Basics of Hematopoietic Cell Transplantation for Primary Care Physicians and Internists

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KEYWORDS

- Bone marrow transplant • Stem cell transplant • Graft-versus-host disease
- Engraftment

KEY POINTS

- Hematopoietic cell transplant (HCT) activity is increasing worldwide.
- Longitudinal care for transplant survivors is frequently provided by primary care providers and internists.
- Transplant survivors can develop unique long-term complications due to chemotherapy and/or radiation exposure that primary care physicians and internists need to be aware of.

BASICS OF HEMATOPOIETIC CELL TRANSPLANTATION FOR PRIMARY CARE PHYSICIANS AND INTERNISTS

The field of HCT began more than 50 years ago when Dr Don Thomas started to perform bone marrow transplantation for cancers.[1] Fast forward half a century, more than 60,000 HCTs are performed worldwide annually to treat a variety of malignant and nonmalignant conditions. Although HCT is complicated and risky, a majority of the HCT recipients are surviving for many years post-transplant and are seen by nontransplant physicians, including hematologists, oncologists, internists, pediatricians, hospitalists, and primary care physicians for care delivery. There are few transplant centers given this is a specialized field; therefore, most patients travel for the receipt of HCT to a large medical institution and, once the required 1-month to 3-month stay in the vicinity of the transplant center is done, they return home. Hence, the longitudinal long-term care of HCT recipients is frequently dictated by primary care providers. The complications of this procedure are unique; thus, it requires an individualized care delivery plan to each patient. This article presents the basics of

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transplantation, HCT types/stem cell sources, mobilization and conditioning procedures, indications for HCT, conditioning regimens, engraftment, graft-versus-host-disease, and lastly survivorship issues.

BASICS OF HEMATOPOIETIC CELL TRANSPLANTATION — TERMINOLOGY

The term, bone marrow transplantation, lexicographically is a misnomer. When this procedure started, donors were taken to an operating room, and from both the iliac crests, multiple bone marrow biopsies were obtained to get a sufficient amount of marrow. Over time with better recognition of hematopoietic stem cells and availability of mobilizing agents, HCTs have been facilitated by using stem cells obtained from a donor's blood. A majority (>70%) of the adult HCTs in the United States currently use peripheral blood stem cells (PBSCs) from donors; thus, both the terms, *stem cell transplantation* and *bone marrow transplantation*, colloquially used, constitute HCT.

TYPES OF HEMATOPOIETIC CELL TRANSPLANTATION AND DONOR STEM CELL SOURCES

The 3 types of HCT are syngeneic, autologous, and allogeneic (**Table 1**). Grafts or stem cells (or bone marrow) for syngeneic, autologous, and allogeneic HCTs are obtained from identical twins, self, or another nonidentical human donor, respectively. No xenografts (transplantation from one species to another species) are used in the field of HCT currently.

Approximately half of HCTs globally are autologous HCT. In the United States, because multiple myeloma and lymphomas are common, a majority of the HCTs are autologous HCT.[2] In autologous HCT, stem cells from recipients are obtained usually after their cancer goes into remission. The stem cells are then frozen and can be used any time for HCT.

For allogeneic HCT, a donor is selected based on many factors, most important of which is HLA matching at the allele level (HLA-A, HLA-B, HLA-C, HLA-DR, or HLA-DQ). Other factors that play a role in donor selection include ABO blood group match for donor/recipient [D/R], cytomegalovirus D/R, weight D/R, and age of the donor (younger donors are preferred).

A full match consists of allele-level matching at the 5 HLA antigens (therefore a 10/10 match!). Hence, a 9/10 allele match is considered a partially matched (mismatched) donor. In general, the 3 main donor sources for allogeneic HCT include (1) related donor, (2) unrelated donor, and (3) cord blood stem cells (obtained from an umbilical cord during childbirth).

Table 1
Types of hematopoietic cell transplantations

Type	Source	Graft vs Tumor Effect	Comments
Syngeneic	From identical twin	None	Rarely used due to poor availability
Autologous	One's own stem cells	None	Mainly used for myelomas and lymphomas
Allogeneic	From another human	Yes	Can be obtained from related donors, unrelated donor or from the umbilical cord blood