■ Article

Quality-of-Life Considerations With Taxane-Based Therapy in Metastatic Breast Cancer:
A Case Vignette

Cathy Maxwell, RN, OCN®

© iStockphoto.com/SilviaJansen

As with many other types of chemotherapy, taxanes are associated with side effects that can affect patients' quality of life. One of the major side effects of taxane therapy is taxane-induced peripheral neuropathy (TIPN). The development of TIPN is accompanied by troublesome burning, tingling, and numbness; TIPN also can affect patient safety because of the decreased ability to perceive sensations (e.g., pain, heat). Pain and fatigue are common side effects of taxane therapy. These particular symptoms may hinder patients from working or performing daily activities, thus affecting quality of life. This case vignette provides an example of the symptoms that can accompany taxane therapy, including TIPN. The case vignette also demonstrates the long-lasting effects that TIPN can have on patients receiving taxane-based therapy, as well as the hindrance to the ability to work and perform daily activities because of numbness, pain, and fatigue. In addition, identification and management of taxane-related side effects are explored from the nursing perspective, and important aspects of patient education are discussed.

Cathy Maxwell, RN, OCN®, is the director of Clinical Operations at Advanced Medical Specialties in Miami, FL. The author received editorial support from Christopher Carter, PhD, of MediTech Media, which was funded by Celgene Corporation. The author is fully responsible for the content of and editorial decisions about this article and received no honorarium for its development. Celgene Corporation provided funding for the publication of this article and provided a medical accuracy review of content for author consideration. The content of this article has been reviewed by independent peer reviewers to ensure that it is balanced, objective, and free from commercial bias. No financial relationships relevant to the content of this article have been disclosed by the independent peer reviewers or editorial staff. Mention of specific products and opinions related to those products do not indicate or imply endorsement by the *Clinical Journal of Oncology Nursing* or the Oncology Nursing Society. Maxwell can be reached at cmaxwellfla@gmail.com, with copy to editor at CJONEditor@ons.org. (First submission October 2012. Revision submitted November 2012. Accepted for publication November 16, 2012.)

Digital Object Identifier:10.1188/13.CJON.S1.35-40

The patient, a 78-year-old woman, has a history of cholecystectomy, left knee replacement, hyperlipidemia, and hypertension. She experienced menopause at age 53 and received only six weeks of hormone-replacement therapy. The patient also has a family history of cancer, including a sister who died of breast cancer and a maternal aunt who died of ovarian cancer. At the time of her initial visit, the patient was taking no medications. In January 2011, she experienced discomfort in her right breast, for which she underwent a mammogram that revealed a mass that was further confirmed by ultrasound and fine-needle aspirate. The patient also complained of vague abdominal pains and had an elevated lactate dehydrogenase level (300 U/L). A positron-emission tomography/computed tomography scan revealed a liver lesion. The primary tumor was observed to be 1.2 cm and was identified as invasive ductal carcinoma that was positive for estrogen and progesterone receptors and human epidermal growth factor receptor 2. The sentinel biopsy was positive. The tumor was identified as T1c N2 M1. First-line chemotherapy with paclitaxel plus trastuzumab was prescribed.

At the start of cycle 3, the patient's key concerns were fatigue, shortness of breath, diarrhea, aches and pain, and alopecia. Her physical functioning was restricted in strenuous activity, but she was able to perform light work. Prior to cycle 4, she reported the same key symptoms as she did at her previous visit, as well as mild bleeding and bruising problems and bilateral neuropathic symptoms such as numbness, burning, or tingling in her hands. The patient's physical functioning also had decreased from an Eastern Cooperative Oncology Group performance status (ECOG PS) of 0–1 (she was able to care for herself but was unable to work, and she was able to be out of bed more than 50% of waking hours) (Oken et al., 1982). At the time of her fifth cycle, the patient mentioned that she was experiencing numbness in her fingertips and hands and that it was bothersome. She mentioned that, because of the numbness in her fingers, she was now unable to cross-stitch, which was a hobby that she truly

