HORIZON (OP-106) Study of Melflufen in Patients With Relapsed/Refractory Multiple Myeloma (RRMM) Refractory to Daratumumab and/or Pomalidomide: Updated Efficacy and Safety

Poster MM-250

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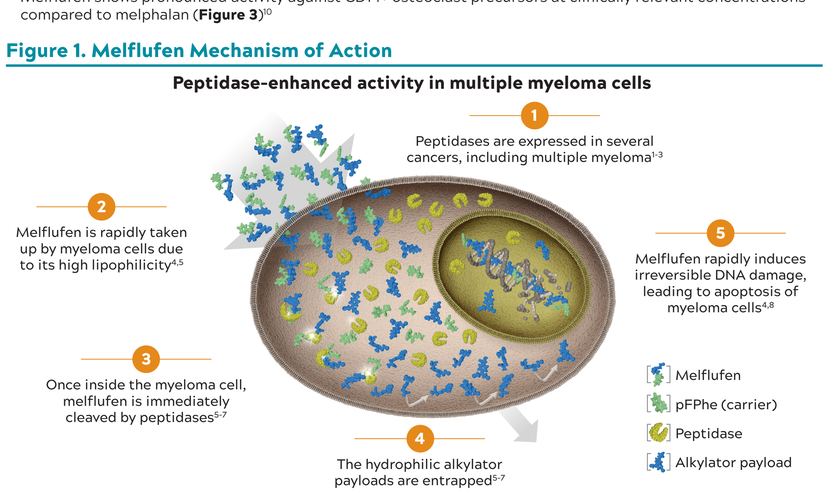
BACKGROUND

SELECTIVE CYTOTOXICITY OF MELFLUFEN

- Melflufen is a lipophilic peptide-conjugated alkylator that rapidly delivers a highly cytotoxic payload into myeloma cells through peptidase-enhanced activity (**Figure 1**)[1-8]
- *In vivo* human xenograft mouse models treated with melflufen showed higher inhibition of tumor growth and prolonged survival versus those treated with alkylators such as melphalan alone (**Figure 2**)[4]
- Melflufen showed pronounced anti-angiogenic activity (up to >100-fold) at lower doses than the alkylator melphalan alone (**Figure 2**)[9]
- Osteoclasts have a short half-life, but activity against CD14+ osteoclast precursors should lower osteoclast activity and potentially improve bone pain in patients with multiple myeloma (MM)
- Melflufen shows pronounced activity against CD14+ osteoclast precursors at clinically relevant concentrations compared to melphalan (**Figure 3**)[10]

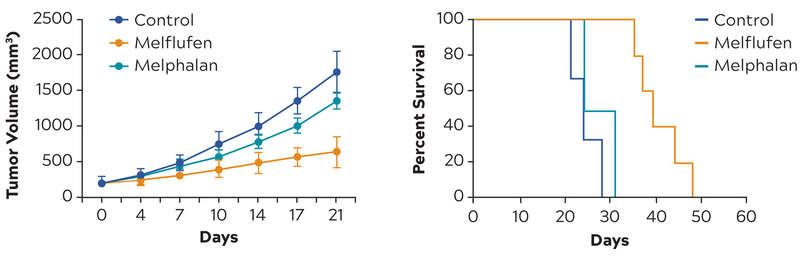
Figure 1. Melflufen Mechanism of Action



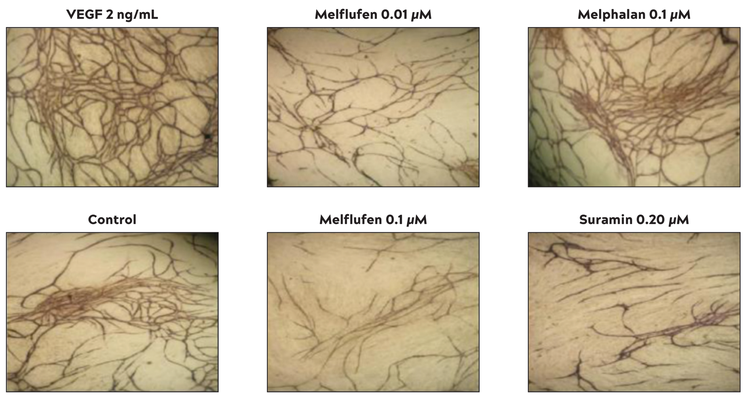
Melflufen is 50-fold more potent than melphalan in myeloma cells in vitro due to increased intracellular alkylator activity[4,5]

pFPhe, p-Fluorophenylalanine.

