Not for publication or presentation

A G E N D A
CIBMTR WORKING COMMITTEE FOR PLASMA CELL DISORDERS AND ADULT SOLID TUMORS
Orlando, FL
Thursday, February 20, 2020, 12:15 – 2:15 pm

Co-Chair:	**Muzaffar Qazilbash, MD, MD Anderson Cancer Center, Houston, TX; Telephone: 713-745-3458; E-mail: mqazilba@mdanderson.org**
Co-Chair:	**Shaji Kumar, MD, Mayo Clinic Rochester, Rochester, MN; Telephone: 507-284-2017; E-mail: kumar.shaji@mayo.edu**
Co-Chair:	**Nina Shah, MD, University of California, San Francisco, CA; Telephone: 415-514-6354; E-mail: nina.shah@ucsf.edu**
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Statistician:	**Noel Estrada-Merly, MS, CIBMTR Statistical Center, Milwaukee, WI; Telephone: 414-805-0692; E-mail: nestrada@mcw.edu**

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1. **Introduction**
   a. Minutes and overview plan from February 2019 meeting (Attachment 1)
   b. Instructions for sign-in and voting

2. **Accrual summary** (Attachment 2)

3. **Presentations, Published or Submitted Papers**
   a. **MM14-01** Autologous Transplantation for Germ Cell Tumors: Improved Outcomes over 3 decades. **Published**
   b. **MM17-01** Hematopoietic cell transplantation utilization and outcomes for primary plasma cell leukemia in the current era. **Presented at ASH 2019. Submitted**
   c. **MM18-01** The t(11;14) abnormality confers superior survival in African Americans undergoing autologous hematopoietic cell transplantation for multiple myeloma. **Submitted**
   d. **MM18-02** Novel Prognostic Scoring System for Autologous Hematopoietic Cell Transplantation in Multiple Myeloma. **Presented at ASH 2019. Manuscript in preparation**
   e. **MM18-03** To compare the outcomes in young patients with multiple myeloma at diagnosis undergoing autologous or allogeneic hematopoietic stem cell transplant (HCT) with older patients: progression-free and overall survival in a case match analysis. **Presented at ASH 2019. Manuscript in preparation**

f. **MM18-04** Busulfan, Melphalan, and Bortezomib versus High-Dose Melphalan as a Conditioning Regimen for Autologous Hematopoietic Stem Cell Transplantation in Multiple Myeloma: Long Term Follow Up of a Novel Conditioning Regimen. **Presented at ASH 2019. Submitted**

4. Studies in Progress (Attachment 3)

a) **MM17-01** Hematopoietic cell transplantation utilization and outcomes for primary plasma cell leukemia in the current era (S Girnius/S Patel/L Bachegowda/B Dhakal) **Submitted**
b) **MM17-02** The Impact of Bortezomib Based Induction Therapy vs No Induction Therapy on Outcomes for Light Chain Amyloidosis (R Cornell/S Goodman/L Costa) **Analysis**
c) **MM18-01** The t(11;14) abnormality confers superior survival in African Americans undergoing autologous hematopoietic cell transplantation for multiple myeloma (T Badar) **Submitted**
d) **MM18-02** Deriving a prognostic score for patients undergoing high dose therapy and autologous SCT for myeloma and examining validity of this in long-term exceptional responders (A Hall/B Dhakal/Z Gahvari/S Chhabra/N Callander) **Manuscript in preparation**
e) **MM18-03** To compare the outcomes in young patients with multiple myeloma at diagnosis undergoing autologous or allogeneic hematopoietic stem cell transplant (HCT) with older patients: progression-free and overall survival in a case match analysis (P Munshi/A Jurczyszyn/J Zaucha/D Vesole) **Manuscript in preparation**
f) **MM18-04** Busulfan, Melphalan, and Bortezomib versus High-Dose Melphalan as a Conditioning Regimen for Autologous Hematopoietic Stem Cell Transplantation in Multiple Myeloma: Long Term Follow Up of a Novel Conditioning Regimen (P Hagen/P Stiff) **Submitted**
g) **MM19-01** Impact of Induction Therapy with VRD vs. VCD on Outcomes in Patients with Multiple Myeloma Undergoing Stem Cell Transplantation (S Sidana/M Norkin/S Kumar/S Giralt) **Protocol Development**
h) **MM19-02** Maintenance therapy after second autologous hematopoietic cell transplantation for Multiple Myeloma. (O Pasvolsky/ M Yeshurun U Rozovski/ L Alon) **Protocol Development**
i) **MM19-03** Second autologous stem cell transplantation as salvage therapy for relapsed or refractory AL amyloidosis (C Tan/H Fung) **Protocol Development**

5. Future/Proposed Studies

a. **PROP 1911-95** Serum Free light Chain measurement following Autologous Hematopoietic Cell Transplantation is predictive of outcomes in Multiple Myeloma. (Murthy/Kharfan-Dabaja/Kumar) (Attachment 4)
b. **PROP 1911-96** Prexisting malignancy as risk factor for development of new primary malignancy following Autologous Stem Cell Transplantation and Maintenance therapy in Multiple Myeloma (Murthy/Kharfan-Dabaja/Kumar) (Attachment 5)
c. **PROP 1911-123** Outcomes after autologous hematopoietic cell transplantation in POEMS syndrome. (Kansagra/Cornell/Dispenzieri) (Attachment 6)
d. **PROP1910-21/PROP1911-141/PROP1911-228/PROP1911-44** Combined proposal: Risk factors for and characteristics of secondary primary malignancies following autologous hematopoietic cell transplant for multiple myeloma (Attachment 7)
Submitted proposals:
Studying risk factors for developing therapy related myeloid neoplasm (t-MN) in multiple myeloma (MM) patients undergoing autologous stem cell transplant (Shah/Alkhateeb/Kumar)
Characteristics and Outcomes of Patients with Therapy Related Myelodysplastic Syndromes and

Acute Leukemias Following Autologous Hematopoietic Cell Transplantation for Multiple Myeloma (Ragon/Usmani/Copelan)
Multiple Myeloma: Comparative Study of Newcancers in Patients Undergoing Autologous Stem Cell Transplants for Myeloma Over the last 2 Decades with an Emphasis on Maintenance Drugs. (Gowda/Hashmi/Tamari)
Cumulative incidence of second primary malignancies and their outcomes in patients with multiple myeloma after autologous transplant. (George/Binod/Chhabra)

e. **PROP1911-134/PROP1911-237/PROP1911-26** Combined proposal: Impact of bortezomib-based vs. lenalidomide maintenance therapy on outcomes of patients with high-risk multiple myeloma. (Attachment 8)
Submitted proposals:
Assessing real world trends and outcomes in post-autologous stem cell transplant (ASCT) maintenance/consolidation therapy in patients with multiple myeloma (MM) with high risk cytogenetics. (Bumma/Khan/Devarakonda)
Impact of bortezomib- based vs. lenalidomide maintenance therapy on outcomes of patients with high-risk multiple myeloma (Sidana) Is lenalidomide an optimal maintenance in cytogenetic high-risk multiple myeloma patients after autologous stem cell transplantation? - a real world experience analysis. (Dhakal/Chhabra)

Dropped proposed studies

a. **PROP1911-03** The impact of response kinetics on outcomes while on lenalidomide maintenance after autologous hematopoietic cell transplantation in multiple myeloma. *Dropped Reason - Feasibility*
b. **PROP1911-07** Transplant outcomes in multiple myeloma-associated AL amyloidosis *Dropped Reason - Insufficient score to proceed among submitted proposals*
c. **PROP1911-107** Impact of Melphalan dose on outcomes following autologous stem cell transplantation in light chain amyloidosis with renal involvement in young vs. older patients. *Dropped Reason - Insufficient score to proceed among submitted proposals*
d. **PROP1911-117** The effect of coexistent amyloid and multiple myeloma in patients undergoing autologous stem cell transplant. *Dropped Reason - Insufficient score to proceed among submitted proposals*
e. **PROP1911-122** Growth Factors vs. Growth Factors + Chemotherapy in Peripheral Blood Stem Cell Mobilization for Autologous Hematopoietic Stem Cell Transplantation in Multiple Myeloma Patients. *Dropped Reason - Overlap with SC15-04*
f. **PROP1911-130** Melphalan dosing in the setting of advanced age and comorbidity**.** *Dropped Reason - Overlap with MM18-03*
g. **PROP1911-17** Comparison of high dose melphalan with 1 day vs. 2day regimen followed by autologous hematopoietic cell transplantation in patients with multiple myeloma. *Dropped Reason - Feasibility*
h. **PROP1911-177** To compare the outcomes of upfront autologous hematopoietic stem cell transplant using melphalan 200mg/m2 to melphalan <200mg/m2 in young and older patients with renal insufficiency and multiple myeloma in the US *Dropped Reason - Overlap with MM14-03*
i. **PROP1911-180** Success and safety of re-mobilization of stem cell for patients with Multiple Myeloma who have previously undergone autologous stem cell transplant. *Dropped Reason - Feasibility*

j. **PROP1911-186** Evaluation of factors predictive of successful outcomes in allogeneic hematopoietic cell transplantation for multiple myeloma. *Dropped Reason - Feasibility*
k. **PROP1911-189** The Mayo 2012 and European 2015 Staging Systems for Systemic Light Chain Amyloidosis Predict Survival following High Dose Melphalan and Autologous Stem Cell Transplantation Irrespective of Transplant Center Experience *Dropped Reason - Feasibility*
l. **PROP1911-230** Outcomes with an intensified conditioning regimen of BCNU/melphalan compared with melphalan alone in myeloma patients not achieving deep hematologic response prior to ASCT *Dropped Reason - Insufficient score to proceed among submitted proposals*
m. **PROP1911-255** Outcome of patients with Multiple Myeloma undergoing Autologous (AHCT) and Allogeneic Stem Cell Transplantation (Allo-HCT) stratified by Lactate Dehydrogenase (LDH). *Dropped Reason - Feasibility*
n. **PROP1911-269** Study the Impact of Bone marrow microenvironment using thrombocytopenia and anemia as a surrogate marker in Multiple Myeloma patients undergoing autologous stem cell transplant *Dropped Reason - Insufficient score to proceed among submitted proposals*
o. **PROP1911-29** KRD vs. VRD induction in transplant eligible multiple myeloma patients undergoing autologous stem cell transplantation *Dropped Reason - Feasibility*
p. **PROP1911-37** Predictors and Prognostic Impact of Early Relapse After Salvage Second Autologous Hematopoietic Cell Transplantation for Relapsed. *Dropped Reason - Insufficient score to proceed among submitted proposals*
q. **PROP1911-43** Assessing outcomes of patients with AL amyloidosis with t(11;14) after autologous stem cell transplant *Dropped Reason - Insufficient score to proceed among submitted proposals*
r. **PROP1911-62/PROP1911-65** Outcomes of autologous hematopoietic cell transplantation in multiple myeloma with pre-existing monoclonal gammopathy of unknown significance, smoldering myeloma or solitary plasmacytoma. *Dropped Reason - Insufficient score to proceed among submitted proposals*
s. **PROP1911-71** Evaluation of the outcomes of the use of allogeneic stem cell transplant in refractory or relapsed systemic amyloid light chain amyloidosis. *Dropped Reason - Insufficient score to proceed among submitted proposals*
t. **PROP1911-84** Efficacy analysis of melphalan dose reduction in multiple myeloma patients undergoing autologous transplant in the era of novel agent induction and maintenance. *Dropped Reason - Insufficient score to proceed among submitted proposals*
u. **PROP1911-94** Outcomes of HIV+ Patients undergoing Autologous HCT for Multiple Myeloma *Dropped Reason – Feasibility*
v. **PROP1911-213** Comparing outcomes of maintenance therapies after autologous stem cell transplant (SCT) in patients with multiple myeloma *Dropped Reason -Insufficient score to proceed among submitted proposals*
w. **PROP1910-03** Optimal conditioning regimen for relapsed Multiple Myeloma, prior to second salvage autologous hematopoietic stem cell transplant. *Dropped Reason- Insufficient score to proceed among submitted proposals*

MINUTES AND OVERVIEW PLAN
CIBMTR WORKING COMMITTEE FOR PLASMA CELL DISORDERS AND ADULT SOLID TUMORS
Houston, Texas
Saturday, February 23, 2019, 12:15 – 2:15 pm

Co-Chair:	**Tomer Mark, MD, University of Colorado Hospital, Aurora, CO; Telephone: 720-848-3389; E-mail: tomer.mark@ucdenver.edu**
Co-Chair:	**Shaji Kumar, MD, Mayo Clinic Rochester, Rochester, MN; Telephone: 507-284-2017; E-mail: kumar.shaji@mayo.edu**
Co-Chair:	**Nina Shah, MD, University of California, San Francisco, CA; Telephone: 415-514-6354; E-mail: nina.shah@ucsf.edu**
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1. Introduction

The CIBMTR Plasma Cell Disorders and Adult Solid Tumors Working Committee was called to order at 12:15PM on Saturday, February 23rd, by Dr. D'Souza. Dr. D'Souza introduced the committee leadership and welcomed the committee participants. Dr. D'Souza acknowledged Dr. Tomer Mark, who unfortunately could not be present for the meeting, for all his effort during the past years as Co-Chair. Dr. D'Souza introduced Dr. Muzaffar Qazilbash as the newly appointed Chair for the Working Committee starting March 1, 2019. Dr. D'Souza introduced the committee goal and expectations to the audience and reviewed presentations, publications and submitted papers in 2018. Dr. D'Souza gave update on the current status of ongoing studies and their goals for July 2019. Dr. D'Souza presented and explained the Advisory Committee Metrics, for which the committee received outstanding grade in 2018. Dr. Hari discussed important details about how the committee works, CIBMTR study development cycle and explained the different sources of CIBMTR data collection (TED and CRF). Dr. Hari also discussed future priorities of the committee: revision of plasma cell disorders forms to include new drugs, more details on POEMS, MGRS- VEGF, MRD, therapies at relapse, imaging (PET) information. Dr. Hari clarified the voting process to the audience and explained the PI's rule of conduct on the study cycle: timely completion of abstract, slides, and manuscript after the analysis is completed. If the PI does not write the first draft of the manuscript, after 3 requests, the paper will be reassigned i.e. the person who writes the manuscript will be the first author. The CIBMTR statistical resource was clarified to the audience. The average time to complete a study is 2-3 years upon statistical hour allocation and other competing projects.

2. Accrual summary (Attachment 2)

Due to the full agenda the accrual summary of registration and research cases between 1990 and 2018 were not presented to the committee but were available as part of the Working Committee attachments. The accrual summary provides information about the number of patients available in the registration level and research level for potential studies. As of December 2018, 80,342 plasma cell disorder cases were reported at the registration only level and 14,725 cases at the research level to the CIBMTR for first autologous transplant. For first allogeneic transplants, these numbers are 4,908 cases and 2,026 cases respectively.