enjoyed. She stated that she felt somewhat depressed because of this. At the time, she also spoke of worsening fatigue as well as intermittent aches and pains. At the sixth cycle, her physical functioning had declined to an ECOG PS of 2 (unable to work and in bed more than 50% of waking hours). She continued to express concern about fatigue, pain, diarrhea, and worsening numbness in her fingertips and mentioned that she was now experiencing numbness in her toes and feet. The patient had her seventh cycle of paclitaxel delayed because of neutropenia, for which she received granulocyte–colony-stimulating factor (G-CSF) therapy. The patient also had several subsequent cycles of paclitaxel delayed because of continuing neuropathy. After the patient had received 12 cycles of paclitaxel, both she and the physician decided to stop paclitaxel therapy because of the side effects. At her final cycle, in addition to the key concerns from previous visits, the patient mentioned worsening of the neuropathy in her fingers and hands, as well as difficulty when walking because of the numbness in her feet. She said that the numbness in her hands now prevented her from preparing her own food because she was afraid that she would cut or burn herself; she also was unable to button her clothing and stated that she was self-conscious about not being able to wear the clothing she normally wears. She was offered medication (gabapentin) for the neuropathy, but refused because she did not want to take another medication. Her ECOG PS was still 2, which required her daughter to move in with her to provide care. The patient said that she felt like she was a burden on her daughter.

The patient continued trastuzumab therapy. About one week after her last cycle of paclitaxel, she reported dizziness and lightheadedness in addition to the ongoing numbness, burning, or tingling, and her physical functioning was still limited. She now stated that the neuropathy was affecting her feet to the extent that she was worried about falling when she walked. She also mentioned that she had dropped something twice because of the numbness in her hands. The patient reported that she felt self-conscious about her hair loss and did not want to exercise in the swimming pool because she did not want others to notice that she had lost her hair. She continued to report no change in the neuropathic symptoms at each visit. About four months after her last cycle of paclitaxel, she reported continued numbness and tingling in her hands and feet and that she was still unable to make her own food. At this point, she was referred to a neurologist and was again offered medication (duloxetine) for the neuropathy, which she refused because of the potential side effects. Her physical functioning had improved to an ECOG PS of 1. Her daughter was able to move out of the house and visited her 3–4 times per week now. About six months after her last cycle of paclitaxel, the patient disclosed that she had fallen during the time she was receiving paclitaxel, which resulted in a wrist injury. She explained that she tripped going up the stairs because she was unable to feel the step beneath her foot. She said that she did not want to mention her fall earlier in fear that the physician would stop her treatment. In the following months, the patient reported that the neuropathy began to slowly improve; about one year after her last dose of paclitaxel, she said that the neuropathy was still present but was "not as noticeable." She was again able to cook for herself and to button clothing; however, she stated that she was still unable to cross-stitch. Figure 1 shows a timeline of this patient's experience with paclitaxel-induced neuropathy.

Taxanes have well-known safety profiles, and the symptoms experienced by this patient, such as fatigue, diarrhea, alopecia, rash, neutropenia, and neuropathy, are not uncommon for patients receiving paclitaxel (Bristol-Myers Squibb, 2011). Unfortunately, many of these adverse events affect patient quality of life. That was evident in the change in the patient's physical functioning score over time, as well as in her personal testimony at each follow-up visit.