Figure 2. In Vivo Efficacy of Melflufen

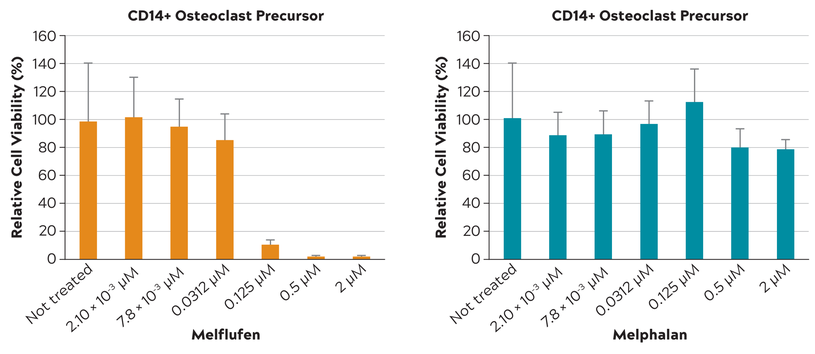


In vivo efficacy of melflufen shown using a human plasmacytoma MM.1S xenograft mouse model. Treatment of tumor-bearing mice with melflufen intravenously significantly inhibited MM.1S tumor growth ($P = 0.001$) and prolonged survival ($P < 0.001$) of these mice.[4]



Decrease in tubule length and vessel junctions shown for melflufen, with dose response seen, compared with the positive control vascular endothelial growth factor receptor (VEGF; 2 ng/mL).[9]

Figure 3. Osteoclast Precursor Activity of Melflufen[10]



CD14, cluster of differentiation 14.

UNMET MEDICAL NEED IN RELAPSED AND REFRACTORY MM (RRMM)

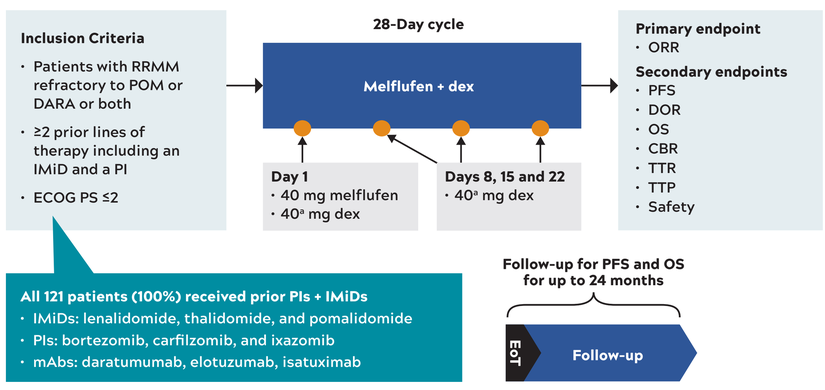
- Lenalidomide and proteasome inhibitor (PI)-based failure in patients who subsequently become refractory to salvage therapy with daratumumab (anti-CD38 monoclonal antibody [mAb]) and/or pomalidomide have limited effective treatment options[11]
- Introducing a treatment class switch with a novel compound may represent an important therapeutic strategy
- Of particular importance is to develop new treatment strategies for patients who are triple-class refractory (IMiD + PI + anti-CD38 mAb), and especially those patients with extramedullary disease (EMD), who have very poor prognosis[12]