3. Presentations, published or submitted papers

Dr. D'Souza presented the following publications and presentations from the committee's work during this year.

a. **MM14-01** M Qayed, D Kilari, T Olson, KY Chiang, A D'Souza, P Hari. Characteristics and outcomes of patients with refractory germ cell tumor undergoing autologous hematopoietic stem cell transplantation. **Presented at GU-ASCO 2018. Submitted**

b. **MM16-01a** E Scott, P Hari, S Kumar, Y Nieto, T Mark, S Kumar, C Gasparetto, A D'Souza. Staging Systems for Newly Diagnosed Myeloma Patients Undergoing Autologous Hematopoietic Cell Transplantation: The Revised International Staging System Shows the Most Differentiation between Groups. ***Biology of Blood and Marrow Transplantation. 2018 Dec;24(12):2443-2449. doi:10.1016/j.bbmt.2018.08.013. Epub 2018 Aug 21.***

c. **MM16-01b** S Kumar, A D'Souza, E Scott, C Gasparetto, S Kumar, T Mark, Y Nieto, P Hari. Revised-International Staging System (R-ISS) is Predictive and Prognostic for Early Relapse (<24 months) after Autologous Transplantation for Newly Diagnosed Multiple Myeloma (MM). ***Biology of Blood and Marrow Transplantation. 2018 Dec 20. pii: S1083-8791(18)30963-7. doi: 10.1016/j.bbmt.2018.12.141.***

d. **MM16-02** F Sahebi, L Garderet, A Kanate, N Shah, Q Bashir, S Ciurea. Outcomes of Haploidentical Transplantation in Patients with Relapsed Multiple Myeloma: An EBMT/CIBMTR Report. ***Presented at EBMT 2018. Biology of Blood and Marrow Transplantation. doi:10.1016/j.bbmt.2018.09.018. Epub 2018 Sep 20.***

e. **MM18-01** Racial Discrepancy in Clinical Outcomes of Multiple Myeloma Patients with and without t(11;14) Genetic Abnormality (D Sivaraj /A Krishnan /C Gasparetto). ***Analysis complete***

4. Studies in progress (Attachment 3)

Dr. D'Souza introduced the following studies in progress and goal by July 2019.

a. **MM14-01: Characteristics and Outcomes of patients with refractory germ cell tumor undergoing autologous hematopoietic stem cell transplantation** (M Qayed/D Kilari/ T Olson/ KY Chiang/P Hari). The primary aim of the study is to determine the overall outcomes of patients with testicular and extragonadal GCT (excluding intracranial tumors) who underwent high-dose chemotherapy and autologous SCT. The paper has been submitted. The goal of the study is to publish paper by June 2019.

b. **MM17-01: Hematopoietic cell transplantation for primary plasma cell leukemia in the era of novel agents** (S Girnius/S Patel/L Bachegowda/B Dhakal). This study looks to evaluate transplant outcomes of patients aged ≥ 18 years with pPCL who underwent autologous HCT and allogeneic. Analysis is underway. The goal of the study is to complete analysis by July 2019.

c. **MM17-02: The Impact of Bortezomib Based Induction Therapy vs No Induction Therapy on Outcomes for Light Chain Amyloidosis** (R Cornell/S Goodman/L Costa) This study looks to compare pre-transplant bortezomib-based induction therapy with no induction therapy prior to autologous hematopoietic cell transplantation and evaluate transplant outcomes in patients with light chain (AL) amyloidosis. Study is delayed pending IT updates with data retrieval for AL amyloidosis. The study will only be started once data is available to the WC.

d. **MM18-01: Racial Discrepancy in Clinical Outcomes of Multiple Myeloma Patients with and without t(11;14) Genetic Abnormality** (D Sivaraj /A Krishnan /C Gasparetto) This study looks to assess the effects

of t(11;14) on survival outcomes between African American and non-African American with multiple myeloma who underwent high dose melphalan plus autologous hematopoietic cell transplantation. The study is in manuscript preparation phase. The goal is to submit paper by June 2019.

e. **MM18-02: Deriving a prognostic score for patients undergoing high dose therapy and autologous SCT for myeloma and examining validity of this in long-term exceptional responders** (A Hall/B Dhakal/Z Gahvari/S Chhabra/N Callander) This study looks to identify pre-transplant factors that can help develop a prognostic score at the time of transplant. The purpose of this score is to help predict outcomes in transplant eligible myeloma patients and help predict a group of patients at high risk of early relapse as well as "exceptional responders" with extremely long responses to high dose melphalan. The study is in protocol development. The goal is to finalize datafile by May 2019 and proceed to analysis.

f. **MM18-03: To compare the outcomes in young patients with multiple myeloma at diagnosis undergoing autologous or allogeneic hematopoietic stem cell transplant (HCT) with older patients: progression-free and overall survival in a case match analysis** (P Munshi/A Jurczyszyn/J Zaucha/D Vesole) This study looks to compare the outcomes of autologous and allogeneic HCT in patients with MM < 50 years in different age groups (20-39 years and 40-49 years) with patients ≥ 50 years (50-59 years, 60-69 and ≥ 70). The study is in datafile preparation. The goal is to finalize datafile and analysis by April 2019.

g. **MM18-04: Busulfan, Melphalan, and Bortezomib versus High-Dose Melphalan as a Conditioning Regimen for Autologous Hematopoietic Stem Cell Transplantation in Multiple Myeloma: Long Term Follow Up of a Novel Conditioning Regimen** (P Hagen/P Stiff) This study looks to update the outcomes among multiple myeloma patients treated on a phase I/II BUMELVEL cohort and a CIBMTR MEL 200 control cohort. The goal for this study is to complete the analysis by April 2019.

5. Future/proposed studies

This year, we received 25 proposals, 10 of which were invited to present at the meeting (including 1 merge of 3 proposals with similar research objectives). After the introduction of the voting process, the following new proposals were presented and voted on. Dr. Shah introduced the first 4 proposals.

a. **PROP 1811-58** Outcomes of Autologous Hematopoietic Cell Transplantation for Relapsed/Refractory Germ Cell Tumors in Females (Sagar Patel/Navneet Majhail) (Attachment 4)

Dr. Patel presented the proposal on behalf of the group. This study hypothesizes that outcomes of autologous hematopoietic cell transplantation for relapsed/refractory germ cell tumors in females are comparable to those with males with testicular germ cell tumors. There are 98 female patients (13 in CRF) who underwent AutoHCT for germ cell tumor from 2008-2017. The audience had concerns regarding the low number of CRF patients in the database, and how we will be able to draw clear conclusions due to this limitation. The proposal also wanted to limit the population to adults ≥ 18 years, but over 50% of the population was below 18 years of age.

<u>Amyloidosis:</u>

b. **PROP 1811-168** Second autologous stem cell transplantation as salvage therapy for relapsed or refractory AL amyloidosis (Carlyn Tan/Henry Fung) (Attachment 5)

Dr. Tan presented the proposal on behalf of the group. This study hypothesizes that second course of high-dose therapy and autologous stem cell transplant as salvage therapy results in improvement in the progression free survival and overall survival of patients with relapsed/refractory AL amyloidosis. There are 90 patients (27 in CRF) who underwent 2nd HCT from Amyloidosis from 1999-2016. The audience had suggestions including allowing coexistent Multiple Myeloma patients, organ involvement information available for 1st and 2nd HCT, limit population to year of transplant > 2006 since there where no relevant drugs before this year for amyloidosis, and the role of tandem transplants in this population.

Multiple Myeloma:

c. **PROP 1811-49** Serum Free light Chain ratio at Day +100 and Day + 180 following Autologous Hematopoietic Cell Transplantation is predictive of outcomes in Multiple Myeloma (Hemant Murthy/Nosha Farhadfar/John Wingard) (Attachment 6)

Dr. Murthy presented the proposal on behalf of the group. This study hypothesizes that normalization of serum free light chain ratio at day +100 and day +180 following autologous hematopoietic cell transplantation is independently predictive of superior progression free and overall survival in multiple myeloma. There are 4,586 patients in CRF who underwent AutoHCT for multiple myeloma from 2008-2016 but only approximately third of these at FLC ratio available at baseline and day 100. The audience had questions regarding the handling of patients with normal light chain ratio before transplant, limitation of only one end point (day 100) as predictor of outcomes, and to consider the use of absolute amount of free light chain instead of the ratio.

d. **PROP 1811-108** Maintenance therapy after second autologous hematopoietic cell transplantation for Multiple Myeloma (Oren Pasvolsky /Moshe Yeshurun/Uri Rozovski/Liat Shargian-Alon) (Attachment 7)

Dr. Kumar presented the proposal on behalf of the group. This study hypothesizes that maintenance therapy may prolong progression free survival and overall survival after second AutoHCT. There are 500 patients in CRF who underwent 2nd AutoHCT for Multiple Myeloma from 2008 - 2016. The audience had questions about the limitation of not knowing the specific reason why the patient received or did not receive maintenance therapy thereby not being able to draw clear conclusions, possible stratification of patients by response after 1st HCT, role of tandem transplants, possible stratification of patients by year of transplant, and conditioning regimen given (other than melphalan).

Dr. Kumar introduced the last 3 proposals.

e. **PROP 1811-05** Outcomes for patients with Multiple Myeloma treated with Autologous or Syngeneic Allogenic Stem Cell Transplantation (Andrew Pham /Anuj Mahindra) (Attachment 8)

Dr. Pham presented the proposal on behalf of the group. This study hypothesizes that autologous stem cell transplant will still be shown to provide benefit to patients with multiple myeloma and that syngeneic transplantation will be demonstrated to be safe and efficacious as well. There are 55 patients who underwent syngeneic AlloHCT and 4,624 who underwent AutoHCT from 2008 - 2016. The audience questioned the low number of patients in syngeneic group therefore not being able to draw clear conclusions, as well as lack of novelty since the CIBMTR has published this type of analysis in the past.

f. **PROP 1810-06/1811-117/1811-153** Comparison of real-world experience of maintenance strategies in multiple myeloma patients after autologous stem cell transplantation (Dhakal Binod/ Shebli Atrash/ Gayathri Ravi/ Ehsan Malek/ Peter Voorhees) (Attachment 9)

Dr. Ravi presented the proposal on behalf of the group. This study hypothesizes that Lenalidomide based maintenance is superior to non-lenalidomide based maintenance. There are 4,834 patients who underwent AutoHCT with maintenance therapy information available from 2008 - 2016. The audience had questions regarding the information available of specific drugs given as consolidation or maintenance therapy, cytogenetics information available, and effect of patients enrolled in clinical trials during this time period.

g. **PROP 1812-07** Impact of Induction Therapy with VRD vs. VCD on Outcomes in Patients with Multiple Myeloma Undergoing Stem Cell Transplantation (Surbhi Sidana/Maxim Norkin/Shaji K. Kumar/ Sergio Giralt) (Attachment 10)

Dr. Sidana presented the proposal on behalf of the group. This study hypothesizes that patients with newly diagnosed multiple myeloma receiving bortezomib- cyclophosphamide-dexemethasone (VCD) based chemotherapy prior to AutoHCT have similar progression free survival compared to those receiving bortezomib-lenalidomide- dexamethasone (VRD) based induction, after adjusting for other prognostic

factors. There are 796 patients who received VRD and 291 patients who received VCD prior to AutoHCT for MM from 2010 - 2016. The audience had question regarding dose of chemotherapy given prior to transplant, results from trials that shown VRD is better than VCD, possibility of limiting population to patients with renal deficiencies, how many patients received tandem transplants, and information about maintenance and consolidation therapy.

The Plasma Cell and Adult Solid Tumors working committee meeting came to a close at 2:00 PM. The committee leadership met with members of the committee and answered questions. Each participant in the meeting had the opportunity to rate each proposal using paper ballots. Based on the voting results, the following studies will move forward as the committee's research portfolio for the upcoming year:

PROP 1812-07 Impact of Induction Therapy with VRD vs. VCD on Outcomes in Patients with Multiple Myeloma Undergoing Stem Cell Transplantation (Surbhi Sidana/Maxim Norkin/Shaji K. Kumar/ Sergio Giralt)

PROP 1811-108 Maintenance therapy after second autologous hematopoietic cell transplantation for Multiple Myeloma (Oren Pasvolsky /Moshe Yeshurun/Uri Rozovski/Liat Shargian-Alon)

PROP 1811-168 Second autologous stem cell transplantation as salvage therapy for relapsed or refractory AL amyloidosis (Carlyn Tan/Henry Fung)

Working Committee Overview Plan for 2019 - 2020

Study number and title	Current status	Goal with date	Total hours to complete	Total hours to goal	Hours allocated to 6/30/2019	Hours allocated 7/1/2019-6/30/2020	Total Hours allocated
MM17-01: Hematopoietic cell transplantation for primary plasma cell leukemia in the era of novel agents	Manuscript Prep	Submission - May 2019	70	**70**	70	10	**80**
MM17-02: The Impact of Bortezomib Based Induction Therapy vs No Induction Therapy on Outcomes for Light Chain Amyloidosis	Deferred	Manuscript prep - April 2020	280	**210**	0	210	**210**
MM18-01: Racial Discrepancy in Clinical Outcomes of Multiple Myeloma Patients with and without t(11;14) Genetic Abnormality	Manuscript Prep	Submission – June 2019	50	**50**	50	10	**60**
MM18-02: Deriving a prognostic score for patients undergoing high dose therapy and autologous SCT for myeloma and examining validity of this in long-term exceptional responders	Protocol Development	Submission - June 2020	310	**310**	240	70	**310**
MM18-03: To compare the outcomes in young patients with multiple myeloma at diagnosis undergoing autologous or allogeneic hematopoietic stem cell transplant (HCT) with older patients:	Datafile prep	Submission - May 2019	160	**160**	90	70	**160**

progression-free and overall survival in a case match analysis							
MM18-04: Busulfan, Melphalan, and Bortezomib versus High-Dose Melphalan as a Conditioning Regimen for Autologous Hematopoietic Stem Cell Transplantation in Multiple Myeloma: Long Term Follow Up of a Novel Conditioning Regimen	Datafile prep	Published - Jan 2020	40	**40**	40	10	**50**
MM19-01: Impact of Induction Therapy with VRD vs. VCD on Outcomes in Patients with Multiple Myeloma Undergoing Stem Cell Transplantation	Protocol pending	Analysis - March 2020	330	**200**	0	200	**200**
MM19-02: Maintenance therapy after second autologous hematopoietic cell transplantation for Multiple Myeloma	Protocol pending	Analysis - May 20	330	**200**	0	200	**200**
MM19-03: Second autologous stem cell transplantation as salvage therapy for relapsed or refractory AL amyloidosis	Protocol pending	Datafile prep - June 2020	290	**100**	0	100	**100**

Oversight Assignments for Working Committee Leadership (March 2019)

Shaji Kumar:	**MM17-01:** HCT for primary plasma cell leukemia **MM18-01:** Racial discrepancy in MM patients with t(11;14) **MM19-01:** VRD vs. VCD as induction for MM patients
Nina Shah:	**MM17-02:** Bortezomib induction therapy for light chain amyloidosis **MM18-02:** Prognostic score system **MM18-03:** Compare young vs. old MM patients
Muzaffar Qazilbash:	**MM18-04:** BuMelVel vs High dose Mel in MM **MM19-02:** Maintenance therapy after second AutoHCT for MM **MM19-03:** Second AutoHCT for AL Amyloidosis

Accrual Summary for the Plasma Cell Disorders and Adult Solid Tumor Working Committee

Recipients of first autologous transplant for **Plasma Cell Disorders** registered to the CIBMTR, 1990-2019

Characteristic	TED	Research
No. of patients	88,084	15,793
No. of centers	468	314
Age at transplant, median (range), years - median (min-max)	59.89 (18.15-85.33)	58.77 (20.17-83.21)
Disease - no. (%)		
Multiple Myeloma	83,030 (94.3)	13,911 (88.1)
Amyloidosis	2,707 (3.1)	1,404 (8.9)
Plasma cell leukemia	734 (0.8)	191 (1.2)
Solitary plasmacytoma	389 (0.4)	52 (0.3)
Waldenstrom macroglobulinemia [a]	325 (0.4)	44 (0.3)
POEMS Syndrome	445 (0.5)	82 (0.5)
Multiple Plasmacytomas	53 (0.1)	4 (0)
LCDD	303 (0.3)	94 (0.6)
Others [b]	98 (0.1)	11 (0.1)
Graft type - no. (%)		
BM	374 (0.4)	82 (0.5)
PB	86,285 (98)	15,565 (98.6)
CB	8 (0)	2 (0)
Missing	1,417 (1.6)	144 (0.9)
Year of transplant - no. (%)		
1990-1991	207 (0.2)	44 (0.3)
1992-1993	322 (0.4)	70 (0.4)
1994-1995	630 (0.7)	243 (1.5)
1996-1997	1,326 (1.5)	475 (3)
1998-1999	2,335 (2.7)	697 (4.4)
2000-2001	3,504 (4)	930 (5.9)
2002-2003	4,631 (5.3)	851 (5.4)
2004-2005	4,932 (5.6)	1,491 (9.4)
2006-2007	5,226 (5.9)	1,387 (8.8)
2008-2009	6,318 (7.2)	1,526 (9.7)
2010-2011	9,967 (11.3)	678 (4.3)
2012-2013	10,855 (12.3)	1,192 (7.5)
2014-2015	11,687 (13.3)	1,915 (12.1)
2016-2017	14,126 (16)	2,061 (13.1)
2018-2019 [c]	12,018 (13.6)	2,233 (14.1)
Follow-up - median (min-max)	51.35 (0-320.49)	60.99 (0.43-267.53)

[a] Small lymphoplasmacytic lymphoma cases were not included.