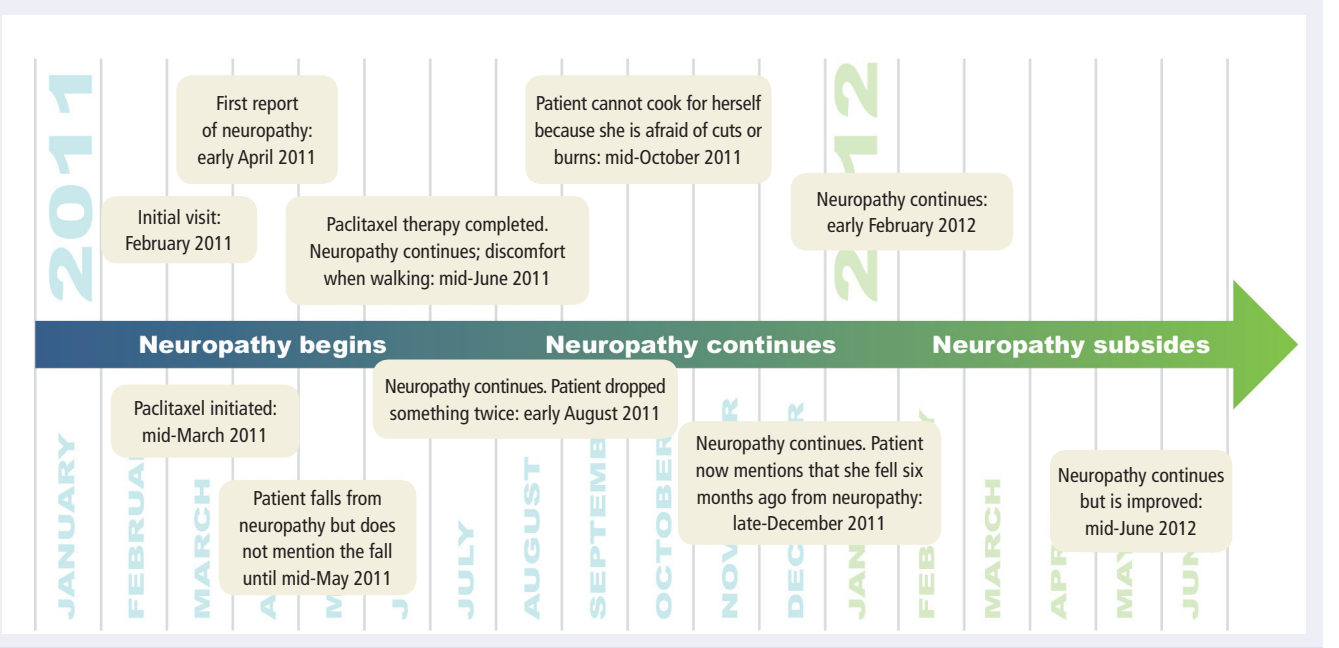

FIGURE 1. Timeline of Events During the Case Patient's Treatment

Neuropathy and Quality of Life

One of the most concerning adverse effects of taxane therapy is neuropathy. Although the exact mechanism behind taxane-induced peripheral neuropathy (TIPN) is still unclear, the cause is likely from the disruption of normal microtubule activity, which leads to impaired cell growth (Scripture, Figg, & Sparreboom, 2006). Because microtubules are important for the development and maintenance of neurons, this likely is the basis for the neurotoxicity induced by taxanes (Kobayashi & Mundel, 1998; Scripture et al., 2006). In addition, the solvent used to formulate paclitaxel, Cremophor® EL (now renamed as Kolliphor® EL), has been associated with neurotoxic effects in animal studies (Authier, Gillet, Fialip, Eschalier, & Coudore, 2000; Windebank, Blexrud, & de Groen, 1994). Unfortunately, effective therapies for treating all patients with TIPN are not yet available (Wolf, Barton, Kottschade, Grothey, & Loprinzi, 2008). Several medications are used in the treatment of neuropathic symptoms; however, the effectiveness of those therapies is questionable (Pachman, Barton, Watson, & Loprinzi, 2011). In addition, as evidenced by the case vignette, many patients do not want to take neuropathy medications because of the potential for side effects.

Gabapentin is commonly used to treat neuropathic pain and is associated with dizziness, somnolence, edema, and nausea (Pfizer Inc., 2012). Gabapentin is an antiepileptic drug, and many of these types of agents have the potential to increase the risk of suicidal thoughts or behavior in patients receiving them for any reason (Pfizer Inc., 2012). Duloxetine, an antidepressant, also has been used to treat neuropathic pain (Eli Lilly and Company, 2012). In a phase III study by Smith et al. (2012), duloxetine was shown to be efficacious and well tolerated in patients who had developed TIPN, with grade 2 fatigue being the most commonly reported adverse event. Like gabapentin, duloxetine also is associated with nausea, dizziness, somnolence, and an increased risk of suicidal thoughts and behaviors (Eli Lilly and Company, 2012).

In addition to pharmacologic interventions such as taxane dose reductions or delays and topical, adjuvant, or opioid analgesics, nonpharmacologic interventions for treating TIPN exist (i.e., exercise, hydrotherapy, massage, acupuncture, electrotherapy, dietary supplements, and relaxation), and healthcare providers commonly manage TIPN with dose reductions or dose delays of the taxane. However, although these interventions may be useful for treating TIPN, more research is needed to verify their effectiveness.

