Body Composition After Bone Marrow Transplantation in Childhood

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Obesity and altered body composition, including central obesity (abdominal obesity), have been identified as complications after treatment of childhood cancer (Garmey et al., 2008; Miller et al., 2010; Nysom et al., 2003; Oeffinger et al., 2003). In addition, obesity in the general population is a growing public health concern; a threefold increase of obesity in children has occurred since 1976, and more than a third of American adults are overweight or obese (Flegal, Carroll, Ogden, & Curtin, 2010; Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Excess body fat and central obesity in childhood are risk factors for cardiovascular disease, insulin resistance, compromised pulmonary function, musculoskeletal dysfunction, altered gonadal hormone levels, and psychological compromise (Baer, Colditz, Willett, & Dorgan, 2007; Daniels et al., 2005; Eisenmann, DuBose, & Donnelly, 2007; Gonzalez-Barcala et al., 2007; Raitakari, Juonala, & Viikari, 2005; Schiel et al., 2007). Similar complications are seen in adults, where obesity carries an increased mortality rate from cardiovascular and kidney disease, diabetes, and cancers considered obesity-related (Flegal, Graubard, Williamson, & Gail, 2007). Although general and central obesity are significant concerns for the general population, they may have even more harmful consequences for bone marrow transplantation (BMT) survivors who may have preexisting health conditions.

Cranial radiation at higher doses, such as those used to treat brain tumors, is the most common treatment associated with obesity (Garmey et al., 2008; Lustig et al., 2003; Pietilä et al., 2009). Damage to the hypothalamus, including disruption of growth hormone, thyroid, and gonadal function, as well as changes in sensitivity to leptin, ghrelin, and insulin, are mechanisms by which cranial radiation may contribute to obesity (Schwartz, Woods, Porte, Seeley, & Baskin, 2000). Moderate doses of cranial radiation (1,200–2,400 cGy) used to treat childhood acute lymphoblastic leukemia (ALL) have been associated with obesity, including central, liver, and visceral obesity (Janiszewski et al., 2007; Oeffinger et al., 2003).

Energy imbalance, or consuming more calories than burned, is another possible contributor to obesity in childhood cancer survivors, with decreased physical activity documented in this population (Warner, 2008). In ALL survivors, decreased energy expenditure was...