-Roth, 2002; Spratto & Woods, 2002.
is approved for use with moderately emetogenic chemotherapy agents and usually is given twice daily beginning 30 minutes before chemotherapy administration and continuing for one or two days after completion of the therapy (Anastasia, 2000).

Researchers suggest that granisetron may be the most effective for the prevention of acute N&V caused by moderately or highly emetogenic chemotherapy (Bauduer, 1999). It usually is given as a single dose prior to chemotherapy.

Several researchers have compared the efficacy of granisetron to that of ondansetron. A double-blind study of 1,085 patients receiving chemotherapy randomized subjects to receive either granisetron 2 mg orally plus an IV placebo or ondansetron 32 mg via IV plus an oral placebo; use of dexamethasone or methylprednisolone was permitted as needed (Perez et al., 1998). The researchers found no significant differences between the two groups in the proportion of patients who attained total control of emesis during the first 24 or 48 hours after treatment.

In another study of 1,053 patients receiving highly emetogenic chemotherapy, patients were given either granisetron 2 mg orally or ondansetron 32 mg via IV; again, corticosteroids were permitted as needed (Gralla et al., 1998). The researchers found that the serotonin receptor antagonists were equally effective in controlling chemotherapy-induced N&V in this population.

Dolasetron, the most recently released serotonin receptor antagonist, has been found to have a shorter time to maximum concentration and a higher bioavailability than ondansetron or granisetron. Hydrolasetron, its active metabolite, is 50 times more potent in serotonin receptor antagonist activity than dolasetron. It usually is given in a single dose within one hour of chemotherapy administration (Valley, 2000).

Serotonin receptor antagonists have the advantages of a high rate of efficacy in the prevention of acute N&V, the option of oral or IV dosing, and fewer side effects than other types of antiemetics (Anastasia, 2000; Dranitsaris et al., 2001; Gralla et al., 1998, 1999). Side effects include headache, constipation, diarrhea, and transient, asymptomatic transaminase increases (Anastasia; Gralla et al., 1999). Dolasetron and ondansetron have been associated with mild prolongations in the cardiac QT interval several hours after administration (Anastasia; Valley, 2000). In addition, whether these drugs are effective in the prevention or treatment of delayed N&V is unclear (Latreille et al., 1998).

**Corticosteroids**

Corticosteroids, including dexamethasone and methylprednisolone, are used widely in the treatment of acute, delayed, and persistent chemotherapy-induced N&V. Although the exact mechanism of action of these drugs is not fully understood, they are believed to inhibit prostaglandin activity that promotes emesis. They also may change cellular permeability peripherally and in the CTZ, as well as stimulate the release of endorphins that cause appetite stimulation and a sense of well-being (Pendergrass, 1998). Butyrophenones act by blocking the dopamine receptors. Like metoclopramide, the phenothiazines are associated with extrapyramidal side effects, including sedation, postural hypotension, akathisia, and dystonic reactions. The use of high doses of phenothiazines is contraindicated, especially in children, because of these reactions (Pendergrass, 1998). These medications have the advantages of lower cost and oral or IV dosing options.

**Substituted Benzamides**

Metoclopramide is the only substituted benzamide in use for the control of N&V in the United States. In addition to increasing gastric motility, metoclopramide acts as an antagonist for the dopamine D2 receptors at low doses; at higher doses, the drug also blocks serotonin receptors, although it is slightly less selective in this activity than the serotonin receptor antagonist drugs (Gralla et al., 1999; Pendergrass, 1998). Extrapyramidal side effects, including acute dystonic reactions, akathisia, and sedation, are associated with metoclopramide use (Gralla et al., 1999). In one study, 12% of patients treated with metoclopramide developed extrapyramidal side effects compared to 0% of patients treated with dolasetron (Valley, 2000). IV administration has been linked to cardiovascular side effects, particularly hypotension, tachycardia, and bradycardia (Thongprasert, 2000). The incidence of these effects increases with higher doses and in young adults and children (Pendergrass, 1998). Although the effects can be managed by premedication with diphenhydramine, extrapyramidal reactions are considered a dose-limiting toxicity (Gralla et al., 1999; Pendergrass; Thongprasert).

