Post autologous hematopoietic cell transplant care in the “home sweet home” setting: a treatment paradigm shift

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# RESEARCH ARTICLE

## Post-Autologous Hematopoietic Cell Transplant Care in the “Home Sweet Home” Setting: A Treatment Paradigm Shift

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### Abstract

**Background:** Multiple myeloma (MM) is the second most common hematologic malignancy, with 34,470 estimated new cases in 2022. High-dose therapy followed by autologous hematopoietic cell transplantation (auto-HCT) remains a standard treatment for MM even in the era of novel therapies. This is usually performed in hospital-based settings, either in the inpatient or outpatient units. Advanced Care at Home (ACH) represents a virtual hybrid hospital-at-home program that combines a virtual provider-staffed command center with a vendor-mediated supply chain capable of delivering high-acuity care in the comfort of the patients’ own homes. In our program, we used the existing ACH platform to deliver post-HCT care for recipients of auto-HCT.

**Patients and methods:** Four patients (female = 2, 50%) with MM, with a median age of 60 (range, 40–74) years, were admitted to the inpatient Blood and Marrow Transplant (BMT) unit. The conditioning regimen consisted of melphalan 200 mg/m² administered on day −2. All patients received stem cell infusion (day 0) in the inpatient setting, with a median dose of 3.64 (range, 2.92–8.22) £ 10⁶/kg CD34 cells.

**Results:** Patients were discharged to their homes after completing the infusion on day 0 or day +1 at the latest. Post-infusion care was provided by the ACH team in coordination with the BMT team. The median time intervals to absolute neutrophil count and platelet engraftment were 12 (range, 11–13) and 11 (range, 9–16) days, respectively. All patients were successfully discharged from the ACH program at a median of day +14 (range, day +14 to day +15).

**Conclusions:** Our results highlight the feasibility of delivering post-HCT care for auto-HCT recipients in the home setting and confirm the generalizability of this approach.

### Keywords: Advanced care at home, Healthcare cost, Autologous hematopoietic stem cell transplantation, Multiple myeloma

### 1. Introduction

Healthcare cost in the US has been increasing at an alarming rate over the past decades, and this trend is expected to continue in the future. Recent data show that US health care spending has increased by 4.6% to reach $3.8 trillion in 2019, with hospital care accounting for $1.19 trillion (31%) [1]. Overall, healthcare spending comprises approximately 17.8% of the US economy [2]. Increases in...
The following criteria were required for patients to be enrolled into this program: (a) they must be receiving an auto-HCT for MM; (b) residing within 30 miles from our brick-and-mortar hospital facility; (c) have a 24-hour caregiver available; (d) not require continuous cardiac monitoring; and (e) not require intravenous medications for pain control.

Four patients with MM who received high-dose melphalan followed by an auto-HCT from June 2021 until March 2022 were included in this retrospective analysis, which was approved by the Institutional Review Board of Mayo Clinic and conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines.

2. Statistical analysis

Baseline characteristics were summarized using median and range for continuous data, and frequency and percentage for categorical data, as appropriate. Statistical analysis was conducted using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA).

3. Results

3.1. Clinical cases

As summarized in Table 1, four patients (female = 2, 50%) with MM with a median age of 60 (range 40–74) years were admitted to the inpatient Blood and Marrow Transplant (BMT) unit at Mayo Clinic in Jacksonville, FL. The median HCT comorbidity index (HCT-CI) was 3 (range, 0–3). In all 4 cases, the conditioning regimen consisted of melphalan 200 mg/m² administered on day −2. All patients received their autologous stem cell infusion (day 0) in the inpatient BMT unit, with a median dose of 3.64 (range, 2.92–8.22) × 10⁶/kg CD34 cells. Patients were discharged to their homes after completion of the infusion on day 0 or day +1 at the latest. Post-infusion care was provided by the ACH team in coordination with the BMT team. Specifically, one BMT advanced care provider (APP) was tasked with evaluating the patients in their homes until engraftment, and care was coordinated with an attending physician who also rounded on the patients, albeit virtually. All patients were prescribed prophylactic antimicrobials consisting of acyclovir,
fluconazole, and levofoxacin. Laboratory tests were obtained in the home setting. As per institutional operating standards, all patients were started on granulocyte colony-stimulating factor (G-CSF) on day +9 post-infusion (5 µg/kg/day).

