

# Potential Mechanisms for Chemotherapy-Induced Impairments in Cognitive Function

Catherine Jansen, RN, MS, OCN®, Christine Miasowski, RN, PhD, FAAN, Marilyn Dodd, RN, PhD, FAAN, Glenna Dowling, RN, PhD, and Joel Kramer, PsyD

**Purpose/Objectives:** To review the domains of cognitive function and their corresponding neuroanatomic structures as well as present current evidence for neurotoxicity associated with specific chemotherapeutic agents and potential mechanisms for chemotherapy-induced cognitive impairments.

**Data Sources:** Published research articles, review articles, and textbooks.

**Data Synthesis:** Chemotherapy does not appear to cross the blood-brain barrier when given in standard doses; however, many chemotherapy drugs have the potential to cause cognitive impairments through more than one mechanism. In addition, patient factors may be protective or place individuals at higher risk for cognitive impairments.

**Conclusions:** Although evidence of chemotherapy-induced impairments in cognitive function exists, no clinical studies have attempted to elucidate the mechanisms for chemotherapy-induced impairments in cognitive function. In addition, further studies are needed to determine predictive factors, potential biomarkers, and relevant assessment parameters.

**Implications for Nursing:** The ability to identify high-risk patients has important implications for practice in regard to informed consent, patient education about the effects of treatment, and preventive strategies.

Chemotherapy is one of the primary treatments for cancer and has been used successfully to extend patients' lives. Although the occurrence of cognitive impairments following chemotherapy treatment has been documented (Cull et al., 1996; Oxman & Silberfarb, 1980; Peterson & Popkin, 1980; Silberfarb, Philibert, & Levine, 1980), most reports of cognitive impairments in adults are anecdotal. Chemotherapy does not appear to cross the blood-brain barrier when given in standard doses; however, recent studies have substantiated chemotherapy-induced impairments in various domains of cognitive function (Ahles et al., 2002; Brezden, Phillips, Abdoell, Bunston, & Tannock, 2000; Kaasa, Olsnes, & Mastekaasa, 1988; Meyers, Byrne, & Komaki, 1995; Schagen et al., 1999; Tchen et al., 2003; van Dam et al., 1998; Wefel, Lenzi, Theriault, Davis, & Meyers, 2004; Wieneke & Dienst, 1995).

Although cognitive impairment, commonly referred to as "chemo brain," is a growing area of interest among cancer survivors and clinicians, little is known about the potential mechanisms that produce these changes. This article provides a description of the domains of cognitive function and their corresponding neuroanatomic structures. In addition, current evidence for neurotoxicity associated with specific

### Key Points . . .

- ▶ Cognitive function is a multidimensional concept that describes the domains that result from healthy brain performance, which are attention and concentration, executive function, information-processing speed, language, motor function, visuospatial skill, learning, and memory.
- ▶ The mechanisms for chemotherapy-induced impairments in cognitive function most likely are multifactorial.
- ▶ Future investigations need to describe the phenomenon of "chemo brain" and elucidate the mechanism or mechanisms responsible for chemotherapy-induced impairments in cognitive function.

### Goal for CE Enrollees:

To enhance nurses' knowledge regarding the domains of cognitive function and the effects of chemotherapy on cognitive function.

### Objectives for CE Enrollees:

1. Describe two deficits that result from chemotherapy exposure via passage through the blood-brain barrier.
2. Discuss which chemotherapy agents may put patients at higher risk for developing cognitive deficits.
3. Identify other known chemotherapy-related side effects that may have an effect on cognitive function.

*Catherine Jansen, RN, MS, OCN®, is an oncology clinical nurse specialist at Kaiser Permanente Medical Center in San Francisco, CA, and a doctoral candidate in the Department of Physiological Nursing at the University of California, San Francisco. Christine Miasowski, RN, PhD, FAAN, is a professor and chair in the Department of Physiological Nursing, Marilyn Dodd, RN, PhD, FAAN, is a professor in the Department of Physiological Nursing, Glenna Dowling, RN, PhD, is a professor and chair in the Department of Physiological Nursing, and Joel Kramer, PsyD, is a clinical professor in the Department of Neurology, all at the University of California, San Francisco. (Submitted December 2004. Accepted for publication February 21, 2005.)*

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