[b] Other include: other plasmacytoma (n=36), MGUS (n=17); plasmablastic (n=14), Scleromyexdema (n=13), EPS (n=2), plasma cell dyscrasia (n=10), plasmacytosis (n=5),

[c] Cases continue to be reported. Abbreviations: TED=Transplant essential data, CRF=Comprehensive report form.

Recipients of first allogeneic transplant for **Plasma Cell Disorders** registered to the CIBMTR, 1990-2019

Characteristic	TED	Research
No. of patients	4993	2086
No. of centers	337	264
Age at transplant, median (range), years - median (min-max)	50.54 (1.29-78.34)	49.83 (10.25-78.64)
Disease - no. (%)		
Multiple Myeloma	4517 (90.5)	1865 (89.4)
Amyloidosis	30 (0.6)	7 (0.3)
Plasma cell leukemia	233 (4.7)	122 (5.8)
Solitary plasmacytoma	40 (0.8)	6 (0.3)
Waldenstrom macroglobulinemia [a]	113 (2.3)	70 (3.4)
POEMS Syndrome	1 (0)	0
Multiple Plasmacytomas	2 (0)	1 (0)
Others [b]	57 (1.1)	15 (0.7)
Graft type - no. (%)		
BM	1161 (23.3)	624 (29.9)
PB	3708 (74.3)	1418 (68)
CB	31 (0.6)	40 (1.9)
Missing	93 (1.9)	4 (0.2)
donorgp - no. (%)		
HLA-identical sibling	3225 (64.6)	1308 (62.7)
Monozygotic twin	143 (2.9)	137 (6.6)
Other relative	334 (6.7)	97 (4.7)
Unrelated donor	1200 (24)	523 (25.1)
Missing	91 (1.8)	21 (1)
txgp - no. (%)		
1	2269 (45.4)	1190 (57)
2	2724 (54.6)	896 (43)
Year of transplant - no. (%)		
1990-1991	71 (1.4)	95 (4.6)
1992-1993	171 (3.4)	141 (6.8)
1994-1995	282 (5.6)	146 (7)
1996-1997	339 (6.8)	144 (6.9)
1998-1999	311 (6.2)	128 (6.1)
2000-2001	460 (9.2)	248 (11.9)
2002-2003	567 (11.4)	208 (10)
2004-2005	459 (9.2)	255 (12.2)
2006-2007	349 (7)	204 (9.8)
2008-2009	407 (8.2)	134 (6.4)
2010-2011	433 (8.7)	59 (2.8)
2012-2013	388 (7.8)	49 (2.3)
2014-2015	354 (7.1)	92 (4.4)
2016-2017	300 (6)	93 (4.5)
2018-2019 [c]	102 (2)	90 (4.3)

Characteristic	TED	Research
Follow-up - median (min-max)	63.03 (0-336.64)	119.7 (0-288.22)

[a] Small lymphoplasmacytic lymphoma cases were not included.

[b] Other include: LCDD (n=1), Other plasmacytoma (n=9), not specified (n=61).

[c] Cases continue to be reported. Abbreviations: TED=Transplant essential data, CRF=Comprehensive report form.

First adult autologous transplant for **Sarcoma** registered to the CIBMTR, 1990-2019

		Bone Sarcoma		Other Sarcoma
Characteristic	**TED**	**CRF**	**TED**	**CRF**
	N (%)	N (%)	N (%)	N (%)
No. of patients	503	151	221	82
No. of centers	161	77	103	49
Age at transplant, median (range), years - median (min-max)	22.58 (18.01-61.14)	22.95 (18.05-59.23)	28.61 (18.04-64)	27.71 (18.01-61.47)
Disease - no. (%)				
Bone sarcoma (exc. Ewing)	124 (24.7)	35 (23.2)	0	0
Ewing sarcoma	379 (75.3)	116 (76.8)	0	0
Soft tissue sarcoma	0	0	170 (76.9)	68 (82.9)
Sarcoma unspecified	0	0	51 (23.1)	14 (17.1)
Gender - no. (%)				
Male	347 (69)	98 (64.9)	138 (62.4)	38 (46.3)
Female	156 (31)	53 (35.1)	83 (37.6)	44 (53.7)
Graft type - no. (%)				
BM	37 (7.4)	17 (11.3)	30 (13.6)	10 (12.2)
PB	452 (89.9)	134 (88.7)	179 (81)	72 (87.8)
Missing	14 (2.8)	0	12 (5.4)	0
Year of transplant - no. (%)				
1990-1991	18 (3.6)	8 (5.3)	23 (10.4)	6 (7.3)
1992-1993	28 (5.6)	14 (9.3)	27 (12.2)	4 (4.9)
1994-1995	22 (4.4)	12 (7.9)	23 (10.4)	8 (9.8)
1996-1997	28 (5.6)	33 (21.9)	20 (9)	20 (24.4)
1998-1999	50 (9.9)	37 (24.5)	28 (12.7)	21 (25.6)
2000-2001	57 (11.3)	15 (9.9)	17 (7.7)	9 (11)
2002-2003	52 (10.3)	2 (1.3)	28 (12.7)	3 (3.7)
2004-2005	44 (8.7)	3 (2)	9 (4.1)	3 (3.7)
2006-2007	34 (6.8)	12 (7.9)	13 (5.9)	2 (2.4)
2008-2009	47 (9.3)	10 (6.6)	6 (2.7)	3 (3.7)
2010-2011	39 (7.8)	1 (0.7)	11 (5)	0
2012-2013	31 (6.2)	3 (2)	4 (1.8)	0
2014-2015	25 (5)	0	3 (1.4)	2 (2.4)
2016-2017	17 (3.4)	0	6 (2.7)	1 (1.2)
2018-2019 [c]	11 (2.2)	1 (0.7)	3 (1.4)	0
Follow-up - median (min-max)	69.08 (0.43-314.08)	107.07 (3.29-237.63)	64.74 (0.36-181.45)	130.99 (15.2-144.9)

[a] Cases continue to be reported in this interval.

Abbreviations: TED=Transplant essential data, CRF=Comprehensive report form.

First adult autologous transplant for **Neuroblastoma, Medulloblastoma & Wilm's Tumor** registered to the CIBMTR, 1990-2019

	Neuroblastoma		Medulloblastoma		Wilm's Tumor
Characteristic	**TED**	**CRF**	**TED**	**CRF**	**TED**
	N (%)	N (%)	N (%)	N (%)	N (%)
No. of patients	138	30	182	29	38
No. of centers	79	26	90	24	34
Age at transplant, median (range), years - median (min-max)	23.98 (18.05-61.93)	22.63 (18.21-39.23)	26.84 (18.08-66.15)	28.48 (19.09-48.99)	24.98 (18.28-52.57)
Disease - no. (%)					
Neuroblastoma	138	30	0	0	0
Medulloblastoma	0	0	182	29	0
Wilms Tumor	0	0	0	0	38
Gender - no. (%)					
Male	77 (55.8)	16 (53.3)	117 (64.3)	17 (58.6)	21 (55.3)
Female	61 (44.2)	14 (46.7)	65 (35.7)	12 (41.4)	17 (44.7)
Graft type - no. (%)					
BM	8 (5.8)	3 (10)	11 (6)	3 (10.3)	4 (10.5)
PB	127 (92)	26 (86.7)	168 (92.3)	26 (89.7)	33 (86.8)
Missing	3 (2.2)	1 (3.3)	3 (1.6)	0	1 (2.6)
Year of transplant - no. (%)					
1990-1991	7 (5.1)	2 (6.7)	0	1 (3.4)	1 (2.6)
1992-1993	9 (6.5)	2 (6.7)	1 (0.5)	1 (3.4)	1 (2.6)
1994-1995	5 (3.6)	4 (13.3)	2 (1.1)	1 (3.4)	2 (5.3)
1996-1997	3 (2.2)	5 (16.7)	6 (3.3)	1 (3.4)	2 (5.3)
1998-1999	7 (5.1)	4 (13.3)	13 (7.1)	8 (27.6)	1 (2.6)
2000-2001	4 (2.9)	2 (6.7)	16 (8.8)	1 (3.4)	4 (10.5)
2002-2003	6 (4.3)	1 (3.3)	13 (7.1)	1 (3.4)	3 (7.9)
2004-2005	10 (7.2)	2 (6.7)	22 (12.1)	3 (10.3)	5 (13.2)
2006-2007	6 (4.3)	1 (3.3)	10 (5.5)	5 (17.2)	3 (7.9)
2008-2009	12 (8.7)	0	20 (11)	5 (17.2)	1 (2.6)
2010-2011	15 (10.9)	0	20 (11)	0	4 (10.5)
2012-2013	14 (10.1)	0	11 (6)	2 (6.9)	2 (5.3)
2014-2015	16 (11.6)	1 (3.3)	20 (11)	0	4 (10.5)
2016-2017	10 (7.2)	2 (6.7)	13 (7.1)	0	1 (2.6)
2018-2019 [c]	14 (10.1)	4 (13.3)	15 (8.2)	0	4 (10.5)
Follow-up - median (min-max)	59.77 (0.63-182.89)	86.18 (3.65-86.18)	68.06 (0-192.24)	82.27 (2.43-82.27)	62.11 (1.97-201.88)

[a] Cases continue to be reported in this interval.

Abbreviations: TED=Transplant essential data, CRF=Comprehensive report form.

First adult autologous transplant for **Ovarian/Testicular Cancer & Germ Cell Tumor** registered to the CIBMTR, 1990-2019

	Ovarian/ Testicular		Germ cell Tumor	
Characteristic	**TED**	**CRF**	**TED**	**CRF**
	N (%)	N (%)	N (%)	N (%)
No. of patients	3111	1147	1108	128
No. of centers	266	170	212	75
Age at transplant, median (range), years - median (min-max)	37.19 (18-73.07)	42.48 (18.04-75.92)	30.78 (18.05-69.05)	31.17 (18.74-57.58)
Disease - no. (%)				
Ovarian (epithelial)	1088 (35)	604 (52.7)	0	0
Testicular	2023 (65)	543 (47.3)	0	0
Germ cell tumor, extragonadal	0	0	1108	128
Gender - no. (%)				
Male	2025 (65.1)	541 (47.2)	966 (87.2)	106 (82.8)
Female	1086 (34.9)	606 (52.8)	142 (12.8)	22 (17.2)
Graft type - no. (%)				
BM	188 (6)	195 (17)	29 (2.6)	9 (7)
PB	2784 (89.5)	943 (82.2)	1067 (96.3)	118 (92.2)
Missing	139 (4.5)	9 (0.8)	12 (1.1)	1 (0.8)
Year of transplant - no. (%)				
1990-1991	146 (4.7)	98 (8.5)	4 (0.4)	5 (3.9)
1992-1993	138 (4.4)	126 (11)	20 (1.8)	7 (5.5)
1994-1995	194 (6.2)	197 (17.2)	36 (3.2)	6 (4.7)
1996-1997	360 (11.6)	230 (20.1)	14 (1.3)	6 (4.7)
1998-1999	374 (12)	171 (14.9)	90 (8.1)	11 (8.6)
2000-2001	149 (4.8)	74 (6.5)	94 (8.5)	8 (6.3)
2002-2003	158 (5.1)	44 (3.8)	71 (6.4)	7 (5.5)
2004-2005	180 (5.8)	36 (3.1)	69 (6.2)	12 (9.4)
2006-2007	128 (4.1)	26 (2.3)	95 (8.6)	8 (6.3)
2008-2009	93 (3)	78 (6.8)	52 (4.7)	21 (16.4)
2010-2011	230 (7.4)	7 (0.6)	80 (7.2)	3 (2.3)
2012-2013	229 (7.4)	18 (1.6)	102 (9.2)	3 (2.3)
2014-2015	261 (8.4)	15 (1.3)	129 (11.6)	11 (8.6)
2016-2017	244 (7.8)	21 (1.8)	118 (10.6)	9 (7)
2018-2019 [c]	227 (7.3)	6 (0.5)	134 (12.1)	11 (8.6)
Follow-up - median (min-max)	60.46 (0-315.36)	95.39 (1.15-240.69)	43.98 (0-241.35)	54.24 (1.22-183.26)

[a] Cases continue to be reported in this interval.

Abbreviations: TED=Transplant essential data, CRF=Comprehensive report form.

First adult autologous transplant for **Breast Cancer, Lung Cancer & CNS Tumor**[a] registered to the CIBMTR, 1990-2019

	Breast Cancer		Lung Cancer		CNS Tumor	
Characteristic	**TED**	**CRF**	**TED**	**CRF**	**TED**	**CRF**
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
No. of patients	17015	5647	87	119	587	107
No. of centers	277	199	42	26	130	46
Age at transplant, median (range), years - median (min-max)	45.94 (18.91-73.15)	45.92 (19.4-72.27)	50.43 (20.72-74.39)	50.26 (30.17-66.19)	32.87 (18.02-69.15)	33.98 (18.21-61.67)
Disease - no. (%)						
Breast cancer, NOS	14706 (86.4)	4983 (88.2)	0	0	0	0
BC, inflammatory	432 (2.5)	87 (1.5)	0	0	0	0
BC, non-inflammatory	1877 (11)	577 (10.2)				
Lung cancer, small cell	0	0	58 (66.7)	114 (95.8)	0	0
Lung cancer, non-small cell	0	0	22 (25.3)	5 (4.2)	0	0
Lung, not specified	0	0	7 (8)	0	0	0
CNS Tumor, including CNS PNET	0	0	0	0	587	107
Gender - no. (%)						
Male	134 (0.8)	27 (0.5)	47 (54)	64 (53.8)	377 (64.2)	65 (60.7)
Female	16881 (99.2)	5620 (99.5)	40 (46)	55 (46.2)	210 (35.8)	42 (39.3)
Graft type - no. (%)						
BM	1801 (10.6)	820 (14.5)	7 (8)	15 (12.6)	44 (7.5)	21 (19.6)
PB	13816 (81.2)	4822 (85.4)	73 (83.9)	104 (87.4)	501 (85.3)	86 (80.4)
Missing	1398 (8.2)	5 (0.1)	7 (8)	0	42 (7.2)	0
Year of transplant - no. (%)						
1990-1991	619 (3.6)	495 (8.8)	13 (14.9)	16 (13.4)	40 (6.8)	6 (5.6)
1992-1993	1852 (10.9)	930 (16.5)	8 (9.2)	30 (25.2)	37 (6.3)	7 (6.5)
1994-1995	3477 (20.4)	1269 (22.5)	19 (21.8)	28 (23.5)	38 (6.5)	12 (11.2)
1996-1997	5373 (31.6)	1473 (26.1)	13 (14.9)	34 (28.6)	71 (12.1)	13 (12.1)
1998-1999	4596 (27)	1273 (22.5)	16 (18.4)	11 (9.2)	81 (13.8)	17 (15.9)
2000-2001	755 (4.4)	181 (3.2)	11 (12.6)	0	45 (7.7)	12 (11.2)
2002-2003	150 (0.9)	19 (0.3)	1 (1.1)	0	33 (5.6)	4 (3.7)
2004-2005	79 (0.5)	5 (0.1)	2 (2.3)	0	49 (8.3)	4 (3.7)
2006-2007	18 (0.1)	0	0	0	23 (3.9)	6 (5.6)
2008-2009	43 (0.3)	2 (0)	3 (3.4)	0	27 (4.6)	17 (15.9)
2010-2011	39 (0.2)	0	0	0	36 (6.1)	0
2012-2013	13 (0.1)	0	0	0	31 (5.3)	4 (3.7)
2014-2015	0	0	0	0	34 (5.8)	2 (1.9)
2016-2017	0	0	1 (1.1)	0	20 (3.4)	1 (0.9)
2018-2019[c]	1 (0)	0	0	0	22 (3.7)	2 (1.9)
Follow-up - median (min-max)	136.74 (0-337.37)	115.59 (0.26-270.43)	45.82 (0.36-216.15)	58.32 (3.78-192.6)	66.32 (0-263.36)	83.95 (0.76-215.76)

[a] Includes CNS PNET.