**Phenothiazines**

Phenothiazines such as prochlorperazine and perphenazine are used primarily for management of N&V associated with minimally or moderately emetogenic chemotherapy (Pendergrass, 1998). They act by blocking the dopamine D2 receptors. Like metoclopramide, the phenothiazines are associated with extrapyramidal side effects, including sedation, postural hypotension, akathisia, and dystonic reactions. The use of high doses of phenothiazines is contraindicated, especially in children, because of these reactions (Pendergrass, 1998). These medications have the advantages of lower cost and oral or IV dosing options.
The side effects of butyrophenones may be severe and include sedation, postural hypotension, akathisia, and dystonic reactions. Tolerance may develop with long-term dosing. These factors limit these drugs' usefulness in the management of chemotherapy-induced N&V (Pendergrass, 1998).

Cannabinoids

Although tetrahydrocannabinol, the active ingredient in marijuana, has been found to have antiemetic activity in patients receiving moderately emetogenic chemotherapy, it seldom is used as first-line antiemetic therapy (Pendergrass, 1998). The antiemetic effects of this compound in its pharmaceutical form, dronabinol, are less than that of metoclopramide or the serotonin receptor antagonists (Gralla et al., 1999).

A review of clinical trials testing the antiemetic efficacy and side effects of cannabinoids found that most patients preferred the inhaled form of the drug to the oral form (Tramer et al., 2001). The information consolidated from 30 randomized studies also indicated that although cannabinoids may have some use in controlling emesis, they are significantly more toxic, especially to elderly patients. Side effects include dizziness, sedation, hypotension, hallucinations, paranoia, and dysphoria (Gralla et al., 1999; Pendergrass, 1998; Tramer et al.). The severity of these side effects is so intense that it may lead to patients' withdrawal from treatment (Tramer et al.).

Benzodiazepines

Because they are highly effective in relieving anxiety, benzodiazepines may be useful in the prevention and management of anticipatory N&V (Pendergrass, 1998). Drugs in this class include alprazolam and lorazepam. Although benzodiazepines have low antiemetic activity, they are considered to be useful as adjuncts to other antiemetic medications (Gralla et al., 1999; Pendergrass, 1998). However, a multicenter, randomized study of 225 patients compared the efficacy of granisetron alone to granisetron and alprazolam in the prevention of acute N&V after chemotherapy (Bauduer, 1999). The researchers found no significant differences in the control of these symptoms, suggesting that the use of a benzodiazepine does not improve the effectiveness of serotonin receptor antagonists in management of acute chemotherapy-induced N&V.

Neurokinin-1 Receptor Antagonists

Research currently is under way to investigate the use of neurokinin-1 receptor antagonists in chemotherapy-induced N&V. These agents block the activity of substance P, one of the neurotransmitters active in the emetogenic process (Dranitsaris et al., 2001; Pendergrass, 1998). Clinical studies indicate that neurokinin-1 receptor antagonists may be useful in the treatment of acute and delayed N&V (Pendergrass).

Several studies have examined the use of neurokinin-1 receptor antagonists in the control of acute chemotherapy-induced N&V. A double-blind, multicenter, parallel group study of 351 patients compared the effects of the neurokinin-1 receptor antagonist MK-869 in various combinations with granisetron and dexamethasone prior to and after highly emetogenic chemotherapy (Campos et al., 2001). They found that the group that received the combination of granisetron, dexamethasone, and MK-869 achieved significantly better control of acute N&V. Another study of 159 patients investigated the use of neurokinin-1 receptor antagonists combined with granisetron and dexamethasone (Navari et al., 1999). These researchers found that administration of all three drugs improved the control of acute N&V.

Neurokinin-1 receptor antagonists also may be useful in the control of delayed N&V. In one study, 63% of patients who received the neurokinin-1 receptor antagonist had no delayed symptoms, whereas only 29% of those who did not receive this treatment had no delayed N&V (Campos et al., 2001). Other studies have found that even a single dose of a neurokinin-1 receptor antagonist provided protection from delayed N&V (Navari et al., 1999; Rittenberg, 2002). This suggests that neurokinin-1 receptor antagonists may be valuable because few effective medications currently exist for this side effect.