MELFLUFEN IN RRMM: O-12-M1 AND ANCHOR

- O-12-M1 (N=45): melflufen plus dexamethasone (dex) demonstrated promising and durable response in heavily pretreated RRMM[13,14]
  - Patients were refractory to both immunomodulators (IMiDs) and PIs and had progressed on their last line of therapy
  - Overall response rate (ORR) was 31% and clinical benefit rate (CBR) was 49% (with similar results regardless of disease status)
  - ORR was 33% in patients (8 of 24) refractory to prior alkylator therapy
  - ORR was 42% in patients (5 of 12) who progressed on prior alkylator therapy within ≤12 months
  - Median duration of response (DOR) was 8.4 months, progression-free survival (PFS) 5.7 was months, and overall survival (OS) was 20.7 months
  - Favorable tolerability - hematologic toxicity common but clinically manageable; nonhematologic adverse events (AEs) infrequent
- Phase 1/2 study ANCHOR, melflufen plus dex demonstrated high response rate when combined with bortezomib or daratumumab in RRMM patients[15]
  - 100% ORR with bortezomib
  - 82% ORR with daratumumab (in patients with ≥2 completed cycles of therapy)

METHODS

Figure 4. HORIZON: Phase 2 Single-Arm, Open-Label, Multicenter Study (NCT02963493)



CBR, clinical benefit rate; DARA, daratumumab; dex, dexamethasone; DOR, duration of response; ECOG PS, Eastern Cooperative Oncology Group performance status; EoT, end of treatment; IMiD, immunomodulatory agent; ORR, overall response rate; OS, overall survival; PFS, progression-free survival; PI, proteasome inhibitor; POM, pomalidomide; RRMM, relapsed/refractory multiple myeloma; TTP, time to progression; TTR, time to response.
[a]Patients aged >75 years received dex 20 mg.

RESULTS

Table 1. Baseline Patient Characteristics

Characteristic	(N=121)
Age, median (range), years	64 (35-86)
Gender (male / female), %	55 / 45
Time since diagnosis, median, years	6.2 (0.7-25)
No. of prior lines of therapy, median (range)	5 (2-12)
ISS stage I / II / III / unknown,[a] %	38 / 30 / 29 / 4
ECOG PS 0 / 1 / 2,[a] %	24 / 61 / 14
High-risk cytogenetics,[b] % ≥2 high-risk abnormalities, % Del(17p), %	62 19 17
Extramedullary disease,[c] %	60

ECOG PS, Eastern Cooperative Oncology Group performance status; ISS, International Staging System.
[a]ISS stage and ECOG PS at study entry, with data pending for 16 and 10 patients, respectively.
[b]High-risk cytogenetics [t(4;14), del(17/17p), t(14;16), t(14;20), nonhyperdiploidy, gain(1q) or karyotype del(13)] at study entry; data pending for 40 patients; 5 patients with unknown status at study entry had high-risk cytogenetics at diagnosis and were included in the high-risk group.
[c]Data pending for 54 patients.
Data cutoff 06 May 2019.

Table 2. Prior Treatment and Refractory Status

Prior Therapy Status	(N=121)
Double-class (IMiD + PI) exposed / refractory	100% / 91%
Anti-CD38 mAb exposed / refractory	79% / 79%
Triple-class (IMiD + PI + anti-CD38 mAb) exposed / refractory	79% / 74%
Alkylator exposed / refractory ≥1 Prior ASCT ≥2 Prior ASCTs Relapsed ≤1 year after ASCT	86% / 59% 69% 11% 20%
Refractory in last line of therapy	98%

ASCT, autologous stem cell transplantation; IMiD, immunomodulatory agent; PI, proteasome inhibitor; mAb, monoclonal antibody.
Data cutoff 06 May 2019.

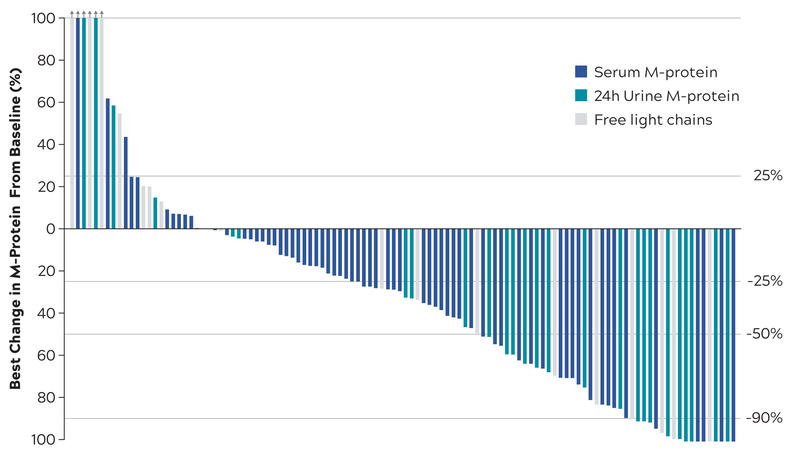
- 36% used ≥3 treatment regimens in last 12 months prior to enrolment