Aside from the physical symptoms of TIPN, such as numbness, burning, tingling, dizziness, and weakness, TIPN affects patient quality of life in multiple ways (Almadrones, McGuire, Walczak, Florio, & Tian, 2004; Bakitas, 2004). For many patients, neuropathic symptoms contribute not only to discomfort but also emotional effects. Many patients are emotionally affected by the inability to wear certain clothing items or shoes (because of the inability to button or tie), put on makeup or jewelry, perform a specific job, or participate in a hobby or sport (Tofthagen, 2010). For example, the case patient's inability to cross-stitch left her feeling somewhat depressed, and her inability to wear the types of clothing she was used to made her feel self-conscious. In addition, many patients become unable to care for themselves and may need to rely on a caregiver, as the patient in the case vignette did with her daughter (Anastasia & Hay, 2002). That reliance may cause patients to feel like a burden to family members. Neuropathic symptoms also can contribute to safety concerns. In the case vignette, after developing paclitaxel-induced neuropathy, the patient spoke of bothersome numbness, became afraid to cook for herself, had difficulty walking, and experienced a fall. In addition, her physical functioning decreased over time during her treatment. TIPN can persist well beyond the duration of treatment. Hershman et al. (2011) reported that neuropathic symptoms were common for as many as two years after adjuvant taxane therapy in survivors of breast cancer. The patient in the case vignette experienced neuropathic symptoms that lasted for more than one year after completion of paclitaxel therapy.

Visual Assessment

- Assess the patient's gait. Is the patient holding onto the wall or leaning in a manner that is not typical for him or her?
- Assess the patient's clothing and jewelry. Is the patient wearing a pullover sweater instead of his or her usual button-up shirt? Were buttons skipped when dressing? Is the patient missing jewelry that he or she normally wears, such as earrings?
- Assess the patient's personal hygiene. Is the patient not wearing makeup or is his or her hair styled differently?
- Place several coins on a table top. Does the patient have trouble picking them up?
- Ask the patient to button and unbutton his or her clothing or to tie his or her shoes. Does the patient have trouble doing these tasks?

Example Trigger Questions for Patients

- Are you experiencing numbness or tingling in your fingertips or toes?
- Do you have trouble buttoning buttons or tying your shoes?
- Do you have difficulty holding a cup?
- Are you having trouble performing your normal activities?
- Have you fallen recently?
- Are you able to cook for yourself?

FIGURE 2. Quick Tips for Assessing Taxane-Induced Peripheral Neuropathy

Other Quality-of-Life Concerns

In addition to neuropathy, many other side effects of taxane therapy can affect patient quality of life. Neutropenia is a common side effect of all taxanes (Bristol-Myers Squibb, 2011; Celgene Corporation, 2012; sanofi-aventis, 2010). Common neutropenia-related symptoms include fatigue, negative emotional effects, and fever (febrile neutropenia) (Friese, 2006). Because neutrophils are involved in the immune response to infections, neutropenia can predispose patients to infection (Bodey, 1986). Fortunately, treatment with G-CSFs has demonstrated effectiveness in the treatment of chemotherapy-induced neutropenia (Crawford et al., 1991; Green et al., 2003). Another concerning side effect of taxanes is fatigue, which can prevent

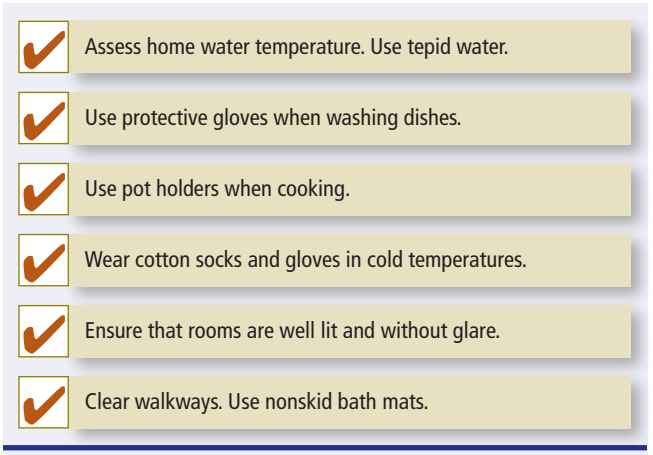

FIGURE 3. Tips for Preventing Injuries Related to Taxane-Induced Peripheral Neuropathy

Note. Based on information from Makino, 2004.