The side effects of neurokinin-1 receptor antagonists include constipation, diarrhea, abdominal pain, headache, hiccups, asthenia, and anorexia (Campos et al., 2001). Phase III clinical trials of MK-869 currently are being conducted.

Combination Therapy

The current recommendations for the management of chemotherapy-induced N&V suggest that combining antiemetic agents will provide the best protection while minimizing adverse effects. This strategy is effective because N&V develops along multiple pathways; using medications that affect these different pathways will provide better control of the symptoms. Expert panels, including the American Society of Clinical Oncology (Gralla et al., 1999), ASHP (1999), and NCCN (2001), have developed guidelines to assist clinicians in choosing the most effective medications for each type of N&V. See Table 3 for a summary of these guidelines.

Routes of Administration

Although most antiemetic medications are equally effective when given orally or via IV (ASHP, 1999; Gralla et al., 1999), the route of administration selected for a particular drug regimen can influence patients' compliance (Kraut & Fauser, 2001). To be most effective, a medication regimen should be convenient and cost effective and result in minimal adverse effects. Current research efforts are being directed toward developing improved drug delivery systems that will enhance medications' therapeutic effects as well as patient compliance.

Oral

Oral medication administration is preferred over most other routes because it is simple, convenient for most patients, and generally lower in cost than other methods (Anastasia, 2000). Fast-dissolving formulations are being developed for many medications, including antiemetics, which will further simplify medication administration (Kraut & Fauser, 2001).

The oral route may not be acceptable for all patients, however. Those who have severe stomatitis or esophagitis secondary to cancer treatment may not be able to swallow pills or capsules easily. Impaired gastrointestinal absorption may alter the metabolism of the drug, making it less effective. Nausea, vomiting, and diarrhea may make it difficult for patients to take oral medications or keep them in the gastrointestinal tract long enough to be absorbed properly (Kraut & Fauser, 2001).

Transmucosal

Rapidly dissolving tablets and films are being developed for use in patients who cannot swallow oral medications.
Table 3. Summary of Clinical Practice Guidelines for Treatment of Chemotherapy-Induced Nausea and Vomiting

