ABSTRACT

Chemotherapy-induced nausea and vomiting (CINV) has a broad range of consequences that can affect not only the patient’s general health status but also daily function and quality of life. Patients undergoing chemotherapy should be encouraged to maintain adequate nutritional and fluid intake to prevent the weight loss, electrolyte imbalances, and dehydration that can result from CINV. Patients also should be monitored closely for signs and symptoms of these problems because early intervention may assist in avoidance of more serious, potentially life-threatening complications. In addition to the physical manifestations of cancer and CINV, the psychosocial consequences of CINV may result in decreased quality of life for the patient. Physical impairment, fatigue, and stresses associated with treatment may cause the patient’s relationships with other people to become strained. Younger patients (<65 years) have been shown to have greater problems with CINV than older patients (≥65 years). Effective management of CINV should include patient and family counseling, prophylactic intervention, flexibility in the therapeutic approach, and constant reassessment of the treatment plan. Up-to-date knowledge of the pathophysiology of CINV, available antiemetics, and nonpharmacologic interventions not only help oncology nurses to improve clinical outcomes and quality of life for patients receiving chemotherapy but also to maintain treatment cost effectiveness. (Adv Stud Nurs. 2005;3(1):16-21)

CHEMOTHERAPY-INDUCED NAUSEA AND VOMITING (CINV) affects different patients in varying degrees: It may have no effect on one patient but may cause negative emotional responses and major disruptions in lifestyle for another. The effects on quality of life are greatest when CINV is severe or long lasting, interferes with activities of daily living, magnifies the other toxicities of treatment, and affects a patient’s ability to receive treatment for cancer.

Over the past 2 decades, surveys of patients with cancer indicate that CINV is considered among the most significant adverse events following therapy. Some patients may consider discontinuing treatment with chemotherapy, despite its therapeutic benefits because of intolerable CINV. Studies have indicated that patients who experience CINV have difficulty completing household tasks, enjoying meals and leisure activities, and maintaining daily functions such as going to work, preparing meals, caring for themselves, or relaxing.

A recent study showed that healthcare providers often underestimate the incidence of delayed CINV.

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Several conditions may predicate this underestimation, including the following: Significant improvements in the management of acute CINV have occurred and patients are often not formally assessed while at home during periods of delayed nausea and vomiting. Clinicians may assume that CINV is being effectively managed in the home setting with the prescribed antiemetic and, as a result, may not fully assess the effectiveness of an agent for individual patients.3

This article examines the effects of CINV on the functional status and quality of life of patients with cancer. Adverse effects are discussed, along with the psychosocial effects, tolerance of CINV among different age groups, and the economic impact of CINV.

**Nutritional, Fluid, and Electrolyte Imbalances**

More than 50% of patients diagnosed with cancer complain of anorexia and weight loss, which can also be presenting signs of the disease. Weight loss is a prognostic indicator that is inversely correlated to the length of survival. Approximately 40% to 80% of patients with cancer are malnourished.4 Nutritional status may be predictive of how patients will tolerate therapy.5

Patients undergoing chemotherapy must maintain adequate nutritional intake to prevent weight loss and muscle loss and to maintain protein stores. Prolonged or delayed CINV may cause patients to experience anorexia by preventing adequate nutritional intake and resulting in a wasting cycle.6 Weight loss causes the body to burn fat and protein stores for energy, which causes muscle wasting and fatigue. This process is perpetuated because patients often become too tired or weak to eat.

Patients require immediate intervention if weight loss is greater than 5% in 1 month or greater than 10% in 6 months.3 Protein-energy malnutrition can be identified when body mass index is less than 17 kg/m².3 Table 1 shows the laboratory values that indicate