patients from caring for themselves or participating in many activities, including job responsibilities (Bakitas, 2004). Often, patients may be too tired to exercise, which can lead to weight gain (Bakitas, 2004). Alopecia is another common side effect of taxane therapy. The high visibility of this side effect can be emotionally difficult for patients (Boehmke & Dickerson, 2005). Hair loss can severely affect patient self-esteem and prevent the patient from participating in normal activities. As mentioned in the case vignette, the patient reported that she did not want to go into the swimming pool because she did not want others to notice her hair loss. In addition, the patient experienced a fall related to her neuropathic symptoms but did not mention this fall to her physician until several months later. Patients may be afraid of mentioning any taxane-related side effects to a healthcare provider because they fear that the provider may decrease or delay their dose of chemotherapy or that they will have to receive yet another medication (with its own side-effect profile) (Reyes-Gibby, McCrory, & Cleeland, 2003; Markman, 2006; Polomano & Farrar, 2006). That, in turn, affects the patient's quality of life because of the feeling of having to just "put up with" side effects of taxane therapy.

Nursing Considerations

With regard to TIPN, proper assessment is very important. Infusion nurses are a patient's first line of defense prior to receiving their infusion. If a nurse notices signs and symptoms of TIPN, he or she can relay that information to the provider, advanced practice nurse, or physician's assistant. That information will help the provider, advanced practice nurse, or physician's assistant decide on a plan of action, such as delaying or reducing the dose. Neurologic assessments should be performed by healthcare providers at each visit (Tofthagen, 2010; Wickham, 2007). Unfortunately, many nurses do not have the time to perform a thorough neurologic examination. To this end, education on methods for early assessment of TIPN will help to improve the overall care of the patient (Donovan, 2009). Although time often is limited, patient discussions can take place anywhere, from the examination room to the hallway, and even during walks to and from the infusion location. Some tips for quickly assessing a patient for TIPN are listed in Figure 2. It also is critical for the nurse to be able to distinguish the development of TIPN from neuropathy related to other causes. Peripheral neuropathy is generally bilateral and presents as "stocking-glove" dysesthesia, which normally starts in the fingers and toes and moves upward (Donovan, 2009). Other causes of peripheral neuropathy, such as tumor compression or blood clots, do not normally display this pattern. On the other hand, neuropathy caused by diabetes may present similarly to that caused by chemotherapy; therefore, an awareness of a patient's comorbid conditions is important in assessing TIPN (Wolf et al., 2008).

Because patient education is critical, nurses should discuss the potential for neuropathy with patients at the initial visit (Barharmand, 2004). It also may be helpful to remind patients of the potential for neuropathy at each visit to help the patient understand why he or she is undergoing a neurologic assessment. During discussions, healthcare providers should take care to not frighten patients and to obtain feedback on their level of understanding of what was discussed (Harris, 1998). Patients also should be made aware of the potential safety hazards of developing neuropathy, such as falls and burns (Almadrones & Arcot, 1999; Armstrong, Almadrones, & Gilbert, 2005; Paice, 2007). In addition, the caregiver should be involved in as much of the patient education as possible (Harris, 1998). Caregivers should be educated about patient safety by explanations of how they can help the patient who is experiencing neuropathy (e.g., removing throw rugs from the patient's living areas, placing nonskid coverings on floors and stairs, keeping rooms well lit) (Almadrones & Arcot, 1999; Paice, 2007). Some suggested interventions for both patients and caregivers for preventing injuries from neuropathy can be found in Figure 3.

Patients should be instructed on the importance of reporting neuropathic symptoms as soon as possible (Markman, 2006). Many patients may not report TIPN symptoms when they first begin to notice them or may underreport the extent of the TIPN symptoms because they fear that their dose will be altered (Markman, 2006). Patients should be reassured that dose delays or reductions are a normal part of managing neuropathy

- **The Foundation for Peripheral Neuropathy**
  Living With Peripheral Neuropathy
  www.foundationforpn.org/livingwithperipheralneuropathy/index.cfm
- **Mayo Clinic**
  Peripheral Neuropathy
  www.mayoclinic.com/health/peripheral-neuropathy/DS00131
- **National Cancer Institute**
  Bulletin on Chemotherapy-Induced Peripheral Neuropathy
  www.cancer.gov/aboutnci/ncicancerbulletin/archive/2010/022310/page6
- **National Institute of Neurological Disorders and Stroke**
  Peripheral Neuropathy Information Page
  www.ninds.nih.gov/disorders/peripheralneuropathy/peripheralneuropathy.htm

FIGURE 4. Patient Education Resources

Implications for Practice

- Taxane-induced peripheral neuropathy can persist for an extended period of time, even after taxane therapy treatment is discontinued.
- Learning to identify and manage patients with peripheral neuropathy is an important aspect of care.
- Educating the patient and caregivers on the symptoms and dangers related to taxane-induced peripheral neuropathy is a key role of oncology nurses.

