Management of Peripheral Neuropathy Caused by Microtubule Inhibitors

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Any patient receiving an agent that targets microtubules (e.g., taxanes, vinca alkaloids, epothilones) is at some risk for encountering peripheral neuropathy. This article provides tools and discussion to aid nurses in managing peripheral neuropathy in their patients through early identification and education. Some patients are at higher risk than others based on their chemotherapeutic regimen, pretreatment history, and comorbidities. When interacting with at-risk patients, nurses should be alert for primarily sensory neuropathy that presents as loss of sensation, numbness, or tingling, beginning at the distal ends of the extremities and moving proximally with a stocking or glove distribution. Clinical assessments for neuropathy generally employ grading scales, questionnaires, quantitative sensory testing, and psychometric assessments; each has benefits and limitations. Patients who experience moderate or severe neuropathy may require a dose reduction or delay until symptoms resolve; these patients may need a lower dose for the next treatment cycle. No known agents have proven to prevent or treat severe neuropathy more effectively than regular neurologic examinations, early intervention, and patient education. In this respect, nurses can make a substantial difference in the impact of neuropathy on treatment efficacy and patients' quality of life.

Many of the most widely used anticancer therapies, such as vinca alkaloids, taxanes, and epothilones (e.g., ixabepilone), bind to and disrupt microtubules. Peripheral neuropathy is a common adverse event associated with all chemotherapeutic agents that target microtubules (Lee & Swain, 2006; Visovsky, 2003). This particular form of neuropathy usually is sensory and distal in nature, with less prominent motor involvement. Peripheral neuropathy commonly presents as a loss of sensation that may progress to numbness or tingling (paresthesia) in the hands and feet, with symptoms appearing first in the toes and then in the fingers. Paresthesia and burning pain may appear in the distal extremities before moving proximally with a stocking or glove distribution, with the plantar surfaces most severely affected. Motor involvement generally manifests as muscle weakness, such as foot drop or difficulty climbing stairs (Argyriou, Koltzenburg, Polychronopoulos, Papapetropoulos, & Kalofonos, 2008; Bhagra & Rao, 2007; Lee & Swain).

Microtubule-targeting agents work by interfering with the dynamic cytoskeletal network within individual cells, effectively promoting programmed cell death (apoptosis). The networks play critical roles in intracellular transport and cell division because cells use their microtubule networks as conveyer belts to move vesicles, organelles, and chromosomes inside the cell (Checchi, Nettles, Zhou, Snyder, & Joshi, 2003; Nogales, 2001). During cell division, microtubules ensure proper segregation of chromosomes into the new daughter cells; interrupting the process signals the cells to stop dividing and eventually undergo apoptosis.

At a Glance

- Patients who are receiving microtubule inhibitors are at risk for peripheral neuropathy, but nursing intervention can minimize the incidence of severe events.
- As nurses interact with patients, they should be alert to early signs of peripheral neuropathy; several tools can assist this process.
- To date, no agents have proven to be more effective at reducing the incidence and severity of microtubule-induced peripheral neuropathy than early intervention and patient education.

Microtubules form when multiple copies of two building block proteins, α- and β-tubulin, form long chains in an energy-dependent polymerization process (Checchi et al., 2003; Wilson, Panda, & Jordan, 1999). Vinca alkaloids, taxanes, and epothilones all bind to β-tubulin, but vinca alkaloids block its polymerization with α-tubulin; taxanes and epothilones keep existing microtubules from reorganizing, thereby disrupting their dynamic function (Checchi et al.; Wilson et al.) (see Figure 1).

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