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**Table 1. Laboratory Values Indicating Depletion of Protein Stores**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Laboratory Value</th>
<th>Physical Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypokalemia</td>
<td>Serum potassium &lt;3.5 mEq/L</td>
<td>Rapid pulse, Electrocardiographic abnormalities (eg, ST-segment depression, T-wave inversion, prominent U waves, and heart block) Arrhythmias, Shallow respirations, Hyporeflexia, Malaise, Fatigue, Weakness, Palpitations, Paresthesias, Cramps, Restless leg syndrome, Decreased urine-specific gravity, Tachycardia, Hypertension or hypotension, Diminished deep tendon reflexes, Sleepiness, Weakness, Lethargy, Seizures, Nausea, Vomiting, Anorexia</td>
</tr>
<tr>
<td>Hyponatremia</td>
<td>Serum sodium &lt;135 mEq/L</td>
<td>Hypovolemia, Tetany, Paresthesias, Restlessness, Confusion, Convulsions, Nausea</td>
</tr>
<tr>
<td>Hypochloremia</td>
<td>Serum chloride &lt;95 mEq/L</td>
<td>Hyperventilation, Tetany, Paresthesias, Restlessness, Confusion, Convulsions, Nausea, Anorexia</td>
</tr>
<tr>
<td>Hypomagnesemia</td>
<td>Serum magnesium &lt;1.5 mEq/L</td>
<td>Increased neuromuscular irritability, Hyperreflexia, Muscle spasms, Twitches, Tremors or cramping, Positive Chvostek’s sign, Positive Troussseau’s sign, Electrocardiogram changes (prolonged QT interval, widened QRS complex, T-wave inversion, and ST-segment depression), Arrhythmias, Nausea, Anorexia</td>
</tr>
</tbody>
</table>

*Indicates altered protein synthesis. Data from Bender et al.3

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Data from Bender et al.3

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**Table 2. Laboratory Values and Physical Manifestations of Electrolyte Imbalances**

<table>
<thead>
<tr>
<th>Electrolyte Imbalance</th>
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<th>Physical Manifestations</th>
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Data from Bender et al.3
depletion in protein stores. Decreases in these laboratory values signal muscle wasting and cachexia.

Patients and/or their caregivers should be encouraged to maintain a diary of the patient’s daily food intake. The Scored Patient-Generated Subjective Global Assessment is another tool that can be used to gather data regarding nutritional status and to provide direction for intervention.3

The depletion of fluid volume from severe CINV can cause dehydration, which includes the loss of water and electrolytes. Vomiting causes loss of gastric secretions, which contain potassium, sodium, hydrogen, chloride, magnesium, and water. Severe vomiting is often associated with hypokalemia, hyponatremia, hypochloremia, and hypomagnesemia. Table 2 shows the laboratory values associated with these electrolyte imbalances and their physical manifestations. Life-threatening electrolyte imbalances may occur if vomiting is severe or prolonged.

Dehydration occurs when more water is lost than electrolytes and may increase the toxicity of nephrotoxic drugs.7 Table 3 shows some of the physical symptoms of dehydration. Early intervention is essential for patients with fluid and electrolyte disturbances.

Laboratory values indicating dehydration include low serum potassium and chloride, increased urine-specific gravity, osmolality, blood urea nitrogen-creatinine ratio greater than 10:1, and hemoconcentration.3 Depending on the relative loss of sodium with respect to free water, serum sodium can be high or low.3

Vital signs may become altered with moderate-to-severe dehydration.7 An increase in a patient’s body temperature often is not a reliable indicator of dehydration, as patients with cancer are at high risk of infection.7 Breathing becomes slower and more shallow as the lungs try to conserve carbon dioxide.7 Heart rate increases to compensate for decreased intravascular volume.7

**Psychosocial Effects**

Psychosocial consequences of CINV affect the patient’s functional ability and relationships. Physical status significantly influences the patient’s sense of well-being. As patients experience physical impairment and/or deterioration, their ability to function normally diminishes, resulting in decreased quality of life.

Maintaining adequate nutritional intake may be difficult for patients who experience CINV. Patients who experience nausea may fear that eating will trigger vomiting. Loss of appetite associated with nausea decreases the quantity and quality of food intake. Patients may limit themselves to eating only certain foods that cause them the least discomfort. Although compromising the balance of nutrients may be relatively harmless for those patients who experience a brief gastrointestinal illness, it may be detrimental to patients undergoing long courses of chemotherapy.

Cancer and its treatment are associated with fatigue. Several physiologic factors and psychosocial issues associated with cancer can exacerbate fatigue. A patient’s energy level may decrease because of inadequate nutritional intake. CINV may prevent patients from resting properly.

Patients’ relationships with family members, friends, and coworkers may be affected by CINV. Financial burdens and time commitments from caregivers may cause patients to become concerned about creating hardships for others. Patients may find that they cannot maintain their usual roles within their families, circles of friends, and at work. In addition, cancer treatment and CINV may contribute to sexual dysfunction.