(Bristol-Myers Squibb, 2011; Celgene Corporation, 2012; sanofi-aventis, 2010). In addition to symptoms such as numbness, tingling, burning, and weakness, the patient should be asked specifically about his or her ability to perform daily activities such as walking, picking things up, and buttoning clothing (Bakitas, 2004; Visovsky, Collins, Abbott, Aschenbrenner, & Hart, 2007). Often, when triggered, patients will be forthcoming with information that they may not have otherwise remembered to discuss (Armstrong et al., 2005). The patient also can be asked to demonstrate buttoning and unbuttoning of clothing in the clinic, which is a good way of obtaining information through observation. Although patient self-reports of neuropathic symptoms may not always be accurate or complete, triggers such as the questions in Figure 2 may help convey information about the side effects they are experiencing.

Many of the mentioned nursing considerations can be applied across a range of anticipated side effects. Nurses need to educate themselves, patients, and caregivers on the potential side effects of taxane therapy. It also is important for patients to be assessed at each visit. In addition, a patient may be reluctant to talk about symptoms he or she is experiencing for many reasons, such as fear of dose reduction or delay, embarrassment, and the possible addition of a new medication (Markman, 2006). Nurses often can visually assess a change in gait; breathing difficulties; changes in clothing, hairstyle, or makeup; or painful expression, and, from there, prompt the patient to elaborate on any problems that he or she may be experiencing (Armstrong et al., 2005; Bakitas, 2004). Nurses should try to develop a relationship with patients and to help them understand that they are there to help patients through their treatment. Patient education is critical, and information should be provided through multiple avenues (e.g., video, written materials, verbal information) (Szpiro, Harrison, Van Den Kerkhof, & Lougheed, 2008). Some patient education resources are provided in Figure 4. Providing information in "chunked" intervals (i.e., information spread out over the course of several visits) also can be helpful (American Medical Association, 2007). Often, patients are anxious or may have cognitive dysfunction, not to mention that dealing with a diagnosis of breast cancer can be overwhelming; therefore, providing information in multiple ways may help patients to better understand and retain it (Szpiro et al., 2008). In addition, educating caregivers is a valuable way of ensuring that information and instructions are available to patients when they are away from the clinic.

Conclusion

Taxane-related symptoms can affect patient quality of life both physically and emotionally. Each taxane has its own unique safety profile that must be considered on an individual patient basis. For example, all of the taxanes are associated with the potential to develop peripheral neuropathy; however, compared with paclitaxel and docetaxel, *nab*-paclitaxel has demonstrated a faster time to improvement in peripheral neuropathy in two clinical trials of patients with metastatic breast cancer (Gradishar et al., 2005, 2012). As frontline managers of supportive care, nurses must educate themselves on the identification and management of these symptoms to help improve patient quality of life. Nurses taking the time to educate themselves on the side-effect profile of the taxanes, as well as the techniques for assessing the presence or severity of symptoms such as TIPN, will ultimately ensure that patients receive the best care. In addition, establishing and maintaining trust will facilitate open communication between patients and nurses, which will play a major role in improving quality of care.

References

Almadrones, L., & Arcot, R. (1999). Patient guide to peripheral neuropathy. *Oncology Nursing Forum, 26,* 1359–1360.

Almadrones, L., McGuire, D.B., Walczak, J.R., Florio, C.M., & Tian, C. (2004). Psychometric evaluation of two scales assessing functional status and peripheral neuropathy associated with chemotherapy for ovarian cancer: A Gynecologic Oncology Group study. *Oncology Nursing Forum, 31,* 615–623.