[b] Cases continue to be reported in this interval.

Abbreviations: BC=Breast cancer, CNS=Central nervous system, PNET=Primitive neuroectodermal tumor, TED=Transplant essential data, CRF=Comprehensive report form.

Recipients of first adult allogeneic transplant for **Adult Solid Tumor** registered to the CIBMTR, 1990-2019

	Hepatobiliary		Renal carcinoma/kidney		Ovarian cancer		Breast cancer	
	TED	CRF	TED	CRF	TED	CRF	TED	CRF
Characteristics	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Number of patients	**13**	**12**	**267**	**210**	**15**	**9**	**93**	**89**
Year of transplant								
1990-1991	0	0	0	0	1 (7)	0	2 (2)	2 (2)
1992-1993	0	0	0	0	0	0	2 (2)	3 (3)
1994-1995	0	0	0	0	1 (7)	0	3 (3)	12 (13)
1996-1997	0	2 (17)	1 (<1)	0	0	0	11 (12)	24 (27)
1998-1999	0	2 (17)	19 (7)	2 (<1)	2 (13)	2 (22)	14 (15)	23 (26)
2000-2001	1 (8)	3 (25)	102 (38)	121 (58)	2 (13)	0	22 (24)	12 (13)
2002-2003	6 (46)	3 (25)	114 (43)	55 (26)	4 (27)	2 (22)	17 (18)	5 (6)
2004-2005	3 (23)	2 (17)	19 (7)	21 (10)	2 (13)	5 (56)	13 (14)	7 (8)
2006-2007	3 (23)	0	2 (<1)	5 (2)	0	0	6 (6)	1 (1)
2008-2009	0	0	4 (1)	6 (3)	1 (7)	0	2 (2)	0
2010-2011	0	0	6 (2)	0	1 (7)	0	1 (1)	0
2014-2015	0	0	0	0	1 (7)	0	0	0
2016-2017	0	0	0	0	0	0	0	0
2018-2019[c]	0	0	0	0	0	0	0	0

Characteristics	TED N (%)	CRF N (%)
Other disease	**172**	**79**
Other malignant, unknown	78 (45)	26 (33)
Head and neck	1 (<1)	1 (1)
Lung cancer, small cell	3 (2)	1 (1)
Lung cancer, non-small cell	6 (4)	0
Pancreas	7 (4)	6 (8)
Prostate	8 (5)	2 (3)
Testis	6 (3)	6 (8)
Cervical	0	1 (1)
Sarcoma unspecified	10 (6)	3 (4)
Bone sarcoma (exc. Ewing)	9 (5)	6 (8)
CNS tumors	1 (<1)	4 (5)

(continued on next column)

	TED	CRF
	N (%)	N (%)
(continued)		
Wilm tumor	1 (<1)	1 (1)
Ewing sarcoma	18 (11)	14 (18)
Germ cell tumor	7 (5)	3 (4)
Medulloblastoma	2 (<1)	1 (1)
PNET	0	1 (1)
Gastric malignancy	1 (<1)	0
Thymoma	1 (<1)	1 (1)
Rhabdomyasarcoma	9 (5)	2 (3)
Leiomyosarcoma	1 (<1)	0
Fibrosarcoma	2 (1)	0
Synovial sarcoma	1 (<1)	0

Abbreviations: CNS=Central nervous system, PNET=Primitive neuroectodermal tumor, TED=Transplant essential data, CRF=Comprehensive report form.

Unrelated Donor HCT Research Sample Inventory - Summary for First Allogeneic Transplants in CRF and TED with biospecimens available through the CIBMTR Repository stratified by availability of paired samples, recipient only samples and donor only samples, Biospecimens include: whole blood, serum/plasma and limited quantities of viable cells and cell lines (collected prior to 2006), Specific inventory queries available upon request through the CIBMTR Immunobiology Research Program

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
Number of patients	793	235	128
Source of data			
CRF	363 (46)	105 (45)	49 (38)
TED	430 (54)	130 (55)	79 (62)
Number of centers	115	68	62
Disease at transplant			
Plasma Cell Disorders, MM	793 (100)	235 (100)	128 (100)
Recipient age at transplant			
10-19 years	3 (<1)	0	1 (1)
20-29 years	5 (1)	4 (2)	1 (1)
30-39 years	68 (9)	24 (10)	12 (9)
40-49 years	229 (29)	62 (26)	28 (22)
50-59 years	346 (44)	106 (45)	59 (46)
60-69 years	140 (18)	38 (16)	27 (21)
70+ years	2 (<1)	1 (<1)	0
Median (Range)	53 (10-71)	53 (22-72)	54 (18-69)
Recipient race/ethnicity			
Caucasian, non-Hispanic	672 (86)	204 (87)	98 (91)
African-American, non-Hispanic	52 (7)	18 (8)	3 (3)
Asian, non-Hispanic	15 (2)	4 (2)	2 (2)
Pacific islander, non-Hispanic	1 (<1)	1 (<1)	0
Native American, non-Hispanic	2 (<1)	1 (<1)	0
Hispanic	39 (5)	6 (3)	5 (5)
Unknown	12 (N/A)	1 (N/A)	20 (N/A)
Recipient sex			
Male	491 (62)	154 (66)	84 (66)
Female	302 (38)	81 (34)	44 (34)
Karnofsky score			
10-80	318 (40)	108 (46)	53 (41)
90-100	443 (56)	120 (51)	70 (55)
Missing	32 (4)	7 (3)	5 (4)
HLA-A B DRB1 groups - low resolution			
5/6	94 (12)	23 (12)	10 (8)
6/6	679 (88)	175 (88)	109 (92)
Unknown	20 (N/A)	37 (N/A)	9 (N/A)
High-resolution HLA matches available out of 8			
<=5/8	7 (1)	0	0
6/8	25 (3)	1 (1)	3 (3)
7/8	121 (17)	22 (14)	18 (20)
8/8	566 (79)	132 (85)	71 (77)

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
Unknown	74 (N/A)	80 (N/A)	36 (N/A)
HLA-DPB1 Match			
Double allele mismatch	108 (28)	12 (20)	4 (20)
Single allele mismatch	217 (57)	29 (48)	12 (60)
Full allele matched	56 (15)	19 (32)	4 (20)
Unknown	412 (N/A)	175 (N/A)	108 (N/A)
High resolution release score			
No	467 (59)	234 (>99)	126 (98)
Yes	326 (41)	1 (<1)	2 (2)
KIR typing available			
No	725 (91)	235 (100)	128 (100)
Yes	68 (9)	0	0
Graft type			
Marrow	135 (17)	31 (13)	18 (14)
PBSC	655 (83)	204 (87)	110 (86)
BM+PBSC	2 (<1)	0	0
PBSC+UCB	1 (<1)	0	0
Number of cord blood units			
1	1 (100)	0	0
Conditioning regimen			
Myeloablative	294 (37)	97 (41)	57 (45)
RIC/Nonmyeloablative	491 (62)	134 (57)	69 (54)
TBD	8 (1)	4 (2)	2 (2)
Donor age at donation			
To Be Determined/NA	9 (1)	37 (16)	3 (2)
10-19 years	17 (2)	11 (5)	0
20-29 years	342 (43)	88 (37)	50 (39)
30-39 years	213 (27)	60 (26)	41 (32)
40-49 years	148 (19)	27 (11)	26 (20)
50+ years	64 (8)	12 (5)	8 (6)
Median (Range)	31 (18-61)	30 (18-58)	33 (20-57)
Donor/Recipient CMV serostatus			
+/+	187 (24)	59 (26)	26 (21)
+/-	78 (10)	35 (15)	14 (11)
-/+	237 (30)	65 (29)	37 (30)
-/-	283 (36)	69 (30)	47 (38)
Unknown	8 (N/A)	7 (N/A)	4 (N/A)
GvHD Prophylaxis			
Ex vivo T-cell depletion	14 (2)	7 (3)	3 (2)
CD34 selection	56 (7)	18 (8)	10 (8)
Post-CY + other(s)	23 (3)	5 (2)	4 (3)
Tacrolimus + MMF +- others	140 (18)	22 (9)	19 (15)
Tacrolimus + MTX +- others (except MMF)	283 (36)	109 (46)	31 (24)
Tacrolimus + others (except MTX, MMF)	41 (5)	12 (5)	5 (4)
Tacrolimus alone	23 (3)	5 (2)	4 (3)
CSA + MMF +- others (except Tacrolimus)	126 (16)	24 (10)	24 (19)
CSA + MTX +- others (except Tacrolimus, MMF)	43 (5)	16 (7)	15 (12)

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
CSA + others (except Tacrolimus, MTX, MMF)	5 (1)	2 (1)	4 (3)
CSA alone	8 (1)	4 (2)	2 (2)
Other GVHD prophylaxis	21 (3)	9 (4)	4 (3)
Missing	10 (1)	2 (1)	3 (2)
Donor/Recipient sex match			
Male-Male	341 (43)	92 (40)	56 (46)
Male-Female	186 (24)	51 (22)	27 (22)
Female-Male	143 (18)	56 (25)	26 (21)
Female-Female	114 (15)	29 (13)	13 (11)
CB - recipient M	1 (<1)	0	0
Unknown	8 (N/A)	7 (N/A)	6 (N/A)
Year of transplant			
1986-1990	1 (<1)	0	0
1991-1995	15 (2)	4 (2)	5 (4)
1996-2000	46 (6)	16 (7)	8 (6)
2001-2005	107 (13)	14 (6)	17 (13)
2006-2010	251 (32)	44 (19)	33 (26)
2011-2015	264 (33)	80 (34)	43 (34)
2016-2019	109 (14)	77 (33)	22 (17)
Follow-up among survivors, Months			
N Eval	191	83	40
Median (Range)	48 (2-288)	36 (0-194)	48 (3-195)

Unrelated Cord Blood Transplant Research Sample Inventory - Summary for First Allogeneic Transplants in CRF and TED with biospecimens available through the CIBMTR Repository stratified by availability of paired, recipient only and cord blood only samples, Biospecimens include: whole blood, serum/plasma and limited quantities of viable cells and cell lines (collected prior to 2006-recipient only), Specific inventory queries available upon request through the CIBMTR Immunobiology Research Program

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
Number of patients	35	10	7
Source of data			
CRF	27 (77)	6 (60)	3 (43)
TED	8 (23)	4 (40)	4 (57)
Number of centers	18	8	5
Disease at transplant			
Plasma Cell Disorders, MM	35 (100)	10 (100)	7 (100)
Recipient age at transplant			
20-29 years	1 (3)	0	0
30-39 years	2 (6)	0	0
40-49 years	9 (26)	1 (10)	3 (43)
50-59 years	21 (60)	6 (60)	2 (29)
60-69 years	2 (6)	3 (30)	2 (29)
Median (Range)	51 (22-64)	57 (48-67)	53 (42-70)
Recipient race/ethnicity			
Caucasian, non-Hispanic	18 (56)	5 (56)	3 (60)
African-American, non-Hispanic	9 (28)	3 (33)	1 (20)
Asian, non-Hispanic	1 (3)	0	1 (20)
Hispanic	4 (13)	1 (11)	0
Unknown	3 (N/A)	1 (N/A)	2 (N/A)
Recipient sex			
Male	20 (57)	7 (70)	3 (43)
Female	15 (43)	3 (30)	4 (57)
Karnofsky score			
10-80	11 (31)	3 (30)	4 (57)
90-100	24 (69)	5 (50)	3 (43)
Missing	0	2 (20)	0
HLA-A B DRB1 groups - low resolution			
4/6	20 (63)	3 (43)	6 (86)
5/6	12 (38)	3 (43)	1 (14)
6/6	0	1 (14)	0
Unknown	3 (N/A)	3 (N/A)	0 (N/A)
High-resolution HLA matches available out of 8			
<=5/8	20 (80)	3 (75)	3 (75)
6/8	3 (12)	1 (25)	1 (25)
7/8	2 (8)	0	0
Unknown	10 (N/A)	6 (N/A)	3 (N/A)
HLA-DPB1 Match			
Double allele mismatch	1 (14)	0	1 (50)
Single allele mismatch	5 (71)	0	1 (50)
Full allele matched	1 (14)	0	0

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
Unknown	28 (N/A)	10 (N/A)	5 (N/A)
High resolution release score			
No	32 (91)	10 (100)	7 (100)
Yes	3 (9)	0	0
KIR typing available			
No	32 (91)	10 (100)	7 (100)
Yes	3 (9)	0	0
Number of cord blood units			
1	27 (77)	0	4 (57)
2	8 (23)	0	3 (43)
Unknown	0 (N/A)	10 (N/A)	0 (N/A)
Graft type			
UCB	33 (94)	10 (100)	5 (71)
PBSC+UCB	2 (6)	0	2 (29)
Conditioning regimen			
Myeloablative	12 (34)	4 (40)	2 (29)
RIC/Nonmyeloablative	22 (63)	5 (50)	5 (71)
TBD	1 (3)	1 (10)	0
Donor age at donation			
To Be Determined/NA	3 (9)	1 (10)	0
0-9 years	32 (91)	9 (90)	5 (71)
10-19 years	0	0	1 (14)
50+ years	0	0	1 (14)
Median (Range)	2 (1-7)	4 (1-10)	3 (1-63)
Donor/Recipient CMV serostatus			
+/+	8 (23)	3 (30)	2 (29)
+/-	4 (11)	2 (20)	1 (14)
-/+	5 (14)	1 (10)	2 (29)
-/-	2 (6)	2 (20)	0
CB - recipient +	10 (29)	0	1 (14)
CB - recipient -	6 (17)	0	1 (14)
CB - recipient CMV unknown	0	2 (20)	0
GvHD Prophylaxis			
CD34 selection	1 (3)	0	0
Tacrolimus + MMF +- others	11 (31)	3 (30)	1 (14)
Tacrolimus + MTX +- others (except MMF)	1 (3)	0	2 (29)
Tacrolimus + others (except MTX, MMF)	1 (3)	0	0
Tacrolimus alone	0	2 (20)	0
CSA + MMF +- others (except Tacrolimus)	14 (40)	4 (40)	2 (29)
CSA + MTX +- others (except Tacrolimus, MMF)	0	1 (10)	0
CSA alone	0	0	2 (29)
Other GVHD prophylaxis	6 (17)	0	0
Missing	1 (3)	0	0
Donor/Recipient sex match			
CB - recipient M	20 (57)	7 (70)	3 (43)
CB - recipient F	15 (43)	3 (30)	4 (57)
Year of transplant			