In a study conducted by Osoba et al, 832 patients who were entering their first cycle of chemotherapy completed the European Organization for Research and Cancer core Quality of Life Questionnaire (QLQ-C30), which assesses functionality, symptoms, and quality of life.1 Questionnaires were completed before chemotherapy (baseline) and at 1 week (day 8) and 2

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**Table 3. Physical Symptoms of Dehydration**

- Fatigue
- Mental status changes
- Poor skin turgor
- Tongue furrows
- Dry oral mucosa, especially between the gingival and buccal mucosa
- Postural hypotension
- Lightheadedness
- Weight loss
- Decreased urine output

Data from Bender et al.3
to 4 weeks after chemotherapy. Patients also completed a self-report nausea and vomiting diary for 5 to 7 days after chemotherapy. All patients received a 5-HT<sub>3</sub> antagonist (ondansetron or granisetron) before and during the first day after chemotherapy; 88% of the patients also received dexamethasone before undergoing chemotherapy. Following the first day after chemotherapy, 79% of patients received a prophylactic treatment with a 5-HT<sub>3</sub> antagonist or dexamethasone (or both) for 4 to 6 days after chemotherapy.

Osoba et al reported that CINV adversely affects a patient's quality of life, regardless of the number of emetic events (ie, patients with 1–2 episodes of vomiting experience almost the same deterioration in quality of life as patients with more than 2 episodes of vomiting).<sup>1</sup> When compared to patients who did not experience CINV, those patients with CINV experienced significant decreases in physical, cognitive, and social functioning and global quality of life. In addition, patients with CINV experienced more fatigue, anorexia, insomnia, and dyspnea (.0001 < P < .05) than patients without CINV.

**Effects of Chemotherapy-Induced Nausea and Vomiting: Differences Among Age Groups**

Approximately 60% of all cases of cancer occur in people 65 years and older.<sup>8</sup> This percentage is likely to increase as the population of older adults increases. In the past, older patients with cancer were less likely to be treated as aggressively as younger patients because the medical literature had shown that, as compared to younger patients, older patients were more prone to the toxic effects of chemotherapy and had a poorer survival rate.<sup>1</sup> Today, older patients receive more aggressive chemotherapy; studies have shown that age is not a factor in chemotherapy tolerance for adjuvant or palliative treatment. The most important factors to consider before treating patients of all ages who have cancer include performance status and comorbidities. However, older patients are more susceptible to hematologic toxicity, which may be related to decreased bone marrow reserve or renal function associated with aging.<sup>9</sup>

In addition to factors, such as the emetogenic potential of specific chemotherapy agents, gender, alcohol consumption, and susceptibility to motion sickness, age is also a factor that contributes to the extent of CINV.<sup>9,10</sup> Younger patients are more likely to experience CINV than older patients.<sup>11-13</sup> In patients with breast cancer, older patients (>50 years) have been shown to respond better to antiemetic therapy than younger patients (<50 years).<sup>13</sup>

Dodd et al examined the differences in the effects of CINV between older (≥65 years; n = 25) and younger (<65 years; n = 102) outpatients receiving 4 cycles of cancer chemotherapy.<sup>4</sup> During the course of the 4-month study, patients completed 2 questionnaires: the Rhodes Index of Nausea and Vomiting (INV) Form 2, which measures the patient's perceived duration of nausea, frequency of nausea, distress from nausea, frequency of vomiting, amount of vomiting, distress from vomiting, frequency of dry heaves, and distress from dry heaves; and the Behavior Checklist, which measures behaviors such as compliance with medications and eating (eg, size of meals, snacks, and liquid intake). Patients were asked to complete the INV at 24 and 48 hours after their chemotherapy sessions; the Behavior Checklist was completed at cycle 4. Younger patients consistently reported experiencing greater problems with CINV. The authors concluded that this pattern was not a function of differences in behaviors. Younger and older patients scored similarly on the Behavior Checklist; however, older patients were less likely to participate in activities that may cause nausea.

**Economic Impact**

Complications of CINV may lead to extended hospitalization, which increases the burden on nursing time, pharmacy resources, and overall treatment cost.

**Table 4. Economic Considerations for the Selection of Antiemetic Regimens**

- Will the regimen reduce the length of hospitalization?
- Will patients be able to maintain their usual level of activity during treatment?
- How will nursing and pharmacy costs be affected?
- Are there any formulary restrictions or restriction for use in clinical settings?<sup>2</sup>
- How will the regimen affect out-of-pocket expenses for the patient?

