Hyperglycemia and Cancer: A State-of-the-Science Review

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PROBLEM IDENTIFICATION: Hyperglycemia can increase the risk for adverse events and outcomes in patients undergoing treatment for cancer. The purposes of this state-of-the-science review were to explore the complexity of hyperglycemia in patients with cancer and to analyze physiologic mechanisms and outcomes in individuals with or at risk for cancer.

LITERATURE SEARCH: PubMed® and the Cochrane Library databases were searched, and 95 articles were included. Findings were evaluated for their methods and analyses. Studies assessed as methodologically flawed were not included.

DATA EVALUATION: The synthesis of the articles provided the evidence for describing normal and glycemic pathways. Hyperglycemia in patients with cancer was explored through chronic inflammatory mechanisms that lead to increased risks for adverse events and outcomes.

SYNTHESIS: This article discusses normal glucose regulation and hyperglycemic pathways, hyperglycemia in patients with cancer, hyperglycemia and cancer-related inflammation, and outcomes (e.g., infections, mortality, symptoms).

IMPLICATIONS FOR RESEARCH: Understanding the contributors to and consequences of hyperglycemia can guide the development of screening tools to predict which individuals are at the greatest risk for hyperglycemic episodes prior to starting cancer therapies. Research can lead to glycemic guidelines specific to patients with cancer for better outcomes.

KEYWORDS blood glucose; immune function; inflammation; infections; mortality; organ dysfunction

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In 2010, a joint statement between the American Diabetes Association (ADA) and American Cancer Society detailed the epidemiologic evidence for the increased risk for certain cancers among individuals with type 2 diabetes (T2D) (Giovannucci et al., 2010). Specifically, preexisting T2D was found to be associated with increased risk for cancers of the liver, pancreas, and endometrium, as well as, to a lesser degree, cancers of the colon, rectum, breast, bladder, and lung (Giovannucci et al., 2010). In alignment, the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System estimated that the overall prevalence of preexisting T2D is 16.7% among cancer survivors (Underwood et al., 2012). In comparison, the prevalence of T2D in the general U.S. population is 9.4% (ADA, 2018b). This evidence highlights the increased risk for developing cancer among those with preexisting T2D and demonstrates the high prevalence of T2D among survivors of cancer.

The hallmark characteristic of T2D is hyperglycemia, which is defined as a random blood glucose (BG) of 126 mg/dl or greater or a fasting BG of greater than 100 mg/dl (ADA, 2018a). Hyperglycemia can also occur at a pre-T2D level, which is a higher-than-normal BG level but has not reached the threshold for a diagnosis of T2D (ADA, 2018a; Anil, Akkurt, Ayturk, Kut, & Gursoy, 2013). Among individuals undergoing treatment for cancer, hyperglycemic episodes can occur with or without having T2D or pre-T2D and can increase the risk for adverse events. For example, one study examined differences between hyperglycemic episodes in individuals with or without T2D undergoing treatment for cancer and found that decreased overall survival was associated with episodes of hyperglycemia rather than the diabetes diagnosis (Villarreal-Garza et al., 2012). This finding suggests that poor glycemic control may be a greater risk for adverse events and outcomes than having a diagnosis of T2D with good glycemic control.