American Medical Association. (2007). T*he physician's role in medication reconciliation—Issues, strategies and safety principles.* Retrieved from http://www.ama-assn.org/resources/doc/cqi/med-rec-monograph.pdf

Anastasia, P., & Hay, J.W. (2002). Chemotherapy-induced neuropathy: Results of an oncology nurse survey [Abstract 2618]. *Proceedings of the American Society of Clinical Oncology.* Retrieved from http://www.asco.org/ASCOv2/Meetings/Abstracts?&vmview=abst_detail_view&confID=16&abstractID=2618

Armstrong, T., Almadrones, L., & Gilbert, M.R. (2005). Chemotherapy-induced peripheral neuropathy. *Oncology Nursing Forum, 32,* 305–311. doi:10.1188/05.ONF.305-311

Authier, N., Gillet, J.P., Fialip, J., Eschalier, A., & Coudore, F. (2000). Description of a short-term Taxol-induced nociceptive neuropathy in rats. *Brain Research, 887,* 239–249. doi:10.1016/S0006-8993(00)02910-3

Bakitas, M.A. (2004). Background noise: The experience of chemotherapy-induced peripheral neuropathy. *Nursing Research, 56,* 323–331.

Barharmand, B.A. (2004). Novel challenges affecting quality of life. In B.A. Barharmand (Ed.), *Moving ahead—Challenges with combination therapies for colorectal cancer* (pp. 1–5). West Conshohocken, PA: Meniscus Educational Institute.

Bodey, G.P. (1986). Infection in cancer patients: A continuing association. *American Journal of Medicine, 81*(Suppl. 1A), 11–26.

Boehmke, M.M., & Dickerson, S.S. (2005). Symptom, symptom experiences, and symptom distress encountered by women with breast cancer undergoing current treatment modalities. *Cancer Nursing, 28,* 382–389.

Bristol-Myers Squibb. (2011). *Taxol® (paclitaxel)* [Prescribing

information]. Retrieved from http://packageinserts.bms.com/pi/pi_taxol.pdf

Celgene Corporation. (2012). *Abraxane® (nab-paclitaxel)* [Prescribing information]. Retrieved from http://www.abraxane.com/hcp/download/Abraxane_Prescribing_Information.pdf

Crawford, J., Ozer, H., Stoller, R., Johnson, D., Lyman, G., Tabbara, I., . . . Glaspy, J. (1991). Reduction by granulocyte colony-stimulating factor of fever and neutropenia induced by chemotherapy in patients with small-cell lung cancer. *New England Journal of Medicine, 325,* 164–170.

Donovan, D. (2009). Management of peripheral neuropathy caused by microtubule inhibitors. *Clinical Journal of Oncology Nursing, 13,* 686–694. doi:10.1188/09.CJON.686-694

Eli Lilly and Company. (2012). *Cymbalta® (duloxetine)* [Prescribing information]. Retrieved from http://pi.lilly.com/us/cymbalta-pi.pdf

Friese, C.R. (2006). Chemotherapy-induced neutropenia: Important new data to guide nursing assessment and management. *Advanced Studies in Nursing, 4,* 21–25.

Gradishar, W.J., Krasnojon, D., Cheporov, S.V., Makhson, A.N., Manikhas, G.M., Clawson, A., & Iglesias, J. (2012). Phase II trial of nab-paclitaxel compared with docetaxel as first-line chemotherapy in patients with metastatic breast cancer: Final analysis of overall survival. *Clinical Breast Cancer, 12,* 313–321. doi:10.1016/j.clbc.2012.05.001

Gradishar, W.J., Tjulandin, S., Davidson, N., Shaw, H., Desai, N., Bhar, P., . . . O'Shaughnessy, J. (2005). Phase III trial of nanoparticle albumin-bound paclitaxel compared with polyethylated castor oil-based paclitaxel in women with breast cancer. *Journal of Clinical Oncology, 23,* 7794–7803. doi:10.1200/JCO.2005.04.937

Green, M.D., Koelbl, H., Baselga, J., Galid, A., Guillem, V., Gascon, P., . . . Piccart, M.J. (2003). A randomized double-blind multicenter phase III study of fixed-dose single-administration pegfilgrastim versus daily filgrastim in patients receiving myelosuppressive chemotherapy. *Annals of Oncology, 14,* 29–35. doi:10.1093/annonc/mdg019

Harris, K.A. (1998). The informational needs of patients with cancer and their families. *Cancer Practice, 6,* 39–46.

Hershman, D.L., Weimer, L.H., Wang, A., Kranwinkel, G., Brafman, L., Fuentes, D., . . . Crew, K.D. (2011). Association between patient reported outcomes and quantitative sensory tests for measuring long-term neurotoxicity in breast cancer survivors treated with adjuvant paclitaxel chemotherapy. *Breast Cancer Research and Treatment, 125,* 767–774. doi:10.1007/s10549-010-1278-0

Kobayashi, N., & Mundel, P. (1998). A role of microtubules during the formation of cell processes in neuronal and non-neuronal cells. *Cell Tissue Research, 291,* 163–174.