<table>
<thead>
<tr>
<th>Indication</th>
<th>American Society of Clinical Oncology</th>
<th>National Comprehensive Cancer Network</th>
<th>American Society of Health-System Pharmacists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipatory nausea and vomiting (N&amp;V)</td>
<td>1. Use the most active antiemetic regimen appropriate for the chemotherapy being given to prevent N&amp;V. 2. If anticipatory N&amp;V occurs, treat with behavioral therapy and systematic desensitization.</td>
<td>1. Prevention by use of effective antiemetic therapy before the first cycle of chemotherapy 2. If anticipatory N&amp;V occurs  a. Behavioral modification therapy  b. May add anxiolytic medications prior to each treatment  c. May add more potent antiemetic medications to the regimen</td>
<td>–</td>
</tr>
<tr>
<td>Acute N&amp;V</td>
<td>Serotonin receptor antagonist plus a corticosteroid 1. Medications in each class may be used interchangeably at equivalent doses. 2. Medications in each class have equivalent activity given orally or via IV. 3. Single doses are preferred.</td>
<td>Serotonin receptor antagonist plus a corticosteroid 1. A benzodiazepine may be added if needed. 2. May be given orally or via IV.</td>
<td>Serotonin receptor antagonist plus a corticosteroid 1. Medications in each class may be used interchangeably at equivalent doses. 2. Oral and IV routes of administration are equivalent.</td>
</tr>
<tr>
<td>High or very high emetogenic potential</td>
<td>Corticosteroid 1. May be used interchangeably at equivalent doses. 2. Has equivalent activity given orally or via IV. 3. Single doses are preferred.</td>
<td>Corticosteroid, phenothiazine, or substituted benzamide 1. Diphenhydramine may be used to minimize adverse effects of the phenothiazines or substituted benzamide. 3. May be given orally or via IV.</td>
<td>–</td>
</tr>
<tr>
<td>Low or very low emetogenic potential</td>
<td>No treatment is recommended.</td>
<td>No treatment is recommended.</td>
<td>–</td>
</tr>
<tr>
<td>Combination chemotherapy</td>
<td>The antiemetic medication(s) recommended for the agent with the highest level of emetogenic potential should be given.</td>
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<td>–</td>
</tr>
<tr>
<td>Delayed N&amp;V</td>
<td>A corticosteroid alone, a corticosteroid plus metoclopramide, or a corticosteroid plus a serotonin receptor antagonist 1. Medications in each class may be used interchangeably at equivalent doses. 2. Medications in each class have equivalent activity given orally or via IV.</td>
<td>A phenothiazine or substituted benzamide 1. A benzodiazepine or butyrophenone may be added if needed. 2. Diphenhydramine may be used to minimize adverse effects of the phenothiazines or substituted benzamide. 3. May be given orally or via IV. 4. If N&amp;V is uncontrolled, consider adjusting the chemotherapy dose or changing chemotherapy agents.</td>
<td>A serotonin receptor antagonist plus a corticosteroid or a phenothiazine plus a corticosteroid</td>
</tr>
<tr>
<td>High or very high emetogenic potential</td>
<td>No regular use of antiemetic medication is recommended.</td>
<td>No regular use of antiemetic medication is recommended.</td>
<td>No regular use of antiemetic medication is recommended.</td>
</tr>
<tr>
<td>Moderate or low emetogenic potential</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Persistent N&amp;V</td>
<td>1. Re-evaluate risk, antiemetic medications, chemotherapy, tumor, and concurrent disease or medication factors. 2. Ensure that the best regimen is being used for the emetic setting. 3. Consider adding an anti-anxiety agent. 4. Consider substituting a dopamine receptor antagonist for the serotonin receptor antagonist (or add the dopamine antagonist to the regimen).</td>
<td>A serotonin receptor antagonist plus a butyrophenone or a cannabinoid alone 1. Serotonin receptor antagonists and butyrophenones may be given orally, rectally, or via IV. 2. Cannabinoids may be given orally or rectally.</td>
<td>1. Add an antiemetic agent from another class of medications; in adults, benzodiazepines, corticosteroids, substituted benzamides, cannabinoids, or butyrophenones may be considered. 2. Increase the dose of the antiemetic drug to the maximum in the acceptable dose range. 3. Use a combination of approaches to control N&amp;V.</td>
</tr>
</tbody>
</table>

Note: Based on information from American Society of Health-System Pharmacists, 1999; Gralla et al., 1999; National Comprehensive Cancer Network, 2001.
Prochlorperazine and ondansetron currently are available; other drugs are under investigation for this type of administration. This route is convenient and easy to use and avoids first-pass elimination. However, it requires a special technique to place the tablet or film into the buccal pouch to ensure rapid dissolution and absorption (Kraut & Fauser, 2001).

**Rectal**

Rectal administration of medication often is used when other routes of administration are not feasible. It has the advantage of being easy to use; however, many patients find this type of administration uncomfortable. Absorption of medications given by this route may be uneven, resulting in peaks and troughs of medication activity (Kraut & Fauser, 2001).

**Transdermal**

The major obstacle for the transdermal route is the physiochemical properties of the drugs themselves; few thus far have been found to be suitable for transdermal administration, although research is ongoing to investigate the use of lergentron, a new serotonin receptor antagonist, in this form (Kraut & Fauser, 2001).

Transdermal administration has several advantages. First, transdermal patches are easy to use, resulting in high patient compliance. Second, this route of administration avoids the first-pass effect, allowing higher bioavailability of the medication. Finally, transdermal administration permits stability of serum drug levels, which allows for long-term effect and fewer serious side effects (Kraut & Fauser, 2001).

Because transdermal administration requires time to reach peak serum concentrations, this route is not useful for patients who require acute control of N&V. Those who have dermatologic side effects of cancer therapy also would be unable to use this technique (Kraut & Fauser, 2001).