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
2006-2010	6 (17)	4 (40)	3 (43)
2011-2015	25 (71)	4 (40)	3 (43)
2016-2019	4 (11)	2 (20)	1 (14)
Follow-up among survivors, Months			
N Eval	4	2	1
Median (Range)	42 (25-72)	68 (64-72)	4 (4-4)

Related Donor HCT Research Sample Inventory - Summary for First Allogeneic Transplants in CRF and TED with biospecimens available through the CIBMTR Repository stratified by availability of paired, recipient only and donor only samples, Biospecimens include: whole blood, serum/plasma and limited quantities of viable cells and cell lines (collected prior to 2006), Specific inventory queries available upon request through the CIBMTR Immunobiology Research Program

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
Number of patients	230	33	18
Source of data			
CRF	83 (36)	7 (21)	7 (39)
TED	147 (64)	26 (79)	11 (61)
Number of centers	30	10	5
Disease at transplant			
Plasma Cell Disorders, MM	230 (100)	33 (100)	18 (100)
Recipient age at transplant			
20-29 years	3 (1)	0	0
30-39 years	10 (4)	1 (3)	0
40-49 years	61 (27)	8 (24)	3 (17)
50-59 years	97 (42)	17 (52)	9 (50)
60-69 years	56 (24)	7 (21)	6 (33)
70+ years	3 (1)	0	0
Median (Range)	55 (26-75)	55 (35-69)	55 (43-65)
Recipient race/ethnicity			
Caucasian, non-Hispanic	149 (67)	21 (64)	12 (67)
African-American, non-Hispanic	23 (10)	6 (18)	3 (17)
Asian, non-Hispanic	11 (5)	1 (3)	1 (6)
Pacific Islander, non-Hispanic	2 (1)	0	0
Native American, non-Hispanic	1 (<1)	0	0
Hispanic	38 (17)	5 (15)	2 (11)
Unknown	6 (N/A)	0 (N/A)	0 (N/A)
Recipient sex			
Male	135 (59)	25 (76)	11 (61)
Female	95 (41)	8 (24)	7 (39)
Karnofsky score			
10-80	88 (38)	11 (33)	5 (28)
90-100	138 (60)	22 (67)	12 (67)
Missing	4 (2)	0	1 (6)
Graft type			
Marrow	18 (8)	1 (3)	3 (17)
PBSC	212 (92)	32 (97)	13 (72)
PBSC+UCB	0	0	2 (11)
Conditioning regimen			
Myeloablative	84 (37)	16 (48)	8 (44)
RIC/Nonmyeloablative	146 (63)	17 (52)	10 (56)
Donor age at donation			
To Be Determined/NA	1 (<1)	0	1 (6)
0-9 years	1 (<1)	0	0
10-19 years	4 (2)	0	0

Variable	Samples Available for Recipient and Donor N (%)	Samples Available for Recipient Only N (%)	Samples Available for Donor Only N (%)
20-29 years	20 (9)	1 (3)	1 (6)
30-39 years	19 (8)	3 (9)	5 (28)
40-49 years	55 (24)	8 (24)	0
50+ years	130 (57)	21 (64)	11 (61)
Median (Range)	52 (0-76)	54 (29-69)	56 (29-65)
Donor/Recipient CMV serostatus			
+/+	91 (40)	13 (39)	6 (33)
+/-	24 (11)	5 (15)	2 (11)
-/+	46 (20)	6 (18)	5 (28)
-/-	67 (29)	9 (27)	5 (28)
Unknown	2 (N/A)	0 (N/A)	0 (N/A)
GvHD Prophylaxis			
Ex-vivo T-cell depletion	2 (1)	0	0
CD34 selection	0	1 (3)	0
Post-CY + other(s)	34 (15)	3 (9)	3 (17)
TAC + MMF +- other(s) (except post-CY)	26 (11)	2 (6)	1 (6)
TAC + MTX +- other(s) (except MMF, post-CY)	104 (45)	20 (61)	10 (56)
TAC + other(s) (except MMF, MTX, post-CY)	8 (3)	3 (9)	1 (6)
TAC alone	2 (1)	1 (3)	0
CSA + MMF +- other(s) (except post-CY)	6 (3)	0	0
CSA + MTX +- other(s) (except MMF, post-CY)	5 (2)	0	0
CSA + other(s) (except MMF, MTX, post-CY)	1 (<1)	1 (3)	0
CSA alone	1 (<1)	0	0
Other(s)	15 (7)	0	1 (6)
Missing	26 (11)	2 (6)	2 (11)
Donor/Recipient sex match			
Male-Male	79 (34)	16 (48)	8 (44)
Male-Female	43 (19)	3 (9)	3 (17)
Female-Male	55 (24)	9 (27)	2 (11)
Female-Female	52 (23)	5 (15)	3 (17)
CB - recipient M	0	0	1 (6)
CB - recipient F	0	0	1 (6)
Unknown	1 (N/A)	0 (N/A)	0 (N/A)
Year of transplant			
2006-2010	27 (12)	7 (21)	6 (33)
2011-2015	113 (49)	19 (58)	8 (44)
2016-2019	90 (39)	7 (21)	4 (22)
Follow-up among survivors, Months			
N Eval	122	11	8
Median (Range)	36 (3-131)	48 (6-121)	39 (13-122)

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TO: Plasma Cell Disorders and Adult Solid Tumors Working Committee Members

FROM: Parameswaran Hari, MD, MS; Scientific Director and Anita D'Souza, MD; Assistant Scientific Director for the Plasma Cell Disorders and Adult Solid Tumors Working Committee

RE: Studies in Progress Summary

MM17-01: Hematopoietic cell transplantation for primary plasma cell leukemia in the era of novel agents (S Girnius/S Patel/L Bachegowda/B Dhakal). This study looks to evaluate transplant outcomes of patients aged ≥ 18 years with pPCL who underwent autologous HCT and allogeneic. The paper has been submitted. The goal of the study is to publish paper by March 2020.

MM17-02: The Impact of Bortezomib Based Induction Therapy vs No Induction Therapy on Outcomes for Light Chain Amyloidosis (R Cornell/S Goodman/L Costa) This study looks to compare pre-transplant bortezomib-based induction therapy with no induction therapy prior to autologous hematopoietic cell transplantation and evaluate transplant outcomes in patients with light chain (AL) amyloidosis. Study was delayed pending IT updates with data retrieval for AL amyloidosis. Analysis has been finalized. The goal of this study is to submit manuscript by June 2020.

MM18-01: Racial Discrepancy in Clinical Outcomes of Multiple Myeloma Patients with and without t(11;14) Genetic Abnormality (T Badar) This study looks to assess the effects of t(11;14) on survival outcomes between African American and Whites with multiple myeloma who underwent high dose melphalan plus autologous hematopoietic cell transplantation. The paper has been submitted. The goal of the study is to publish paper by March 2020.

MM18-02: Deriving a prognostic score for patients undergoing high dose therapy and autologous SCT for myeloma and examining validity of this in long-term exceptional responders (A Hall/B Dhakal/Z Gahvari/S Chhabra/N Callander) This study looks to identify pre-transplant factors that can help develop a prognostic score at the time of transplant. The purpose of this score is to help predict outcomes in transplant eligible myeloma patients. The study is in manuscript preparation. The goal is to submit paper by March 2020.

MM18-03: To compare the outcomes in young patients with multiple myeloma at diagnosis undergoing autologous or allogeneic hematopoietic stem cell transplant (HCT) with older patients: progression-free and overall survival in a case match analysis (P Munshi/A Jurczyszyn/J Zaucha/D Vesole) This study looks to assess the outcomes of upfront autologous HCT by different age groups (20-39, 40-49, 50-59, 60-69 and ≥ 70). The study is in manuscript preparation. The goal is to submit paper by March 2020.

MM18-04: Busulfan, Melphalan, and Bortezomib versus High-Dose Melphalan as a Conditioning Regimen for Autologous Hematopoietic Stem Cell Transplantation in Multiple Myeloma: Long Term Follow Up of a Novel Conditioning Regimen (P Hagen/P Stiff) This study looks to update the outcomes among multiple myeloma patients treated on a phase I/II BUMELVEL cohort and a CIBMTR MEL 200 control cohort. The paper has been submitted. The goal of the study is to publish paper by March 2020.

MM19-01 Impact of Induction Therapy with VRD vs. VCD on Outcomes in Patients with Multiple Myeloma Undergoing Stem Cell Transplantation (S Sidana/M Norkin/S Kumar/S Giralt) This study looks to evaluate outcomes in patients with newly diagnosed MM receiving VCD induction therapy compared with patients receiving VRD induction therapy prior to ASCT. The study is in protocol development. The goal of this study is to have the protocol finalized by April 2020 and proceed to analysis.

MM19-02 Maintenance therapy after second autologous hematopoietic cell transplantation for Multiple Myeloma. (O Pasvolsky/ M Yeshurun U Rozovski/ L Alon) This study looks to evaluate the effect of maintenance therapy given after second AHCT on PFS and OS of MM patients. The study is in protocol development. The goal of this study is to have protocol finalized by July 2020 and proceed to analysis.

MM19-03 Second autologous stem cell transplantation as salvage therapy for relapsed or refractory AL amyloidosis (C Tan/H Fung) The study looks to identify potential prognostic factors after a second course of high-dose chemotherapy and autologous stem cell transplant in patients with relapsed/refractory AL amyloidosis and estimate the outcomes at 2 and 5 years. The study is in protocol development. The goal of this study is to have the protocol finalized by Oct 2020 and proceed to analysis.

Proposal: 1911-95

Title:
Serum Free light Chain measurement following Autologous Hematopoietic Cell Transplantation is predictive of outcomes in Multiple Myeloma

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Hypothesis:
Normalization of serum free light chain ratio and reduction of involved serum free light chain at day +100, day +180 and day+365 following autologous hematopoietic cell transplantation (Auto-HCT) are independently predictive of superior progression free and overall survival in multiple myeloma

Specific aims:
- To assess prognostic impact of autologous HCT patients' normalization of serum free light chain ratio at day +100, day +180, and day+365 with relapse, PFS and OS
- To analyze the impact of % change in involved FLC from baseline and day +100, day +180, and day+365 post-Auto-HCT on relapse, PFS and OS
- To analyze disease and patient specific characteristics that are associated with normalization of serum free light chain ratio at day +100, day +180, and day+365 post Auto-HCT

Scientific justification:
Multiple myeloma (MM) is the second most common hematologic malignancy in the world. Despite improvement in outcome, the disease is still incurable for most patients. However, not all myeloma are the same. With the same treatment, some patients can have very long survival whereas others can have very short survival. This suggests that there is underlying heterogeneity in myeloma(1)
Measurements of serum kappa and lambda serum free light chain (*s*FLC) and their ratio are useful makers for diagnosis and monitoring of various plasma cell dyscrasias, including myeloma. FLC assays could be used to follow the disease course in nearly all multiple myeloma patients. In addition, because of their short serum half-life, changes in serum FLC concentrations provide a rapid indication of the response to treatment (2). Recently, normalization of *s*FLCκ/λ ratio and negativity of clonal plasma cells by immunohistochemistry or immunofluorescence were incorporated into the more stringent degree of response, stringent CR (sCR) definition proposed by the International Myeloma Working Group (IMWG)(3,4).
Serum FLC assays have proven useful markers of progressive disease, and may identify relapse earlier than traditional methods. In immunologically intact MM patients who relapse early after successful treatment, the short half-life of sFLCs offer a distinctive advantage over serum IFE for detecting progression, particularly in IgG MM patients. Serum FLC also has greater sensitivity for detecting residual disease preceding clinical relapse and for identifying light chain escape (5).
Previous studies have explored the potential role of sFLC monitoring in MM, typically as response to initial therapy , demonstrating favorable prognosis with normalization of sFLC following induction therapy (6–8). There are however, fewer studies reported investigating prognostic value of sFLC normalization following auto-HCT. Kapoor et al was able to demonstrate achieving sCR following auto-HCT, which requires normalization of light chain ratio in addition to CR criteria per IMWG criteria, was correlative with improved outcomes(9).

Gentili et al was able to show in 211 patients that normalization of sFLC ratio on day +90 following Auto-HCT may predict for PFS more accurately than the reduction of M-protein, independent of pre-transplant response(10). A Mayo clinic study reported suppression of involved serum free light chain within 12 months of auto-HCT (defined as clonal or involved FLC reduced below the value of the uninvolved FLC) was associated with improved time to progression and overall survival compared to those who did not have suppression(11). In contrast, a study by Trieu et al showed no significant difference in the PFS of patients with abnormal vs. normal free kappa light chains or FLC ratio following auto-HCT (12).
Given the lack of clarity regarding the role of normalization of FLC ratio following auto-HCT, we propose to utilize the Center for International Blood and Marrow Transplantation Research (CIBMTR) database to investigate impact of sFLC as a prognostic marker following auto-HCT on outcomes in MM.

The impact of such a study would be that sFLC could be considered a surrogate marker of long term outcomes following auto-HCT independent of assessment of sCR, and could guide post-transplant therapies to improve outcomes.

Patient eligibility population:
Inclusion criteria:

- Multiple Myeloma patients >18 years of age, undergoing HDT/ASCT and reported to CIBMTR from 2005-2016
- Pts with sFLC ratio of involved FLC/uninvolved FLC at diagnosis at 2:1 or greater
- Pts with involved sFLC (⩾2 mg/dl) or greater

Exclusion criteria:

- MM patients undergoing allogeneic stem cell transplant (allo-HCT)
- Other plasma cell dyscrasias besides MM undergoing with either ASCT or allo-HCT.
- Non-secretory MM

Outcomes:

- Progression-free survival (PFS): survival without relapse/progression or death. Relapse or progression of disease and death are events. Those who survive without recurrence or progression are censored at last contact.
- Overall survival (OS): time to death. Death from any cause
- Relapse/Progression: Cumulative incidence of disease relapse/progression at 1, 3, and 5 years, with NRM as competing event.
- Non-relapse mortality (NRM): Cumulative incidence of NRM at day 100 and 1, and 3 years. NRM is defined as death without preceding disease relapse/progression. Relapse/progression are competing events.

Data requirements:
Patient-related:

- Age at ASCT, years: 18-29; 30-39; 40-49, 50-59, ≥60 years and continuous
- Sex: male vs. female
- Karnofsky performance score: ≥80% vs. <80%
- Race: White vs. Black vs. Asian/pacific islander vs. Hispanic vs. others
- Hematopoietic cell transplantation co-morbidity index (HCT-CI) (≥3 vs. <3)

- International staging system (ISS)/ Durie Salmon Stage: I vs. II vs. III vs. Revised ISS (R-ISS) (if available)

Disease related:

- Serum free light chain (FLC) at diagnosis
    - sFLC ratio at diagnosis (involved/ uninvolved): low (≤10:1), high (10:1-99:1), very high (≥100:1)
    - involved FLC at diagnosis (mg/L): low (≤10), high (10-99), very high (≥100)
    - dFLC (dFLC, difference between iFLC and uninvolved FLC)
- Immunochemical subtype: IgG vs. IgA vs. light chain vs. others
- Hemoglobin at transplant, g/dl: continuous
- Creatinine at transplant: <2mg/dl vs. ≥2 mg/dl
- Cytogenetics: High risk vs. standard risk

Transplant related:

- Total No. of CD34+ cells infused (×106/kg), continuous
- Melphalan dose, mg/m2 (200 versus <200)
- Lines of chemotherapy prior to transplant (0 vs 1 vs >1)
- Chemotherapy (doublet versus triplet; IMID containing; PI containing)
- Disease status at HCT (CR vs VGPR vs PR vs SD vs. other)
- Time from diagnosis to transplant (<6 months vs. 6-12 months vs. 12-24 months)
- Year of transplant, by year

Post-transplant related:

- Serum free light chain (FLC) at day +100 and day +180
    - sFLC ratio (involved/ uninvolved)
    - involved FLC (mg/L)
    - dFLC (dFLC, difference between iFLC and uninvolved FLC)
- Post-ASCT therapy
    - Maintenance therapy (Yes/No, type of maintanence therapy)
    - Consolidation therapy (Yes/No; type of consolidation therapy)
- Median follow-up of patients from the time of diagnosis, months

Study design:

Descriptive tables of patient-, disease-, and transplant-related factors will be prepared. These tables will list median and range for continuous variables and percent of total for categorical variables. The product-limit estimator proposed by Kaplan-Meier will be used to estimate the median and range of the follow-up time. Probability of progression-free survival and overall survival will be calculated using the Kaplan-Meier estimator, with the variance estimated by Greenwood's formula. Values for other endpoints will be generated using cumulative incidence estimates. Comparison of survival curves will be done using the log-rank test.