3.2. Engraftment kinetics

Consistent with established definitions, neutrophil engraftment was defined as the first of 3 successive days of achieving an absolute neutrophil count (ANC) of ≥500/µL [8]. Platelet engraftment was defined as the first of 3 consecutive days with a platelet count of ≥20,000/µL in the absence of platelet transfusion for 7 consecutive days [8].

All patients engrafted in a timely manner. The median time to ANC engraftment was 12 (range, 11–13) days, and the median time to platelet engraftment was 11 (range, 9–16) days (Table 1).

3.3. Post-transplant side effects and complications

All 4 patients developed nausea, 2 had emesis, and 3 had diarrhea. Neutropenic fever was observed in 3 patients, with a median onset time of day +9 (range, day +8 to day +10). Fever work-up was unrevealing in 2 of 3 cases, and in 1 case a urine culture grew *Escherichia coli*. Cefepime was the drug of choice when treating neutropenic fever.

None of the patients required re-admission to the inpatient BMT unit. However, patients requiring blood or platelets transfusions were transferred electively to the outpatient infusion center by the ACH team and driven back to their homes after completing the transfusion(s).

3.4. Discharge from ACH

As shown in Table 1, patients were successfully discharged from the ACH program at a median of day +14 (range, day +14 to day +15). Fig. 1 depicts the entire process from the time of admission for high-dose chemotherapy, discharge from the brick-and-mortar hospital facility to the patients’ home, the home care and monitoring phase, until successful discharge from the ACH program.

4. Discussion

These 4 cases highlight the feasibility of offering safe care for auto-HCT recipients in the home setting. This approach has the potential for decreasing healthcare costs, especially considering that more than 7000 cases of MM are treated with high-dose therapy followed by an auto-HCT and are
reported annually to the Center for International Blood and Marrow Transplant Research [9]. The observed side effects and toxicities in these cases were anticipated with the procedure, and the management of complications such as neutropenic fever, among others, was promptly delivered without the need to transfer to the inpatient hospital unit. Furthermore, the time needed to achieve neutrophil and platelet recovery was in line with the published literature where the procedure was performed in inpatient or outpatient hospital-based settings [10].

Operationally, all care was coordinated via an ACH command center staffed by a physician and APPs. BMT specific expertise was supplemented by an APP who evaluated the patients in their homes and a BMT physician who provided virtual evaluation. We believe that this approach provided additional safety and helped familiarize the ACH team with the specific intricacies of post-HCT management. All labs, including blood cultures, when indicated, were collected in the patient’s home. This was also the case for basic radiologic evaluations such as chest X ray, whenever needed for a diagnostic purpose.

Presently, the ACH program requires that patients reside within 30 miles from the command center. This geographic limitation is necessary for supply chain stability and accessibility to transport patients back to the brick-and-mortar facility in case of emergent care needs or services that cannot be performed in the home setting.

These data demonstrate the feasibility of implementing post-HCT care in the home setting without adversely affecting the outcomes. One limitation of this analysis is the fact that it is restricted to post-auto-HCT care in patients with MM who received high-dose melphalan. Accordingly, we caution the readers not to infer these findings to other conditioning regimens, or the allogeneic HCT setting, owing to the higher incidence and, perhaps, severity of hematologic and non-hematologic toxicities that could result from these interventions. Large multicenter prospective studies are certainly needed to validate these findings.

Authors’ contributions
Designed the study: MAK-D, VR, HM, DF, RM, EG, AJ, RD, and MM.
Collected the data: MAK-D, VR, HM, DF, RM, AG, AB, KM, JMH, AB, SA, and MM.
Analyzed the data: MAK-D, VR, HM, DF, RM, AG, AB, KM, EG, JMH, AB, AJ, SA, RD, and MM.
Designed the figures: MAK-D, DF, RM, RAT-G, AJF, and MM.
Wrote the manuscript: MAK-D, VR, HM, RM, EG, and MM.

Conflict of interest
All authors declare no relevant conflicts of interest in relation to the content of this manuscript.

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