Table 3. Patient Disposition

Disposition	(N=121)
On treatment at data cutoff	35 (29%)
Discontinued treatment at data cutoff[a]	86 (71%)
Disease progression	59 (69%)
Adverse event(s)	17 (20%)
Physician decision	4 (5%)
Lack of response	3 (3%)
Patient request	3 (3%)

[a]Percentages for discontinuation cause have been calculated as fraction of patients who discontinued (n=86).
Data cutoff 06 May 2019.

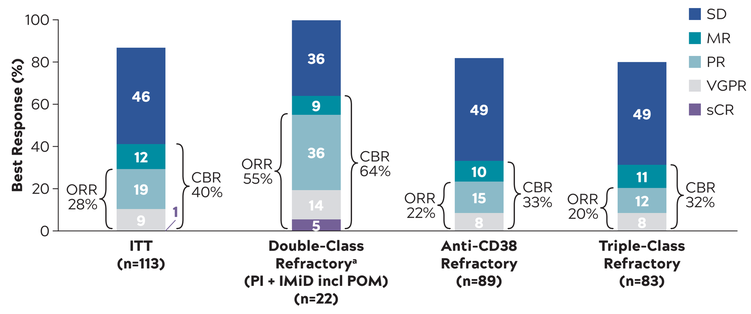
Figure 5. Best M-Protein Response (n=113)[a]



[a]M-protein data for 8 patients pending at time of data cutoff.
Data cutoff 06 May 2019.

- Disease stabilization rate (≥stable disease [SD]) 86% (**Figure 5**)

Figure 6. Best Response by IMWG[16]



CBR, clinical benefit rate; IMiD, immunomodulator; IMWG, International Myeloma Working Group; ITT, intention-to-treat; MR, minimal response; ORR, overall response rate; PI, proteasome inhibitor; POM, pomalidomide; PR, partial response; sCR, stringent complete response; SD, stable disease; VGPR, very good partial response.
[a]Not anti-CD38 refractory.
Data cutoff 06 May 2019.

- Eight patients did not have available response information at data cutoff; 2 patients response evaluable, PI exposed, but refractoriness to PI subject to confirmation, thus excluded from subgroup analysis (**Figure 6**)
- One patient with stringent complete response (sCR) also confirmed as minimal residual disease negative (10^{-6} sensitivity), with ongoing progression-free period of 13.6 months
- Median time to response 1.2 months

Table 4. Best Response for EMD and Non-EMD Patients (n=67)

	ORR, %
EMD-relapsed/refractory patients[a] (n=40)	29
Non-EMD-relapsed/refractory patients[a] (n=27)	38
EMD triple-class refractory[a] (n=37)	23
Non-EMD triple-class refractory[a] (n=20)	26

EMD, extramedullary disease; EoT, end of treatment; ORR, overall response rate.
[a]2, 1, 2, 1 patients, respectively, did not have any available response data or EoT data at the time of data cutoff.
Data cutoff 06 May 2019.