Multivariate analyses will be performed using proportional hazards models. These analyses will fit models to determine which risk factors may be related to a given outcome. All variables will first be examined to assure that they comply with the proportional hazards assumption. Factors found to have non-proportional hazards will be adjusted for in subsequent analyses. A stepwise model building approach will then be used to develop models for relapse, treatment-related mortality, progression-free survival and overall survival.

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Table 1. Characteristics of patients who underwent 1st PB melphalan based autoHCT for Multiple Myeloma from 2008-2018 and reported with CIBMTR, CRF

Characteristic	AUTO HCT
No. of patients	6524
No. of centers	161
median age (range) - median (min-max)	60.27 (20.17-82.6)
Age at transplant, years - no. (%)	
18-39	193 (3)
40-49	832 (12.8)
50-59	2167 (33.2)
60-69	2758 (42.3)
70+	574 (8.8)
Gender - no. (%)	
Male	3603 (55.2)
Female	2921 (44.8)
region - no. (%)	
US	6278 (96.2)
88	246 (3.8)
Race - no. (%)	
Caucasian	4006 (61.4)
2	1990 (30.5)
88	349 (5.3)
Missing	179 (2.7)
Karnofsky score - no. (%)	
≥ 90	3446 (52.8)
< 90	2907 (44.6)
Missing	171 (2.6)
HCT-CI - no. (%)	
0	1964 (30.1)
1	956 (14.7)
2	1060 (16.2)
3+	2506 (38.4)
Missing	38 (0.6)
Kappa/Lambda light chain available @ dx and 100d - no. (%)	
No	3578 (54.8)
Yes	2946 (45.2)
Immunochemical subtype - no. (%)	
IgG	3849 (59)

Characteristic	AUTO HCT
IgA	1259 (19.3)
IgD	41 (0.6)
IgE	3 (0)
IgM	22 (0.3)
Light chain	1268 (19.4)
Non-secretory	79 (1.2)
Unknown Type	3 (0)
ISS stage at diagnosis - no. (%)	
ISS/DS stage I	1978 (30.3)
ISS/DS stage II	1821 (27.9)
ISS/DS stage III	1319 (20.2)
Missing	1406 (21.6)
Disease status prior to transplant - no. (%)	
sCR/CR	1001 (15.3)
VGPR	2273 (34.8)
PR	2650 (40.6)
SD	392 (6)
PD/Relapse	186 (2.9)
Missing	22 (0.3)
Time from diagnosis to transplant - no. (%)	
< 6 months	2016 (30.9)
6 - 12 months	3081 (47.2)
12 - 24 months	888 (13.6)
≥ 24 months	539 (8.3)
Year of transplant - no. (%)	
2008	862 (13.2)
2009	300 (4.6)
2010	234 (3.6)
2011	323 (5)
2012	319 (4.9)
2013	609 (9.3)
2014	531 (8.1)
2015	674 (10.3)
2016	750 (11.5)
2017	671 (10.3)
2018	1251 (19.2)
Follow-up - median (min-max)	38.06 (0.46-138.13)

Proposal: 1911-96

Title:
Prexisting malignancy as risk factor for development of new primary malignancy following Autologous Stem Cell Transplantation and Maintenance therapy in Multiple Myeloma

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Hypothesis:
Preexisting malignancy increases risk of post-autologous hematopoietic cell transplant new malignancy in patients with multiple myeloma

Specific aims:
Determine if presence of preexisting malignancy increase risk of developing new post-transplant malignancy in patients who have undergone autologous stem cell transplantation for multiple myeloma compared to those without preexisting malignancy.

Scientific justification:
With the introduction of novel agents such as proteasome inhibitors and immunomodulatory drugs in conjunction of improved supportive care in autologous stem cell transplantation, survival rates in multiple myeloma continue to increase. Multiple studies have demonstrated significant benefit in progression free survival with autologous stem cell transplantation followed by maintenances therapy.(1–4) With increased survival, there is renewed concerns regarding risk of secondary primary malignancies. Multiple myeloma diagnosis itself serves as a risk factor of developing new primary malignancy (NPM) with registry studies reporting incidence of NPM ranging from 2-6%(5). The addition of lenalidomide has been shown as well to increase the risk of developing NPM as has been shown in randomized trials comparing lenalidomide maintenance to no maintanence.therapy(4).
Studies have shown that prior or synchronously different malignancies are more common than NPMs in MM, occurring in 3%–24% of patients and thus representing a possible confounding factor when a diagnosis of NPM is suspected(5). These patients have prior exposure to chemotherapy or radiation therapy, increasing their risk of developing a SPM. One abstract has reported no increased risk of developing NPM as result of a prior malignancy(6), however this does not take into account stem cell transplantation or maintenance therapy risk on developing NPM, although reported that developing NPM in era of novel therapy confers worse survival(7).
Also noteworthy that the risk of other hematologic malignancies appears strikingly increased in patients with MM, specifically AML, whose risk is consistently elevated in all the studies reviewed with risk ratios between 3 and 20-fold higher than the general population (8) . Acute lymphoblastic leukemia (ALL) appears increased in patients with MM, although at a lower degree than AML), and has been reported in post-autologous transplant recipients receiving lenalidomide maintenance therapy(9,10).
The question often arises over choice of maintenance therapy in myeloma in setting of prior history of malignancy. One retrospective study compared incidence of secondary malignancies between bortezomib and lenalidomide maintanence with 5.4% of those receiving lenalidomide experiencing secondary primary malignancies (SPMs) compared with 3% for bortezomib. This study was limited by small number of patients and lack of patients with cancer diagnosis prior to myeloma diagnosis being evaluated(11)

This proposal serves to elucidate the question with the use of the CIBMTR regarding the impact of preexisting malignancy on development of new primary malignancy and additional factors that may increase risk including choice of maintenance therapy.

Study population:
All patients with multiple myeloma age 18 or older who have undergone autologous stem cell transplantation with history of prior solid tumor as reported by HCT-CI and were reported to CIBMTR between 2008 and 2015.
Exclusion:

- pts with diagnosis of amyloidosis and primary plasma cell leukemia
- pts who received allogeneic stem cell transplantation

Outcomes:

- Cumulative incidence of new post-transplant malignancy
- Cumulative incidence of new secondary hematologic malignancy
- Event free survival
- Progression free survival
- Overall survival

Variables to be described:
Patient-related:

- Age: continuous; by decades
- Karnofsky score: ≥90 vs. <90
- HCT-CI: 0 vs. 1 - 2 vs. 3+

Specific pre-transplant comorbidities:

- Arrhythmia: (atrial fibrillation or flutter, sick sinus syndrome, or ventricular arrhythmias)
    - Cardiac disease (coronary artery disease, congestive heart failure, myocardial infarction, or EF ≤ 50%)
    - Cerebrovascular disease (transient ischemic attack or cerebrovascular accident)
    - Diabetes: requiring treatment with insulin or oral hypoglycemics but not diet alone
    - Heart valve disease (except mitral valve prolapsed)
    - Hepatic dysfunction: bilirubin > ULN to 1.5 × ULN, or AST/ALT > ULN to 2.5 × ULN
    - Infection: active infection requiring continuation of antimicrobial treatment after day 0, HIV test, and CMV status.
    - Inflammatory bowel disease (Crohn's disease or ulcerative colitis)
    - Obesity: body mass index > 35
    - Peptic ulcer (requiring treatment)
    - Psychiatric disturbance (depression or anxiety requiring psychiatric consult or treatment)
    - Pulmonary dysfunction: **mild** (DLco and/or FEV1 < normal but > 80% or no dyspnea on
    - activity), **moderate** (DLco and/or FEV1 66-80% or dyspnea on slight activity), **severe** (DLco
    - and/or FEV1 ≤ 65% or dyspnea at rest or requiring oxygen).
    - Renal dysfunction: serum creatinine > 2 mg/dL or >177 µmol/L, on dialysis, or prior renal
    - Transplantation
    - Rheumatologic disease (SLE, RA, polymyositis, mixed CTD, or polymyalgia rheumatic).
    - **Solid tumor: diagnosed prior to transplant.**

Disease-related:

- Date of diagnosis
- International staging system (ISS)/ Durie Salmon Stage: I vs. II vs. III
- Immunochemical subtype: IgG vs. IgA vs. light chain vs. non-secretory/others
- Hemoglobin at diagnosis: g/dL, continuous
- Creatinine at diagnosis: <2 mg/dL vs. ≥2 mg/dL
- Albumin at diagnosis: g/dL, (<3.5 g/dL vs. >3.5 g/dL)
- Beta-2-microglobulin at diagnosis: mcg/mL, continuous
- Cytogenetics: High risk vs. standard risk
- First line induction chemotherapy: IMID/PI, non-IMID/PI, non-PI/IMID vs. others
- Number of lines of therapies prior to transplant
- Time from diagnosis to transplant (<12 months vs 6-12 months vs. 12-18 months)
- Disease status at transplant: sCR/CR/NCR near CR vs. VGPR vs PR vs. MR vs. SD vs. REL/PD

Transplant-related:

- Time from diagnosis to transplant
- Disease status at time of last follow-up
- Conditioning regimen (melphalan 140 vs melphalan 200 vs other)
- Post transplant therapy given (IMID vs PI vs no maintenance)
- Complete response post-transplant, best response post-transplant
    - First ASCT vs second ASCT or beyond.
    - Single ASCT v Tandem transplant

Forms to be used:

- Recipient baseline data
- Confirmation of HLA typing
- HSCT infusion (2006)
- Pre-TED, post-ted (2400, 2402, 2450)
- Cellular therapy infusion (4000,4006,4100)
- Multiple myeloma/ plasma cell leukemia pre-HSCT data
- Multiple myeloma/ plasma cell leukemia post-HSCT data
- 100 day post-hsct form
- 6 month to two year post hsct data
- Yearly follow up for greater than two years post hsct data
- Recipient death data

Study design:

This is a retrospective study comparing incidence and risk of developing new post transplant malignancy in autologous stem cell transplantation recipients for multiple myeloma based on presence of prexisting malignancy.

Descriptive statistics of patient, disease, and transplant-related factors will be performed, and will be reported as median and range for continuous variables and percent of total for categorical variables. Cumulative Probability of progression-free survival and overall survival will be estimated using the Kaplan-Meier method. Comparison of survival curves will be done using the log-rank test. Probability of relapse and TRM will be estimated using the cumulative incidence function.

Multivariate analysis will be performed using Cox proportional hazards models for various outcomes. A stepwise model building approach will then be used to identify the significant risk factors associated

with the outcomes. Factors, which are significant at a 5% level, will be kept in the final model. The potential interactions between main effect and all significant risk factors will be tested.

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Table 1. Characteristics of multiple myeloma cases undergoing first autologous stem cell transplants from 2008 to 2018

Characteristic	N
No. of patients	534
No. of centers	96
median age (range) - median (min-max)	64.8 (27.7-78.65)
Chronological number of this HSCT - no. (%)	
1	534
Age at transplant, years - no. (%)	
18-39	4 (0.7)
40-49	22 (4.1)
50-59	114 (21.3)
60-69	291 (54.5)
70+	103 (19.3)
Gender - no. (%)	
Male	300 (56.2)
Female	234 (43.8)
Region - no. (%)	
US	527 (98.7)
International	7 (1.3)
Race - no. (%)	
Caucasian	361 (67.6)
Other	159 (29.8)
Missing	14 (2.6)
Karnofsky score - no. (%)	
≥ 90	271 (50.7)
< 90	247 (46.3)
Missing	16 (3)
ISS stage at diagnosis - no. (%)	
ISS/DS stage I	176 (33)
ISS/DS stage II	140 (26.2)
ISS/DS stage III	105 (19.7)
Missing	113 (21.2)
Lines of chemotherapy - no. (%)	
1	355 (66.5)
≥2	162 (30.3)
Missing	17 (3.2)
Immunochemical subtype - no. (%)	
IgG	298 (55.8)
IgA	113 (21.2)
IgD	6 (1.1)

Characteristic	N
IgM	3 (0.6)
Light chain	111 (20.8)
Non-secretory	3 (0.6)
Hemoglobin prior to transplant - no. (%)	
< 10 g/dl	120 (22.5)
≥ 10 g/dl	414 (77.5)
Serum creatinine prior to transplant, mg/dl - no. (%)	
< 2 mg/dl	507 (94.9)
≥ 2 mg/dl	26 (4.9)
Missing	1 (0.2)
Conditioning regimen - no. (%)	
Melphalan only	534
Melphalan dose in conditioning regimen, mg/m - no. (%)	
MEL 140	182 (34.1)
MEL 200	352 (65.9)
Disease status prior to transplant - no. (%)	
sCR/CR	76 (14.2)
VGPR	189 (35.4)
PR	216 (40.4)
SD	38 (7.1)
PD/Relapse	13 (2.4)
Missing	2 (0.4)
Chemotherapy groups - no. (%)	
VTD/VRD/VCD	363 (68)
VD/RD/TD	94 (17.6)
VAD/Others	60 (11.2)
Missing	17 (3.2)
Post-transplant therapy - no. (%)	
no	159 (29.8)
yes	369 (69.1)
Missing	6 (1.1)
Time from diagnosis to transplant - no. (%)	
< 6 months	156 (29.2)
6 - 12 months	249 (46.6)
12 - 24 months	80 (15)
≥ 24 months	49 (9.2)
Year of transplant - no. (%)	
2008	71 (13.3)
2009	38 (7.1)
2010	14 (2.6)

Characteristic	N
2011	31 (5.8)
2012	17 (3.2)
2013	37 (6.9)
2014	35 (6.6)
2015	62 (11.6)
2016	59 (11)
2017	59 (11)
2018	111 (20.8)
New malignancy - no. (%)	
no	485 (90.8)
yes	49 (9.2)
Follow-up - median (min-max)	36.64 (3.06-133.13)

Proposal: 1911-123

Title:
Outcomes after autologous hematopoietic cell transplantation in POEMS syndrome

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Hypothesis:
Autologous hematopoietic cell transplantation (AHCT) will demonstrate low transplant related mortality and prolonged progression free survival when used as treatment for patients with POEMS syndrome

Specific aims:
- To evaluate autologous hematopoietic cell transplantation (AHCT) use in POEMS and determine pre-transplant disease status, mortality rates, day-100 post-transplant disease status, TRM, hematopoietic recovery rates, relapse/progression progression-free survival and overall survival.
- Identify prognostic markers of survival after AHSCT and create a predictive scoring system.
- If feasible based on power, will evaluate the role of induction therapy pre-AHCT vs no-induction therapy on outcomes.

Scientific impact:
POEMS syndrome is a rare disease associated with plasma cell dyscrasia with limited evidence and single institution experiences in the literature regarding the role of AHSCT [1, 2]. Retrospective studies of AHCT have shown excellent response rate of as high has 98% PFS at 1 year and 75% at 5 years[1.] Evaluating the role of AHCT in a large national database would be extremely beneficial in understanding the outcomes of AHCT and provide insight in the predictive factors associated with PFS and OS.

