The Impact of Hyperglycemia on Hematopoietic Cell Transplantation Outcomes: An Integrative Review

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Problem Identification: Many patients undergoing hematopoietic cell transplantation (HCT) for hematologic malignancies experience hyperglycemic events during treatment, leading to adverse outcomes. Understanding how hyperglycemia during the acute HCT treatment phase impacts outcomes is vital for preventing and mitigating adverse events. This integrative review evaluates the impact of hyperglycemia on adult patients undergoing HCT.

Literature Search: PubMed, MEDLINE®, and CINAHL® electronic databases were used to identify relevant articles.

Data Evaluation: The final sample for this integrative review included 12 empirical quantitative reports of clinical patient outcomes. Of the 12, 10 are retrospective, 1 is case-control, and 1 is prospective.

Data Analysis: Content analysis was used to synthesize and summarize findings.

Presentation of Findings: A review of published literature found associations between hyperglycemia and infection, time to engraftment, development of acute graft-versus-host disease, length of stay, and overall survival. Patient-related risk factors for hyperglycemia included older age, preexisting diabetes, and insulin resistance (i.e., prediabetes). Patients of normal weight experiencing hyperglycemia had worse outcomes than patients who were overweight or obese. Treatment-related risk factors for hyperglycemia include dose and duration of immunosuppressants, specifically corticosteroids, treatment with antihyperglycemic medications, and use of total parenteral nutrition.

Implications for Nursing Practice: HCT is one of the most complex treatments for hematologic disorders. The transplantation nurse, as part of an interdisciplinary team, plays an essential role in glycemic control during the acute phase of HCT. Understanding the effects of hyperglycemia, as well as factors that place the patient at risk for hyperglycemia, allows the nurse to make well-informed, proactive interventions aimed at glycemic control.

Key Words: hyperglycemia; hematopoietic cell transplantation; outcomes; integrative review

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Since Van den Berghe et al. (2001) published the results of their groundbreaking study showing that tight glycemic control in the critical care setting significantly improved patient outcomes, researchers have attempted to understand the relationship between hyperglycemia and patient outcomes in a variety of clinical settings. Hyperglycemia, defined by the American Diabetes Association ([ADA], 2013) as a fasting blood glucose (BG) level of 126 mg/dl or greater or a random glucose of 200 mg/dl or greater, is experienced by a large majority of patients during the acute treatment phase of hematopoietic cell transplantation (HCT) (Hammer et al., 2009; Rentschler, 2010), and has, therefore, been studied in this patient population. This review synthesizes the results of these studies.

Hematopoietic Cell Transplantation and Hyperglycemia

HCT is a potentially curative treatment for a variety of malignant and nonmalignant hematologic disorders not resolved through first-line therapies. Although HCT has a high rate of success, it also is associated with a high rate of morbidity and mortality during the acute post-transplantation phase related to infection, organ toxicity, and other complications such as acute and chronic graft-versus-host disease (GVHD) (Appelbaum, Forman, Negrin, & Blume, 2009). Many of the contributors to these adverse outcomes are nonmodifiable. Research is showing, however, that one modifiable factor may be hyperglycemia. Therefore, understanding the scope of the influence of hyperglycemia is essential for optimizing outcomes.

Research completed in a variety of patient populations has shown that hyperglycemia is associated with adverse outcomes in the hospitalized patient and is described in a consensus report by the American Association of Clinical Endocrinologists and the ADA (Moghissi et al., 2009). Hyperglycemia can increase oxidative stress, leading to impaired immune function, decreased healing time, prolonged blood coagulation time, and cause endothelial dysfunction (Hammer &