**Intravenous**

This method is used most often in the inpatient setting but also may be available in patients’ homes through coordination with home infusion agencies. The IV route is useful for patients who require standard, precise doses that can be rapidly metabolized (Kraut & Fauser, 2001). Disadvantages of the IV route of administration include a higher cost for the drugs and the relative complexity of the administration procedure. More nursing time for drug preparation, administration, and port or catheter care add up to a less convenient, more costly alternative (Kraut & Fauser, 2001).

**Intranasal**

Metoclopramide is the only antiemetic medication currently available in intranasal form in the United States. Pharmacokinetic research indicates that intranasal administration is equal to IV and intramuscular metoclopramide in the control of N&V associated with moderately emetogenic chemotherapy. The drug generally is well tolerated and has achieved high compliance among patients. Intranasal metoclopramide is associated with the same types of systemic side effects as metoclopramide given by any other route (Kraut & Fauser, 2001).

**Pulmonary**

The inhalant route of administration is considered one of the most promising for improving the absorption and efficacy of many drugs. Inhalation permits rapid onset of drug effect, instant systemic circulation, and higher drug bioavailability. Currently, cannabinoids are the only antiemetic drugs available in the inhaled form, but the use of marijuana as a medication is not legal in all states (Kraut & Fauser, 2001).

### Implications for Nurses

Nurses play an important role in the management of chemotherapy-induced N&V. Careful assessment of patients, an understanding of the chemotherapy treatments they are receiving, and knowledge of the types of antiemetic drugs available, their indications and contraindications, and their side effects are key to the proper selection of a nursing care plan.

When caring for patients who are receiving chemotherapy, nurses must assess the patients for potential adverse reactions, including N&V. Such assessment should include a physical examination and a thorough health history.

Physical examination of patients with N&V should include assessment of weight changes and evaluation of laboratory values to identify metabolic imbalances at early stages (Itano & Taoka, 1998). Factors to be addressed in the health history include:

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>Emetogenic potential of the chemotherapy agent</td>
<td>Considered to be the most important predictor of chemotherapy-induced nausea and vomiting (N&amp;V)</td>
</tr>
<tr>
<td>Poor control of N&amp;V with prior chemotherapy</td>
<td>Associated with anticipatory, acute, and delayed N&amp;V</td>
</tr>
<tr>
<td>Female gender</td>
<td>Although the association is not strong, gender has been linked with anticipatory, acute, and delayed N&amp;V</td>
</tr>
<tr>
<td>Younger age</td>
<td>Age under 45 years has been associated with anticipatory N&amp;V; age under 50 years, with acute N&amp;V</td>
</tr>
<tr>
<td>History of motion sickness</td>
<td>Associated with anticipatory, acute, and delayed N&amp;V</td>
</tr>
<tr>
<td>Low chronic alcohol intake</td>
<td>Alcohol intake of less than 100 g per day for a period of years has been associated with lower risk of acute N&amp;V; in general, higher intake is associated with lower risk</td>
</tr>
<tr>
<td>Anxiety about treatment</td>
<td>Most strongly associated with anticipatory N&amp;V; may be difficult to treat</td>
</tr>
<tr>
<td>Current infection</td>
<td>Associated with acute, delayed, or persistent N&amp;V</td>
</tr>
<tr>
<td>Metabolic imbalances</td>
<td>Hyperglycemia, hypercalcaemia, and hyponatraemia are common; they can cause N&amp;V or be caused by it</td>
</tr>
<tr>
<td>Food toxins</td>
<td>Associated with damage to enterochromaffin cells in the intestinal tract</td>
</tr>
<tr>
<td>Renal or hepatic dysfunction</td>
<td>Associated with acute, delayed, or persistent N&amp;V</td>
</tr>
<tr>
<td>Central nervous system disease or injury</td>
<td>Primary tumors, metastasis, or treatment-related injuries that affect the chemoreceptor trigger zone</td>
</tr>
<tr>
<td>Gastrointestinal obstruction</td>
<td>Stimulate enterochromaffin cells to release serotonin, which, in turn, stimulates the chemoreceptor trigger zone</td>
</tr>
</tbody>
</table>

Note: Based on information from Bauduer, 1999; Bender et al., 2002; Eckert, 2001; Gralla et al., 1999; Hickok et al., 2001; Itano & Taoka, 1998.
include patients’ knowledge of and experience with chemotherapy, their expectations about the treatment, their current health status, and any comorbidities that could contribute to intolerance of the treatment (Bender et al., 2002). Table 4 provides a summary of risk factors associated with the development of acute emesis. Current infections, metabolic imbalances, or comorbidities such as central nervous system disease or injury or gastrointestinal obstruction also can cause N&V (Itano & Taoka, 1998).

