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Analysis of the Effect of Race, Socioeconomic Status, and Center Size on Unrelated National Marrow Donor Program Donor Outcomes: Donor Toxicities Are More Common at Low-Volume Bone Marrow Collection Centers

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A B S T R A C T

Previous studies have shown that risks of collection-related pain and symptoms are associated with sex, body mass index, and age in unrelated donors undergoing collection at National Marrow Donor Program centers. We hypothesized that other important factors (race, socioeconomic status [SES], and number of procedures at the collection center) might affect symptoms in donors. We assessed outcomes in 2726 bone marrow (BM) and 6768 peripheral blood stem cell (PBSC) donors collected between 2004 and 2009. Pain/symptoms are reported as maximum levels over mobilization and collection (PBSC) or within 2 days of collection (BM) and at 1 week after collection. For PBSC donors, race and center volumes were not associated with differences in pain/symptoms at any time. PBSC donors with high SES levels reported higher maximum symptom levels 1 week after donation ($P = .017$). For BM donors, black males reported significantly higher levels of pain (OR, 1.90; CI, 1.14 to 3.19; $P = .015$). No differences were noted by SES group. BM donors from low-volume centers reported more toxicity (OR, 2.09; CI, 1.26 to 3.46; $P = .006$). In conclusion, race and SES have a minimal effect on donation-associated symptoms. However, donors from centers performing $\leq$ 1 BM collection every 2 months have more symptoms after BM donation. Approaches should be developed by registries and low-volume centers to address this issue.

INTRODUCTION

The pattern of acute toxicities associated with bone marrow (BM) and peripheral blood stem cell (PBSC) donation in unrelated donors has been well described in several studies from the National Marrow Donor Program (NMDP) [1-3]. Several predonation demographic factors from these and other studies have been associated with an increase in acute toxicity, specifically age, gender, body mass index (in PBSC but not BM donors), and anesthetic type [1-10]. It is important to fully understand factors predictive of increased donor risk because knowledge of their impact on post-donation recovery helps us to tailor the predonation consent information to the specific donor, more closely follow at-risk donors during the recovery period, or institute interventions to prevent symptoms in specific groups of donors.

Race/ethnicity and socioeconomic status (SES) have been linked to pain experience and perception in several studies in other areas of medicine such as orthopedics and chronic pain [11-13], but thus far neither have been addressed in the unrelated hematopoietic cell donor population. In addition, the impact on donor outcome of the number of collections performed annually by a center is unknown, and recommendations for a minimum number of procedures per year by regulatory bodies are often not based on data. Collection centers vary tremendously in overall numbers of procedures performed and experience of individuals at that center performing BM collection procedures. The aim of this study was to examine the relationship between donor race/ethnicity, donor SES, and collection center volumes on the acute toxicities (up to 1 week) experienced by NMDP donors.

METHODS

Study Population

The study population consisted of first-time volunteer US donors from the NMDP who underwent granulocyte colony-stimulating factor (G-CSF) (filgastrim, Neupogen; Amgen, Thousand Oaks, CA) mobilized PBSC collection or BM harvest from January 1, 2004 to July 31, 2009. Donors for whom data were available from baseline to the first day of apheresis on the NMDP data collection forms were included. Donors enrolled in BMT CTN protocol 02-01 [14] and rare donors who donated BM after G-CSF administration were excluded. Donors from centers who provided only nonresidential zip codes (eg, work, university, or donor center zip codes) were excluded from the SES analyses (n = 534).

Donor race/ethnicity was self-reported. Donor race and ethnicity were classified as non-Hispanic white, Hispanic-all races, non-Hispanic black, non-Hispanic Asian/non-Hispanic Pacific Islander, and non-Hispanic-other. SES was defined as the median household income in the donor's census block group. Each donor address was geocoded using the ArcGIS 10.1 Business Analyst US address locater (Esri, Redlands, CA). The Esri Business Analyst 2012 dataset was used to extract median household income for each census block group. If the census block group could not be located from reported street address, median household income from the donor's zip code was used instead. Collection center and apheresis center size were based on reaccreditation numbers using the total number of either BM collections for calendar years 2005 to 2008 or PBSC collections for calendar years 2004 to 2008 (regardless of whether autologous or allogeneic).

All donors included in the study provided written informed consent for participation in Center for International Blood and Marrow Transplant Research (CIBMTR) research studies approved by the NMDP Institutional Review Board. This study was conducted in accordance with the Declaration of Helsinki. Donors were evaluated for medical suitability, transplantation-transmissible infectious diseases, and contraindications for PBSC or BM donation using standardized NMDP criteria.

Data Collection

Data collection began at the time of the donor's medical evaluation to determine suitability to donate hematopoietic progenitor cells. For PBSC donations, data collection occurred during each day of G-CSF and on the day of each apheresis procedure. For BM donations, data collection occurred on the day of BM collection. Both BM and PBSC donors were contacted by the donor center 2 days after donation, 1 week after donation, and weekly thereafter until complete recovery. "Complete recovery" was assessed by the donor center coordinator/medical director and based on reports of return to baseline function with no ongoing symptoms.

Because this study addressed acute toxicity, only day 2 and 1 week forms were analyzed. Detailed questions using the toxicity criteria modeled on Common Terminology Criteria for Adverse Events (version 4; available at http://evs.nci.nih.gov/ftp1/CTCAE/CTCAE_4.03_2010-06-14_QuickReference_5x7.pdf) were used to assess specific symptoms, to measure the donor's overall health, and to capture any toxicity the donor may have experienced as a result of the hematopoietic progenitor cells donation process. Symptoms assessed included fever, fatigue, rash, local reactions, nausea, vomiting, anorexia, insomnia, dizziness, syncope, pain, and infections. In addition, a complete blood count and WBC differential were performed at the initial medical evaluation, on the first day of G-CSF, the day(s) of collection, and at annual follow-ups.

PBSC Donation

All PBSC mobilizations were performed according to the NMDP-sponsored and Institutional Review Board–approved research protocol for manufacturing PBSC products, operated under an Investigational New Drug application with the US Food and Drug Administration. G-CSF dose was approximately 10 μg/kg/day actual body weight rounded to combinations of 300-μg and 480-μg vials, as long as protocol-defined targets of 13.3 μg/kg/day were not exceeded. Typically, donors received subcutaneous G-CSF daily for 4 days before and on the first day of apheresis. All donors underwent a maximum of 2 days of apheresis. The volume of whole blood processed was targeted to be between 12 and 24 L per collection. If the PBSC product could not be collected using peripheral veins, a central venous catheter was used.

BM Donation

One or 2 autologous blood units were potentially collected from the donor before donation, based on individual assessment. BM was collected from the donor's posterior iliac crests in an operating room under either