Makino, H. (2004). Treatment and care of neurotoxicity from taxane anticancer agents. *Breast Cancer, 11,* 100–104.

Markman, M. (2006). Chemotherapy-induced peripheral neuropathy: Underreported and underappreciated. *Current Pain and Headache Reports, 10,* 275–278.

Oken, M.M., Creech, R.H., Tormey, D.C., Horton, J., Davis, T.E., McFadden, E.T., & Carbone, P.P. (1982). Toxicity and response criteria of the Eastern Cooperative Oncology Group. *American Journal of Clinical Oncology, 5,* 649–655.

Pachman, D.R., Barton, D.L., Watson, J.C., & Loprinzi, C.L. (2011). Chemotherapy-induced peripheral neuropathy: Prevention and treatment. *Clinical Pharmacology and Therapeutics, 90,* 377–387. doi:10.1038/clpt.2011.115

Paice, J.A. (2007). Peripheral neuropathy: Experimental findings, clinical approaches. *Journal of Supportive Oncology, 5,* 61–63.

Pfizer Inc. (2012). *Neurontin® (gabapentin)* [Prescribing information]. Retrieved from http://www.pfizer.com/products/rx/rx_product_neurontin.jsp

Polomano, R.C., & Farrar, J.T. (2006). Pain and neuropathy in cancer survivors. *American Journal of Nursing, 106*(Suppl. 3), 39–47.

Reyes-Gibby, C.C., McCrory, L.L., & Cleeland, C.S. (2003). Variations in patients' self-report of pain by treatment setting. *Journal of Pain and Symptom Management, 25,* 444–448.

sanofi-aventis. (2010). *Taxotere® (docetaxel)* [Prescribing information]. Retrieved from http://products.sanofi.us/Taxotere/taxotere.html

Scripture, C.D., Figg, W.D., & Sparreboom, A. (2006). Peripheral neuropathy induced by paclitaxel: Recent insights and future perspectives. *Current Neuropharmacology, 4,* 165–172.

Smith, E.M., Pang, H., Cirrincione, C., Fleishman, S. B., Paskett, E. D., Fadul, C.E., . . . Gilman, P. (2012). CALGB 170601: A phase III double blind trial of duloxetine to treat painful chemotherapy-induced peripheral neuropathy (CIPN) [Abstract CRA9013]. *Journal of Clinical Oncology*. Retrieved from http://www.asco.org/ASCOv2/Meetings/Abstracts?&vmview=abst_detail_view&confID=114&abstractID=91721

Szpiro, K.A., Harrison, M.B., Van Den Kerkhof, E.G., & Lougheed, M.D. (2008). Patient education in the emergency department: A systematic review of interventions and outcomes. *Advanced Emergency Nursing Journal, 30,* 34–39.

Tofthagen, C. (2010). Patient perceptions associated with chemotherapy-induced peripheral neuropathy [Online exclusive]. *Clinical Journal of Oncology Nursing, 14,* E22–E28. doi:10.1188/10.CJON.E22-E28

Visovsky, C., Collins, M., Abbott, L., Aschenbrenner, J., & Hart, C. (2007). Putting Evidence Into Practice: Evidence-based interventions for chemotherapy-induced peripheral neuropathy. *Clinical Journal of Oncology Nursing, 11,* 901–913. doi:10.1188/07.CJON.901-913

Wickham, R. (2007). Chemotherapy-induced peripheral neuropathy: A review and implications for oncology nursing practice. *Clinical Journal of Oncology Nursing, 11,* 361–376. doi:10.1188/07.CJON.361-376

Windebank, A.J., Blexrud, M.D., & de Groen, P.C. (1994). Potential neurotoxicity of the solvent vehicle for cyclosporine. *Journal of Pharmacology and Experimental Therapeutics, 268,* 1051–1056.

Wolf, S., Barton, D., Kottschade, L., Grothey, A., & Loprinzi, C. (2008). Chemotherapy-induced peripheral neuropathy: Prevention and treatment strategies. *European Journal of Cancer, 44,* 1507–1515. doi:10.1016/j.ejca.2008.04.018