The emetogenic potential of the chemotherapy agent is considered by most experts to be the most important factor in predicting N&V (ASHP, 1999; Kraut & Fauser, 2001) and most often is the basis for guidelines for antiemetic therapy. Unfortunately, few studies have examined the potential of many of these agents for causing delayed N&V, how their emetogenic potential changes when they are given in combination, or their effects when given as part of a high-dose chemotherapy regimen (Gralla et al., 1999).

Another consideration is the potency of the antiemetic agent. Well-supported guidelines can assist in this assessment; through multiple clinical trials, researchers have established which agents are useful in preventing chemotherapy-induced N&V (Itano & Taoka, 1998).


References


ONF Continuing Education Examination

Antiemetic Therapy in Patients Receiving Cancer Chemotherapy

Credit Hours: 1.7
Passing Score: 80%
Test ID# 03-30/2-02
Test Processing Fee: $15

The Oncology Nursing Society is accredited as a provider of continuing education (CE) in nursing by the
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CE Test Questions

1. Which of the following electrolyte imbalances would be most typical of severe or prolonged vomiting?
   a. Sodium of 160 mEq/l
   b. Potassium of 3 mEq/l
   c. Chloride of 100 mmol/l
   d. Magnesium of 2 mEq/l

2. Ms. Jones is to receive her second cycle of cisplatin. The most appropriate single-agent antiemetic for Ms. Jones is
   a. Droperidol 5 mg via IV every three to four hours for 48 hours.
   b. Metoclopramide 15 mg orally (PO) before and two hours after chemotherapy.
   c. Dexamethasone, 20 mg via IV before chemotherapy and then 8 mg twice a day for two to three days.
   d. Granisetron hydrochloride (HCl) 1 mg given PO one hour prior to and 12 hours after chemotherapy.

3. Mr. Smith is a 62-year-old man scheduled to begin chemotherapy with cyclophosphamide, doxorubicin, and cisplatin for non-small cell lung cancer. He has a history of drinking one beer a day for the past 40 years. The factor that places him at highest risk for acute nausea and vomiting (N&V) is his
   a. Age.
   b. Gender.
   c. History of alcohol intake.
   d. Chemotherapy regimen.

4. The most appropriate treatment for Mr. Smith’s potential for acute N&V is
   a. Dexamethasone and lorazepam.
   b. Granisetron HCl and dexamethasone.
   c. Ondansetron HCl and metoclopramide.
   d. Granisetron HCl and prochlorperazine.

5. Chemotherapy agents are believed to affect the chemoreceptor trigger zone (CTZ) and vomiting center by
   a. Triggering the small intestine to release dopamine.
   b. Directly stimulating the CTZ through blood transmission.
   c. Damaging the enterochromaffin cells in the stomach lining.
   d. Stimulating the CTZ to release serotonin, which stimulates the vomiting center.

6. Mr. Brown’s N&V was controlled during his chemotherapy for non-Hodgkin’s lymphoma. However, he began to complain of N&V 32 hours after his chemotherapy. Mr. Brown most likely is complaining of these symptoms because of
   a. Acute nausea from his treatment with carboplatin.
   b. Delayed nausea from his treatment with cyclophosphamide.
   c. Persistent nausea from the high emetogenic potential of his vincristine.
   d. Anticipatory nausea from his expectation of developing N&V.

7. Ms. Doe is 54 years old and is to begin her second cycle of doxorubicin and cyclophosphamide for breast cancer. When she arrives to the clinic she is complaining of nausea and severe vomiting. What would be the most appropriate treatment prior to chemotherapy administration?
   a. Ondansetron and dexamethasone PO.
   b. Ondansetron, dexamethasone, and lorazepam via IV.
   c. Granisetron via IV, dexamethasone PO, and lorazepam PO.
   d. Metoclopramide, dexamethasone, and alprazolam via IV.

