Biomarkers and Cognitive Function in Children and Adolescents During Maintenance Therapy for Leukemia

Mary C. Hooke, PhD, APRN, PCNS, CPON®, FAAN, Michelle A. Mathiason, MS, Alicia S. Kunin-Batson, PhD, Audrey Blommer, RN, BSN, PHN, Jessica Hutter, BS, CCRP, Pauline A. Mitby, MPH, Ida M. Moore, PhD, RN, FAAN, Susan Whitman, MS, Olga Taylor, MPH, Michael E. Scheurer, PhD, MPH, and Marilyn J. Hockenberry, PhD, RN, PPCNP, FAAN

OBJECTIVES: To explore the relationship between biomarkers of oxidative stress and inflmmation in cerebrospinal fluid (CSF) and cognitive function in children receiving maintenance therapy for acute lymphocytic leukemia (ALL).

SAMPLE & SETTING: 30 participants aged 4–17 years receiving ALL maintenance therapy at two pediatric cancer centers in the United States.

METHODS & VARIABLES: F2-isoprostane (F2-ISoP) and interleukin-8 (IL-8) were evaluated in CSF samples, and cognitive function measures were completed during the first and last cycles of ALL maintenance. The Flanker Inhibitory Control and Attention Test (Flanker) and Dimensional Change Card Sort were completed during the last cycle.

RESULTS: During maintenance therapy, IL-8 decreased, and parent reports of children's cognitive function improved. Higher IL-8 was associated with better parent reports of children's cognitive function at each timepoint. Higher F2-ISoP levels were associated with lower Flanker scores.

IMPLICATIONS FOR NURSING: F2-ISoP may be a useful biomarker in evaluating cognitive dysfunction in children with ALL and merits further investigation.

KEYWORDS acute lymphoblastic leukemia; cognitive function; biomarkers; childhood cancer

***ONF, 48*(6), 623–633.**

DOI 10.1188/21.ONF.623-633

Childhood acute lymphoblastic leukemia (ALL) is the most frequently occurring cancer in children younger than age 15 years and makes up 25% of all childhood cancers (National Cancer Institute [NCI], 2021). Childhood ALL survival rates continue to improve because of advances in treatment, with a survival rate of 91% for children younger than age 15 years and 75% for adolescents aged 15–19 years (Siegel et al., 2020). Treatment of childhood ALL is administered in multiple phases. The more intensive phases, remission-induction and consolidation-intensification therapy, are delivered during the first 12–16 months of treatment (NCI, 2021), which is then followed by repeating cycles of less intensive, but lengthier, maintenance chemotherapy. The total length of childhood ALL treatment is two to three years (NCI, 2021). ALL risk groups are determined by multiple patient and clinical disease characteristics at diagnosis, including age (aged younger than 1 year and aged 10 years or older), sex (males), presenting white blood cell count (50,000/mcl or higher), central nervous system (CNS) involvement, and cytogenetics/genomics (NCI, 2021). High- or very high–risk groups require more intensive therapy to achieve and maintain a remission.

Children and adolescents with ALL receive CNS-directed prophylactic chemotherapy as part of their treatment because the CNS is a sanctuary site where leukemia cells can evade the cytotoxic effects of systemic therapy. CNS-directed therapies include intrathecal therapy, higher-dose systemic therapy that crosses the blood–brain barrier, and cranial radiation therapy for those who have leukemia cells in their CNS