Scientific justification:
Management of POEMS involves chemotherapy with or without AHCT. Chemotherapy options are modelled after those used in other plasma cell dyscrasias and include steroids, melphalan, thalidomide, lenalidomide, bortezomib and cyclophosphamide based therapy, showing variable response rates [3]. As with multiple myeloma, the use of AHCT in patients with POEMS has yielded encouraging results. In a series of 59 patients with POEMS syndrome who underwent AHCT at Mayo Clinic PFS was 98%, 94% and 75% at 1, 2 and 5 years respectively. [1] With durable and prolonged responses after AHCT along with dramatic neurological improvement, AHCT remains as one of the most active therapeutic options for management of POEMS [1,2,4,5]
Hence, we propose a study to evaluate the role of AHCT in patients with POEMS syndrome using CIBMTR data.

Patient eligibility population:
- Diagnosis of POEMS syndrome
- Age ≥ 18 years
- Underwent HSCT from 1990-2018

Data requirements:

Required Form	Required sections
Form 2000 R4.0 Recipient Baseline Data	Recipient Demographics
	Organ Function Prior to Preparative Regimen
	Hematologic Findings prior to Preparative Regimen
Form 2400 R4.0 Pretransplant Essential Data	Recipient Data
	HCT
	Product processing/Manipulation
	Clinical status of Recipient prior to Preparative Regimen
	Comorbid conditions
	Pre-HCT Preparative Regimen (conditioning)
	Post-HCT Disease therapy planned as of Day 0
	Primary Disease for HCT [Multiple Myeloma/PCS (question 589-620)]
Form 2016 R3.0 Multiple Myeloma/Plasma cell leukemia Pre-HCT data	Disease assessment at Diagnosis
	Laboratory studies at diagnosis
	Most Recent disease Assessment Prior to the start of the Preparative Regimen
	Laboratory studies at last evaluation prior to the start of the preparative regimen (conditioning)
	Disease status at the last assessment prior to preparative regimen
Form 2116 R3.0 Plasma cell disorder (PCD) Post-HCT data	Disease Assessment at the time of best response to HSCT
	Laboratory studies supporting best response to HSCT
	Post-HCT therapy
	Disease status at the time of evaluation for this reporting period
Form 2100 R3.0 100 days Post-HSCT data	Vital status
	Neutrophil recovery
	Platelet recovery
	Current Hematologic findings
	Immune reconstitution
	Engraftment syndrome
	Infection
	Clinically significant infections (1)
	Functional status
Form 2300 R3.0: Yearly follow-up for greater than two years post HSCT data	Key field
	Vital status
	Functional status
	New Malignancy
Form 2450 R3.0 Post Transplant Essential Data	Key fields
	100 Day Report Only
	Initial ANC Recovery
	Initial Platelet Recovery

	New Malignancy, Lymphoproliferative or Myeloproliferative disorder
	Survival
	Malignant disease evaluation for this HSCT
	First relapse or progression after HSCT
	Additional treatment
	Method of latest disease assessment
Form 2900 R2.0 Recipient Death Data	Death Data

Sample requirements:
Not required

Study design:
This is a retrospective cohort study of patients receiving AHCT for POEMS. Descriptive statistics will be used to summarize patient-, disease-, and transplant-related characteristics. The t-test or Wilcoxon rank-sum test will be used to compare continuous variables while Pearson chi-square test or Fisher's exact test will be used to evaluate the difference between proportions for categorical variables. The probability of progression-free survival and overall survival will be calculated using the Kaplan-Meier estimator while competing risk endpoints will be summarized using the cumulative incidence function. Comparison of survival and cumulative incidence curves will be done using the log-rank test and Gray's test, respectively.
A multivariate model will be fitted using Cox proportional hazards regression model to identify prognostic factors associated with the above endpoints. A stepwise model building approach will be adopted and variables that attain a p-value less than 5% will be retained in the final model. We plan on keeping the main effect in the model during the variable selection process. Once the final model is determined we will explore interactions between the main effect and the other prognostic variables. Factors to be considered in model building are patient-, disease-, transplant- and post-transplant related covariates. The assumption of proportional hazards will be tested using time-dependent covariates. Variables that violate the proportionality assumption will be adjusted for in subsequent analyses by stratification.

Non-CIBMTR data source:
Not required

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Table 1. Characteristic of POEMS patients >18 years of age, undergoing HDT/ASCT and reported to CIBMTR from 2000-2018

Characteristic	N
No. of patients	418
No. of centers	102
Research level data - no. (%)	
TED	361 (86.4)
CRF	57 (13.6)
median age (range) - median (min-max)	50.56 (18.15-77.4)
Chronological number of this HSCT - no. (%)	
1	405 (96.9)
2	13 (3.1)
Age at transplant, years - no. (%)	
18-39	56 (13.4)
40-49	141 (33.7)
50-59	124 (29.7)
60-69	82 (19.6)
70+	15 (3.6)
Gender - no. (%)	
Male	278 (66.5)
Female	140 (33.5)
Region - no. (%)	
US	387 (92.6)
International	31 (7.4)
Race - no. (%)	
Caucasian	281 (67.2)
African-American	72 (17.2)
Other	65 (15.6)
Karnofsky score - no. (%)	
≥ 90	94 (22.5)
< 90	284 (67.9)
Missing	40 (9.6)
HCT-CI - no. (%)	
0	88 (21.1)
1	40 (9.6)
2	48 (11.5)
3+	175 (41.9)

Characteristic	N
Missing	67 (16)
Graft source - no. (%)	
PB	418
Creatinine at diagnosis, mg/dL - no. (%)	
<2mg/dL	344 (82.3)
>2mg/dL	7 (1.7)
Missing	67 (16)
Melphalan dose(mg/m) - no. (%)	
MEL 140	46 (11)
MEL 200	305 (73)
Missing	67 (16)
Disease status prior to transplant - no. (%)	
sCR/CR	24 (5.7)
VGPR	25 (6)
PR	100 (23.9)
SD	116 (27.8)
PD/Relapse	27 (6.5)
Missing	126 (30.1)
Time from diagnosis to transplant - no. (%)	
<6 months	168 (40.2)
6-12 months	130 (31.1)
12-18 months	36 (8.6)
18-24 months	22 (5.3)
>24 months	61 (14.6)
Missing	1 (0.2)
Year of transplant - no. (%)	
2000	5 (1.2)
2001	1 (0.2)
2002	6 (1.4)
2003	9 (2.2)
2004	7 (1.7)
2005	11 (2.6)
2006	11 (2.6)
2007	13 (3.1)
2008	16 (3.8)
2009	15 (3.6)

Characteristic	N
2010	20 (4.8)
2011	26 (6.2)
2012	29 (6.9)
2013	40 (9.6)
2014	38 (9.1)
2015	44 (10.5)
2016	55 (13.2)
2017	35 (8.4)
2018	37 (8.9)
Follow-up - median (min-max)	48.06 (3.13-215.56)

Combined Proposal: 1910-21/1911-141/1911-228/1911-44

Title:
Risk factors for and characteristics of secondary primary malignancies following autologous hematopoietic cell transplant for multiple myeloma

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Research hypothesis:
In multiple myeloma (MM) patients undergoing autologous hematopoietic cell transplant (auto-HCT), post-transplant therapies can modify the risk of second primary malignancies (SPM), including the risk of secondary hematological malignancies (SHM). Patients who develop SPM following auto-HCT for MM have an inferior overall survival compared to those who do not develop SPM.

Specific aims:
Primary:
- To determine the cumulative incidence of SPM in MM patients following auto-HCT.
- To determine the cumulative incidence of SHM in MM patients following auto-HCT.
- To compare overall survival (OS) in patients with SPM and SHM compared to those without SPM and SHM.

Secondary:
- To identify patient and disease characteristics that predict an increased risk of developing SPM/SHM.
- To determine the risk of SPM/SHM when post auto-HCT lenalidomide therapy is utilized.
- To determine if a longer duration of post-transplant lenalidomide therapy is associated with an increased incidence of SPM/SHM.
- To identify risk factors predicting survival after SPM/SHM diagnosis.
- To determine utilization rate and outcomes for allogeneic hematopoietic cell transplant (allo-HCT) in patients with SHM.

Scientific impact:
During the past 2 decades, outcomes in myeloma have dramatically improved, with the median survival increasing from 2-3 years to 8-10 years. With the improvement in survival, new challenges in the form of long-term toxicity have come to the forefront. One of the most concerning complications of cancer therapy, including that for myeloma, is the development of a secondary malignancy, including secondary solid and hematological malignancies.[1-5]
SPM are becoming increasingly relevant to myeloma patients. With an increased utilization of post-transplant lenalidomide, and continued improvement in outcomes for MM, the incidence of SPM/SHM is expected to rise. Previous studies have suggested a cumulative incidence of SPM to be up to 8%, with SHM comprising approximately 50% of all SPM.[1,6-11] Agents implicated in SPM/SHM are commonly used

in MM, including alkylators (such as melphalan and cyclophosphamide), radiation therapy, and topoisomerase II inhibitors (such as doxorubicin and etoposide). In addition, lenalidomide, one of the most commonly used myeloma agents, has been shown to increase the risk of SHM by 4-8 fold.[12,13] Currently, the standard treatment approach for myeloma patients is to receive a triplet, such as bortezomib, lenalidomide, and dexamethasone, followed by upfront auto-HCT. High-dose melphalan is the most common conditioning regimen for auto-HCT. With increasing evidence of improved overall survival for MM pts, post-HCT lenalidomide has become a *de facto* standard. There is a significant variation in practice regarding how long maintenance therapy is continued. In the United States, maintenance lenalidomide may be used either for 2 years or until relapse.[2]
Therefore, it is pertinent to study the incidence of SPM/SHM in patients following auto-HCT. Further, we will evaluate whether post-transplant lenalidomide therapy and its duration is associated with an increased risk of SPM/SHM in myeloma patients undergoing auto-HCT. We also seek to assess risk factors that predict for development of SPM/SHM and survival after these diagnoses, particularly survival following SHM. With SHM representing a significant portion of SPM pts, we would further investigate the utilization of allogeneic HCT in patients with SHM, and how this impacts outcomes in comparison to those with SHM who do not go on to allo-HCT.
Results from this study would be hypothesis generating for designing future trials to determine the optimal duration of post-HCT lenalidomide therapy and how best to approach pts with SPM/SHM.

Scientific justification:
Auto-HCT is considered for all eligible patients with MM. While auto-HCT offers the possibility of long-term disease control, the exposure to high dose chemotherapy is associated with an increased risk of SPM/SHM.[14] Additionally, lenalidomide, a nearly universal agent used in MM, increases the risk of SPM by approximately 2.5-fold and that of SHM by 5-fold when used in the context of melphalan.[3,4,12,15,16] A recent single center analysis of MM patients undergoing auto-HCT revealed that lenalidomide exposure was associated with an approximately 9-fold increase in the risk of SHM, specifically therapy-related myeloid neoplasms (t-MN).[13] Survival after the diagnosis of t-MN is in the range of <1-6 months for most patients, representing one of the most aggressive malignancies known.[6,17] Only a small minority (<20%) of patients with t-MN underwent allo-HCT.[13] Although a diagnosis of MM and treatments provided for MM are known to increase the risk SPM/SHM, there is a paucity of understanding regarding utilization, characteristics, specific outcomes, and the impact of allo-HCT in this population. Due to the adverse nature of this group of patients, it is crucial to identify, and possibly mitigate, factors that increase the risk of SPM and SHM.

Patient eligibility population:
All MM patients who underwent 1st autologous hematopoietic cell transplant between 2000 and 2018.

Data requirements:
The following data variables are available from the following three forms: **Form 2016** (Pre-HCT Data), **Form 2100** (Post HCT data), and **Form 2116** (PCD Post-HCT Data)

Variables to be analyzed:
- **Patient related variables**
  - Age at transplantation (continuous)
  - Gender (female vs. male)
- **Disease related variables at diagnosis and treatment prior to auto-HCT**
  - Date of MM diagnosis
  - Type of MM (IgA, IgM, or IgA, others)

  - Myeloma risk stage
  - Bone marrow FISH and cytogenetics
  - Gene expression profile
  - Pre-HCT therapy given
  - Systemic therapy
  - Number of lines of therapy
  - Alkylator(s): If yes, dose and duration.
  - Lenalidomide: If yes, duration
  - Other cytotoxic agents: If yes, duration
  - Radiation therapy (yes or no)
- **Disease related variables just prior to auto-HCT**
  - Best response to therapy prior to auto-HCT
  - Complete blood count (hemoglobin, absolute neutrophil count, and platelet)
  - MM status prior to start of preparative regimen
  - Bone marrow cytogenetics (normal, abnormal, not evaluable)
  - Bone marrow FISH (normal, abnormal, not evaluated)
  - Pre-transplant serum creatinine
  - Pre-transplant AST and bilirubin
  - History of CKD: Stage
- **Transplant related variables**
  - Conditioning regimen
    - Agent
    - Dose
  - Use of G-CSF and/or GM-CSF (yes or no)
  - Single vs. tandem autologous transplant
  - Interval from diagnosis to transplant: <3, 3-6, 6-12, 12-24, vs. ≥ 24 months, missing
  - Presence of tumor cells in autologous product
  - Total number CD34+ cells provided
- **Post-transplant variables**
  - Response at day +100
  - Systemic maintenance or consolidation therapy (yes or no)
  - Agent(s)
  - Duration
- **SPM related variables**
  - Type of cancer(s): hematologic – myeloid or lymphoid or others, solid tumors- types)
  - Number of cancers
  - Time from auto-HCT to SPM
- **SHM related variables**
  - Date of diagnosis
  - Time from diagnosis of MM to diagnosis of t-MDS, t-AML, t-ALL, lymphoma
  - Cytogenetic abnormalities at diagnosis of SMN and pre-allo-HCT
  - Molecular markers
  - Presence of extramedullary disease
  - Systemic therapy provided
  - Number of lines of therapy: 1, 2 vs ≥3
  - Best response to therapy
  - Hematopoietic Cell Transplantation-Comorbidity Index (HCT-CI)9

- CIBMTR score for MDS: low, intermediate, high, very high
  - Allo-HCT pursued: yes or no

Sample requirements:
Not applicable.

Study design:
This is a retrospective cohort analysis of data from the CIBMTR to determine the cumulative incidence and risk factors of developing SPM/SHM in MM patients following auto-HCT.
To describe the study population, summary statistics will be used. Patient, disease, and transplant related variables of the groups will be compared using Chi-square or Fisher exact test for categorical variables, and Mann-Whitney test for continuous variables. Patients that received post auto-HCT lenalidomide therapy will further be subcategorized based on cumulative duration of therapy (<6 months, 6-12 months, ≥1 year) to determine risk associations related to duration of lenalidomide treatment. Time to diagnosis of SPM/SHM from auto-HCT will be determined. If baseline patient and disease characteristics are similarly distributed in treatment groups, then they will be compared for transplant outcomes. If the treatment groups have different distributions of disease and patient characteristics, then propensity score matching will be considered for outcome comparisons to be performed. By treating death as a competing risk, cumulative incidence of SPM/SHM will be determined at various time points. Kaplan-Meier method and log-rank testing for univariate comparisons will be used to determine probabilities of OS and RFS. Cox proportional hazards regression models will be used to determine associations among patient, disease, and transplant related variables. Multivariate models will be utilized to identify variables that influence outcomes and variables associated with the development of SPM/SHM following auto-HCT for MM. A *p*-value of <0.05 will be considered significant for this analysis.

Non-CIBMTR data source:
Not applicable.