Data from Berger and Clark-Snow.<sup>7</sup>
The distressing symptoms of CINV have a considerable impact on all aspects of a patient’s quality of life, in addition to the family and caregivers. The distress resulting from these symptoms can escalate over time and can potentially lead to a patient’s refusal to continue with the most effective course of therapy. Advances in research and new chemotherapy choices and treatments often translate into additional healthcare costs for patients and families. Increased use of expensive antiemetics and shortened hospital stays dictated by managed care have shifted focus to primary outpatient management and present healthcare providers with the challenge of providing patients with current and cost-effective therapies. Table 4 shows economic considerations that should be considered when selecting antiemetic regimens.

In a study published in 1999, Engstrom et al examined the impact of antiemetic guidelines to improve efficacy, optimize nursing and pharmacy time, increase compliance, and enhance cost savings in an outpatient oncology clinic in a large metropolitan city in the mid-Atlantic United States. A standard antiemetic order form was developed, categorizing chemotherapy agents according to emetogenic classification (ie, highly/moderately high, high-delayed, moderate, and mild) and pairing each agent with the recommended antiemetic regimen. The guidelines recommended the use of the newer oral antiemetic agents over the use of intravenous (IV) antiemetics. The study enrolled 52 patients who had received prior chemotherapy or were chemotherapy naïve. None of the patients had taken antiemetics prior to the study.

Of the patients who received highly emetogenic chemotherapy (n = 29), 79% of the patients demonstrated complete protection from CINV during the first 24 hours after treatment. All of the patients who received moderate or mild chemotherapy regimens (n = 23) achieved complete protection. In addition, 24 of the patients who received the high emetogenic regimen also were placed on the delayed regimen because they were taking cisplatin. Fifty percent of these patients demonstrated complete protection from CINV. There were no documented toxicities and compliance was excellent (100%).

In the same study, Engstrom et al also analyzed the pharmacy and nursing costs for the 8-month period before the study guidelines were implemented and for the 8-month period after implementation. The cost savings, which are shown in Table 5, did not include patients who were treated off the study. Before the guidelines were developed and implemented, most patients undergoing treatment at the study’s institution received 32 mg of IV ondansetron (usually without dexamethasone) without regard to the emetogenic potential of the chemotherapy regimen. The cost savings of approximately $18,000 reported by the study investigators resulted from the oral antiemetic regimens recommended by the guidelines. The use of IV ondansetron decreased, reducing the costs associated with IV tubing and the time required for the nurse or pharmacist to prepare the dose. An additional advantage of oral antiemetics is that patients usually prefer oral drugs, which can be used in the home or ambulatory setting.

Chemotherapy-induced nausea and vomiting can be managed effectively in 80% to 90% of patients who have been educated about nausea and vomiting associated with chemotherapy. Effective management should include patient and family counseling, prophylactic intervention, flexibility in the therapeutic approach, and constant reassessment of the treatment plan. Oncology nurses must have up-to-date knowledge about chemotherapy, antiemetics, and nonpharmacologic interventions to effectively manage the care of patients receiving chemotherapy, which also will help to improve clinical outcomes and maintain treatment cost effectiveness.

CONCLUSIONS

The impact of CINV on a patient’s quality of life can range from mild to debilitating. Some patients may consider discontinuing chemotherapy because of the intolerable effects of CINV. Anorexia and weight
loss associated with prolonged or delayed CINV prevent adequate nutritional intake and can cause muscle wasting and fatigue. Severe or prolonged CINV may also result in fluid and electrolyte imbalances. Early and immediate intervention is required if patients experience significant weight loss or fluid and electrolyte disturbances. Quality of life is affected not only by the physical manifestations of CINV but also by the psychosocial effects, which can strain relationships with family, friends, and coworkers. There is evidence that CINV adversely affects quality of life, regardless of the number of emetic events experienced by the patient. Studies have shown that younger patients experience greater problems with CINV than older patients, who are more likely to achieve antiemetic control. Prevention and management of CINV with up-to-date antiemetic protocols may not only lessen the negative impact of CINV on quality of life but also relieve some of the economic burden on nursing time, pharmacy resources, and overall treatment costs.

REFERENCES