8. Ms. White is to receive her antiemetic therapy. She questions why she is receiving the ondansetron as a pill instead of in her IV. The nurse’s most appropriate response is
   a. “A smaller chance for side effects exists when giving medications orally versus via IV.”
   b. “We want to limit the amount of fluids you receive prior to your chemotherapy treatment.”
   c. “The ondansetron will work faster when given by mouth because it is better absorbed by the intestines.”
   d. “This medication is well absorbed in the intestines and begins to immediately affect the serotonin receptors there.”

9. A patient with a history of insulin-dependent diabetes and hypertension is to begin chemotherapy. The antiemetics that may be avoided during her treatment are
   a. Phenothiazines.
   b. Corticosteroids.
   c. Substituted benzamides.
   d. Serotonin receptor antagonists.

10. Mr. Jones is on cardiac monitoring. He completed his antiemetic medication and chemotherapy four hours ago. The nurse notes a prolonged cardiac QT interval. What medication on his medication record would the nurse expect to cause this reaction?
    a. Etoposide
    b. Metoclopramide
    c. Ondansetron
    d. Cyclophosphamide

11. A patient’s family member calls from home to the clinic and reports that the patient has stomatitis, vomiting, and
diarrhea. The most appropriate route of administration of ondansetron for this patient at home is
a. Oral.
b. Rectal.
c. IV.
d. Transmucosal.
12. While taking a health history during admission for chemotherapy, the nurse determines a patient is at a higher risk for developing N&V because of
a. Past history of kidney stones.
b. Current cellulitis of his left leg.
c. Diagnosis of stage II lung cancer.
d. History of smoking one pack per day.
13. A patient drives himself to and from the clinic for his admission for chemotherapy treatment. Which antiemetic agent ordered for the test you are taking.
a. Ondansetron IV
b. Metoclopramide PO
c. Ondansetron IV

d. Methylprednisolone IV
14. What is the most appropriate antiemetic regimen for a patient receiving biotherapy?
a. Ondansetron and prochlorperazine
b. Dexamethasone and ondansetron
c. Dolasetron mesylate and dexamethasone
d. Methylprednisolone and granisetron
15. The primary mediator of chemotherapy-induced N&V is
a. Stimulated only by serotonin.
b. Positioned outside the blood-brain barrier.
c. Seldom triggered by vagal nerve stimulation.
d. Located on the floor of the third ventricle of the brain.

Oncology Nursing Forum Answer/Enrollment Form

Antiemetic Therapy in Patients Receiving Cancer Chemotherapy (Test ID #03-30/2-02)

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4. The deadline for submitting the answer/enrollment form is two years from the date of this issue.
5. Contact hours will be awarded to RNs who successfully complete the program. Successful completion is defined as an 80% correct score on the examination and a completed evaluation program. Verification of your CE credit will be sent to you. Certificates will be mailed within six weeks following receipt of your Answer/Enrollment Form. For more information, call 866-257-4667, ext. 6296.

Instructions: Mark your answers clearly by placing an “x” in the box next to the correct answer. This is a standard form; use only the required number of spaces required for the test you are taking.

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Name ___________________________ Telephone # ___________________________
Address ___________________________ Social Security # ___________________________
City ___________________________ State ___________________________ Zip ___________________________

State(s) of licensure/license no(s). ___________________________

Program Evaluation

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1. How relevant were the objectives to the CE activity’s goal?
2. How well did you meet the CE activity’s objectives (see page 259)?
   • Objective #1
   • Objective #2
   • Objective #3
3. To what degree were the teaching/learning resources helpful?
4. Based on your previous knowledge and experience, do you think that the level of the information presented in the CE activity was Too basic Appropriate Too complex
5. How long did it take you to complete the CE activity? ________ minutes

☐ My check or money order payable to the Oncology Nursing Society is enclosed. U.S. currency only. (Do not send cash.) After completing this form, mail it to: Oncology Nursing Society, P.O. Box 3510, Pittsburgh, PA 15230-3510. For more information or information on the status of CE certificates, call 866-257-4667, ext. 6296.