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Table 1. Characteristics of multiple myeloma cases undergoing first autologous stem cell transplants from 2008 to 2018

Characteristic	N
No. of patients	6499
No. of centers	161
median age (range) - median (min-max)	60.25 (20.17-82.6)
Chronological number of this HSCT - no. (%)	
1	6499
Age at transplant, years - no. (%)	
18-39	191 (2.9)
40-49	828 (12.7)
50-59	2161 (33.3)
60-69	2746 (42.3)
70+	573 (8.8)
Gender - no. (%)	
Male	3587 (55.2)
Female	2912 (44.8)
Region - no. (%)	
US	6257 (96.3)
International	242 (3.7)
Race - no. (%)	
Caucasian	3992 (61.4)
Other	2330 (35.9)
Missing	177 (2.7)
Karnofsky score - no. (%)	
≥ 90	3431 (52.8)
< 90	2896 (44.6)
Missing	172 (2.6)
HCT-CI - no. (%)	
0	1957 (30.1)
1	948 (14.6)
2	1059 (16.3)
3+	2497 (38.4)
Missing	38 (0.6)
ISS stage at diagnosis - no. (%)	
ISS/DS stage I	1974 (30.4)
ISS/DS stage II	1816 (27.9)
ISS/DS stage III	1310 (20.2)
Missing	1399 (21.5)
Lines of chemotherapy - no. (%)	

Characteristic	N
0	6 (0.1)
1	4474 (68.8)
≥2	1785 (27.5)
Missing	234 (3.6)
Immunochemical subtype - no. (%)	
IgG	3836 (59)
IgA	1255 (19.3)
IgD	40 (0.6)
IgE	3 (0)
IgM	22 (0.3)
Light chain	1261 (19.4)
Non-secretory	79 (1.2)
Unknown Type	3 (0)
Hemoglobin prior to transplant - no. (%)	
< 10 g/dl	1449 (22.3)
≥ 10 g/dl	5042 (77.6)
Missing	8 (0.1)
Serum creatinine prior to transplant, mg/dl - no. (%)	
< 2 mg/dl	6124 (94.2)
≥ 2 mg/dl	354 (5.4)
Missing	21 (0.3)
Conditioning regimen - no. (%)	
Melphalan only	6499
Melphalan dose in conditioning regimen, mg/m - no. (%)	
MEL 140	1870 (28.8)
MEL 200	4629 (71.2)
Disease status prior to transplant - no. (%)	
sCR/CR	995 (15.3)
VGPR	2261 (34.8)
PR	2644 (40.7)
SD	391 (6)
PD/Relapse	186 (2.9)
Missing	22 (0.3)
Chemotherapy groups - no. (%)	
VTD/VRD/VCD	4433 (68.2)
VD/RD/TD	1017 (15.6)
VAD/Others	815 (12.5)
Missing	234 (3.6)
Post-transplant therapy - no. (%)	
no	1826 (28.1)
yes	4613 (71)

Characteristic	N
Missing	60 (0.9)
Time from diagnosis to transplant - no. (%)	
<6 months	2010 (30.9)
6 – 12 months	3066 (47.2)
12-24 months	882 (13.6)
>= 24 months	540 (8.3)
Missing	1 (0)
Year of transplant - no. (%)	
2008	864 (13.3)
2009	303 (4.7)
2010	234 (3.6)
2011	323 (5)
2012	320 (4.9)
2013	609 (9.4)
2014	527 (8.1)
2015	671 (10.3)
2016	746 (11.5)
2017	668 (10.3)
2018	1234 (19)
New Malignancy - no. (%)	
no	6094 (93.8)
yes	405 (6.2)
New malignancy: AML/ALL/MDS - no. (%)	
yes	86 (1.3)
Missing	6413 (98.7)
Follow-up - median (min-max)	38.59 (3.03-138.13)

Combined Proposal: 1911-134/1911-237/1911-26

Title:
Impact of bortezomib- based vs. lenalidomide maintenance therapy on outcomes of patients with high-risk multiple myeloma.

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Mutually agreed PI roles/responsibilities:

Lead PI: Naresh Bumma MD

Presenting/first author on abstract resulting from study: Binod Dhakal, MD

First author on publication resulting from study: Surbhi Sidana, MD

Research hypothesis:
Lenalidomide single agent as maintenance therapy is associated with inferior progression free survival in high-risk myeloma patients (defined as deletion 17p/monosomy 17, t(4;14), t(14;16), t(14;20) or gain 1q on FISH)

Specific aims:

- To evaluate outcomes after novel agent induction, autologous stem cell transplant (ASCT) and maintenance therapy in patients with high-risk multiple myeloma compared to patients with standard risk disease.
- To evaluate progression free survival (PFS) in patients with high-risk multiple myeloma receiving lenalidomide only maintenance vs. bortezomib-based (alone or in combination) consolidation/maintenance after ASCT.
- To evaluate overall survival (OS) in patients with high-risk multiple myeloma receiving lenalidomide only maintenance vs. bortezomib-based (alone or in combination) consolidation/maintenance after ASCT.

Scientific impact:
The ideal choice of maintenance or consolidation therapy in high-risk multiple myeloma remains unknown. Lenalidomide based maintenance has been shown to improve both PFS and OS in multiple myeloma patients, but this benefit did not extend to patients with high-risk fluorescence in-situ hybridization (FISH) abnormalities.[1] Other studies have shown that bortezomib based therapy as induction and consolidation/maintenance is associated with improved outcome in high-risk MM.[2,3] There is only limited data from retrospective studies comparing different maintenance approaches, especially in high-risk patients. As a result, practice patterns and institutional guidelines on maintenance approaches in high-risk patients vary significantly. This study will help determine whether lenalidomide alone as maintenance is inferior to other regimens, specifically bortezomib-based consolidation/maintenance therapy (either alone or in combination) in patients with high-risk myeloma.

Scientific justification:
Patients with high-risk multiple myeloma [commonly defined as have deletion 17p/monosomy 17, t(14;16), t(4;14), t(14;20) or gain 1q by FISH] have poor outcomes following autologous stem cell

transplant.[4,5] Lenalidomide maintenance after ASCT results in prolongation of both PFS and OS, which has led to the widespread adoption of lenalidomide maintenance as standard of care for most myeloma patients. However, in a meta-analysis of three randomized clinical trials, there was no significant improvement in survival with lenalidomide maintenance in high-risk patients.[1] In the HOVON trial, inclusion of bortezomib as part of induction and maintenance was associated with improved survival outcomes in patients with high-risk multiple myeloma. [2,3] Therefore, proteasome inhibitors such as bortezomib or carfilzomib are considered key drugs in induction regimens for high-risk myeloma patients. There is limited data comparing lenalidomide alone to other maintenance/consolidation regimens, specifically bortezomib based regimens. A retrospective study from Emory University showed that combined bortezomib and lenalidomide maintenance was associated with longer PFS than typically expected in high-risk myeloma patients.[6]
Given the lack of prospective comparisons, it is unclear whether high-risk myeloma patients should receive bortezomib or lenalidomide or both as maintenance therapy. Treatment recommendations for high-risk patients vary across institutions. [5,7] This study will help determine whether high-risk patients receiving lenalidomide alone as maintenance have inferior outcomes compared to other approaches, specifically those receiving bortezomib-based consolidation/maintenance .

Patient eligibility population:
Adult patients with high-risk multiple myeloma [deletion 17p or monosomy 17, (14;16), t(4;14), t(14;20) or gain 1q on FISH] undergoing upfront ASCT from January 2013 to December 2018 after receiving triplet novel agent induction and within 12 months of diagnosis. All patients should have received maintenance/cosolidation therapy.

Data requirements:
- Baseline demographics and diagnosis data
- Data for risk stratification: Baseline labs (hemoglobin, creatinine, calcium, albumin, beta-2-microglobulin, LDH, bone marrow plasma cell percentage, FISH (fluorescence in-situ hybridization) data
- First line chemotherapy details: drugs with start and stop dates
- Date of transplant
- Best hematologic response before transplant
- Treatment after transplant: consolidation or maintenance, with start and stop dates if available
- Relapse and survival data

Sample requirements:
N/A

Study design:
The primary objective of the study is to identify the impact of lenalidomide compared to other maintenance in high risk MM patients >18 years of age who underwent HDT/ASCT from 2005-2018 and reported to CIBMTR will be included. After meeting the selection criteria, patient-, disease- and transplant- related variables will be compared between three maintenance groups: lenalidomide versus bortezomib versus lenalidomide+bortezomib vs. others using chi-square or Wilcoxon rank sum test when appropriate. Estimates of outcomes of interest will be reported as probabilities with 95% confidence intervals (95% CI). The probability of OS and PFS will be calculated with the Kaplan-Meier estimator. Multivariable analysis will be performed using the Cox proportional hazards regression.

Maintenance will be considered the main effect in the multivariable analysis. The assumption of proportional hazards will be tested for each variable, and factors violating the proportionality assumption adjusted by stratification. A stepwise model building approach will be used to develop models for OS, PFS and relapse/progression. Forward selection and backward elimination procedures will be used to confirm the significant co-variates.

Non-CIBMTR data source:
N/A

Conflicts of interest:
Surbhi Sidana: Consultancy, Janssen (< $5000 annually)
Naresh Bumma: Speaker bureau, Amgen (< $5000 annually)

References:

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Table 1a. Characteristic of MM patients >18 years of age, undergoing HDT/ASCT and reported to CIBMTR from 2014-2018-Real World setting

Characteristic	1
No. of patients	28097
No. of centers	205
Research level data - no. (%)	
TED	24083 (85.7)
CRF	4014 (14.3)
median age (range) - median (min-max)	61.86 (16.72-85.33)
Age at transplant, years - no. (%)	
18-39	527 (1.9)
40-49	2693 (9.6)
50-59	8514 (30.3)
60-69	12502 (44.5)
70+	3860 (13.7)
Missing	1 (0)
Gender - no. (%)	
Male	16197 (57.6)
Female	11900 (42.4)
Region - no. (%)	
US	25984 (92.5)
International	2113 (7.5)
Race - no. (%)	
Caucasian	20422 (72.7)
African-American	4710 (16.8)
Other	2965 (10.6)
Karnofsky score - no. (%)	
≥ 90	14909 (53.1)
< 90	12767 (45.4)
Missing	421 (1.5)
HCT-CI - no. (%)	
0	7542 (26.8)
1	3707 (13.2)
2	4704 (16.7)
3+	12131 (43.2)
Missing	13 (0)
Graft source - no. (%)	
PB	28097
Immunochemical subtype - no. (%)	
IgG	16343 (58.2)

Characteristic	1
IgA	5544 (19.7)
Light chain	5565 (19.8)
Non-secretory	331 (1.2)
Others	314 (1.1)
Serum albumin at diagnosis g/dL - no. (%)	
< 3.5 g/dl	8160 (29)
≥ 3.5 g/dl	14987 (53.3)
Missing	4950 (17.6)
Creatinine at diagnosis, mg/dL - no. (%)	
<2mg/dL	26479 (94.2)
>2mg/dL	1610 (5.7)
Missing	8 (0)
Melphalan dose(mg/m) - no. (%)	
MEL 140	5016 (17.9)
MEL 200	23032 (82)
Missing	49 (0.2)
Disease status prior to transplant - no. (%)	
sCR/CR	4086 (14.5)
VGPR	10965 (39)
PR	10531 (37.5)
SD	1615 (5.7)
PD/Relapse	683 (2.4)
Missing	217 (0.8)
Cytorisk High vs. Low - no. (%)	
Normal	6391 (22.7)
High risk	8702 (31)
Standard risk	9179 (32.7)
Test not done/unknown/ No metaphases	3805 (13.5)
Missing	20 (0.1)
Time from diagnosis to transplant - no. (%)	
<6 months	8976 (31.9)
6-12 months	12673 (45.1)
12- 18 months	2797 (10)
18-24 months	1098 (3.9)
> 24 months	2539 (9)
Missing	14 (0)
Additional post-HCT therapy planned - no. (%)	
No	19123 (68.1)
Yes	8857 (31.5)
Missing	117 (0.4)

Characteristic	**1**
Year of transplant - no. (%)	
2014	4949 (17.6)
2015	5165 (18.4)
2016	5753 (20.5)
2017	6079 (21.6)
2018	6151 (21.9)
Follow-up - median (min-max)	24.38 (3.03-68.95)

Table 1b. Characteristics of multiple myeloma cases undergoing first autologous stem cell transplants from 2014 to 2018

Characteristic	N
No. of patients	3879
No. of centers	127
median age (range) - median (min-max)	61.13 (23.97-82.6)
Chronological number of this HSCT - no. (%)	
1	3879
Age at transplant, years - no. (%)	
18-39	104 (2.7)
40-49	431 (11.1)
50-59	1199 (30.9)
60-69	1728 (44.5)
70+	417 (10.8)
Gender - no. (%)	
Male	2073 (53.4)
Female	1806 (46.6)
Region - no. (%)	
US	3729 (96.1)
International	150 (3.9)
Race - no. (%)	
Caucasian	2030 (52.3)
Other	1743 (44.9)
Missing	106 (2.7)
Karnofsky score - no. (%)	
≥ 90	1955 (50.4)
< 90	1845 (47.6)
Missing	79 (2)
HCT-CI - no. (%)	
0	1001 (25.8)
1	542 (14)
2	667 (17.2)
3+	1669 (43)
ISS stage at diagnosis - no. (%)	
ISS/DS stage I	1175 (30.3)
ISS/DS stage II	1084 (27.9)
ISS/DS stage III	691 (17.8)
Missing	929 (23.9)
Lines of chemotherapy - no. (%)	
0	3 (0.1)

Characteristic	N
1	2700 (69.6)
≥2	969 (25)
Missing	207 (5.3)
Immunochemical subtype - no. (%)	
IgG	2280 (58.8)
IgA	744 (19.2)
IgD	21 (0.5)
IgE	1 (0)
IgM	15 (0.4)
Light chain	779 (20.1)
Non-secretory	39 (1)
Hemoglobin prior to transplant - no. (%)	
< 10 g/dl	822 (21.2)
≥ 10 g/dl	3057 (78.8)
Serum creatinine prior to transplant, mg/dl - no. (%)	
< 2 mg/dl	3640 (93.8)
≥ 2 mg/dl	227 (5.9)
Missing	12 (0.3)
Cytorisk High vs. Low - no. (%)	
No abnormal	834 (21.5)
High risk	1246 (32.1)
Standard risk	1393 (35.9)
Test not done/unknown/ No metaphases	401 (10.3)
Missing	5 (0.1)
Conditioning regimen - no. (%)	
Melphalan only	3879
Melphalan dose in conditioning regimen, mg/m - no. (%)	
MEL 140	1173 (30.2)
MEL 200	2706 (69.8)
Disease status prior to transplant - no. (%)	
sCR/CR	586 (15.1)
VGPR	1516 (39.1)
PR	1458 (37.6)
SD	217 (5.6)
PD/Relapse	82 (2.1)
Missing	20 (0.5)
Chemotherapy groups - no. (%)	
VTD/VRD/VCD	3146 (81.1)
VD/RD/TD	264 (6.8)
VAD/Others	262 (6.8)

Characteristic	N
Missing	207 (5.3)
post-HCT therapy (for current transplant) - no. (%)	
VR +/- other	352 (9.1)
VC +/- other	21 (0.5)
V +/- other	288 (7.4)
R +/- other	2170 (55.9)
K +/- other	71 (1.8)
Other	192 (4.9)
Radiation	1 (0)
No planned rx	775 (20)
Missing	9 (0.2)
Time from diagnosis to transplant - no. (%)	
<6 months	1245 (32.1)
months	1846 (47.6)
months	488 (12.6)
months	300 (7.7)
Year of transplant - no. (%)	
2014	531 (13.7)
2015	675 (17.4)
2016	750 (19.3)
2017	671 (17.3)
2018	1252 (32.3)
Follow-up - median (min-max)	23.85 (0.46-67.17)