

Implementation of Infusion Pumps and Filtered Administration Sets for Stem Cell Transplantation

Jessica Miles, MS, RN, CNS, AOCNS®, BMTCN®, and Lindsay Hoffman, CLS, MLS(ASCP)^{CM}



Stem cell infusion practices vary widely among institutions. A nurse-driven quality improvement project sought to determine whether peristaltic pumps and filtered tubing compromised the safety of stem cell infusion. A preclinical and clinical test design using gravity infusion with unfiltered tubing, gravity infusion with filtered tubing, and pump infusion with filtered tubing was performed. There were no significant differences in postinfusion CD34+ (cluster of differentiation 34+) cell recovery or time to engraftment among the three test groups. Findings suggest that the use of infusion pumps and filtered tubing for stem cell infusion does not compromise safety.

AT A GLANCE

- Stem cell infusion practices and guidelines often lack standardization and can vary among institutions.
- Use of peristaltic pumps and non-leukocyte-reducing filters for stem cell infusion was not associated with any clinical differences to neutrophil and platelet engraftment postimplantation.
- When nurses are empowered to question practice and use evidence-based practice, they can improve patient care delivery.

KEYWORDS

stem cell transplantation; engraftment; CD34+ recovery; IV infusion pump

DIGITAL OBJECT IDENTIFIER

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Hematopoietic stem cell transplantation (HSCT) relies on the regenerative ability of hematopoietic progenitor cells (HPCs) because they are capable of self-renewal and proliferation (Schmit-Pokorny & Eisenberg, 2020). HPCs are essential to the HSCT process for several reasons. First, the use of myeloablative chemotherapy and radiation suppresses the bone marrow. After IV infusion, HPCs migrate to the bone marrow and mature into myeloid or lymphoid cells of the immune system. HPCs also exert an antitumor effect when used during the allogeneic HSCT process, which supports remission post-HSCT. Cryopreservation allows cells to be frozen and stored for later use (Schmit-Pokorny & Eisenberg, 2020). Engraftment, or marrow repopulation post-HSCT, is dependent on the appropriate dose of HPCs. Typically, a minimum of 2×10^6 cells/kg of the patient's body weight supports successful engraftment (Schmit-Pokorny & Eisenberg, 2020). Any loss or damage to HPCs prior to infusion would affect the prescribed cell dose, placing patients at risk for engraftment failure. Without engraftment, the patient's bone marrow might not recover post-HSCT, increasing the risk of morbidity and mortality.

Infusion of HPCs through a peristaltic pump had been a long-standing concern on the HSCT unit at University of California, Davis, Health (UCDH) in Sacramento, because the squeezing and rotating action of the mechanical rollers within the pump were thought to damage HPCs, therefore affecting engraftment and patient recovery. As a result, HPCs were traditionally infused via gravity; however, gravity infusions can have variable rates depending on the patient's vascular access or the patient's position or movement. Issues with rate consistency and flow required additional manipulation of the cellular product. This increased the risk of infusion-related side effects and the nursing staff burden (Mulay et al., 2014).

Despite cell infusion standards and best practices available from the Foundation for the Accreditation of Cellular Therapy, the Association for the Advancement of Blood and Biotherapies, and the Oncology Nursing Society, HPC infusion practices are often based on institutional policy because of the lack of clinical data to support a particular infusion practice (Tormey & Snyder, 2015). Standards regarding the use of filtered or non-filtered administration sets can also vary between programs. Because of