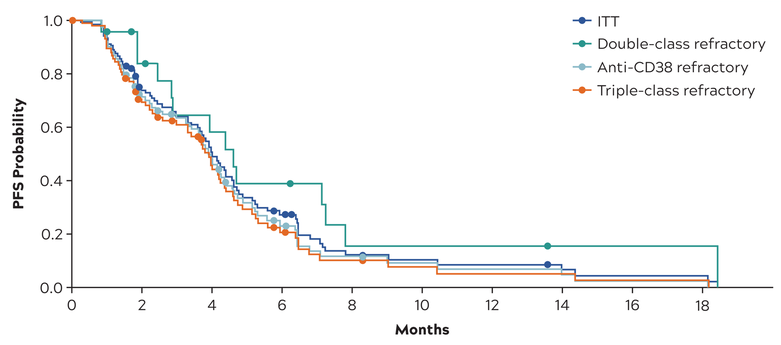
- Poor outcomes observed across the limited clinical trial datasets available[17-21]
- Studies have failed to demonstrate any significant and/or durable response in patients with relapsed EMD: only daratumumab and pomalidomide have shown response with ORRs of 17% and 9%, respectively (≥3 prior lines of therapy; daratumumab and pomalidomide naïve)[17-21]
- HORIZON is one of the largest clinical trial cohorts of EMD-relapsed/refractory patients to date
  - EMD data pending for 54 patients (across 3 major participating centers with recently enrolled patients, limited data entry to date)

Table 5. Duration of Response in Patient Subgroups

	Median DOR, mos	Events, n (%)
All responders[a] (n=32)	4.4	21 (66)
Non-EMD (n=10)	8.1	5 (50)
EMD (n=11)	3.7	7 (64)
Triple-class refractory[a] (n=17)	3.6	12 (71)
Non-EMD (n=5)	7.5	3 (60)
EMD (n=8)	3.7	5 (63)

DOR, duration of response; EMD, extramedullary disease.
[a]11 and 4 responding patients respectively had missing EMD data.
Data cutoff 06 May 2019.

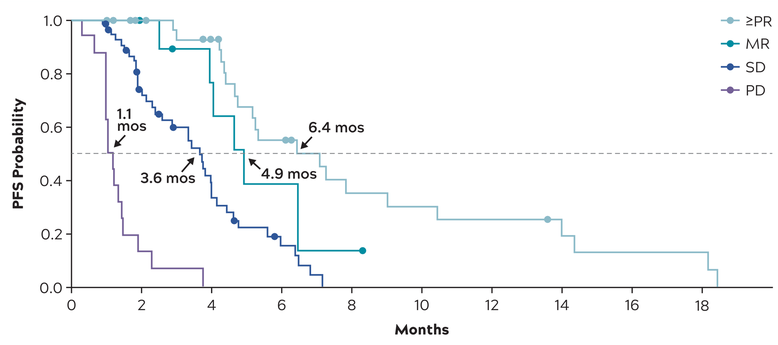
Figure 7. Progression-Free Survival (N=121)



IMiD, immunomodulator; ITT, intention-to-treat; PFS, progression-free survival; PI, proteasome inhibitor.
[a]Not anti-CD38 refractory.
Data cutoff 06 May 2019.

- Median PFS 4.0 months (95% CI, 3.7-4.6; **Figure 7**)
- Similar PFS seen across different refractory subgroups (**Figure 7**)

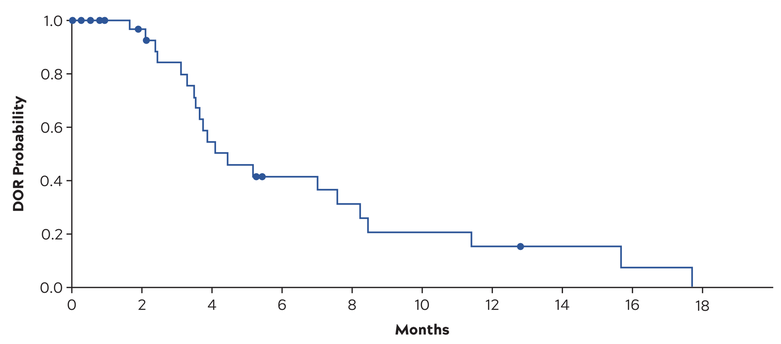
Figure 8. Progression-Free Survival by Response Subgroups (N=121)



MR, minimal response; PD, progressive disease; PFS, progression-free survival; PR, partial response; SD, stable disease.
Data cutoff 06 May 2019.

- Median PFS 6.4 months in patients with ≥ PR; 4.9 months in those with minimal response (MR; **Figure 8**)

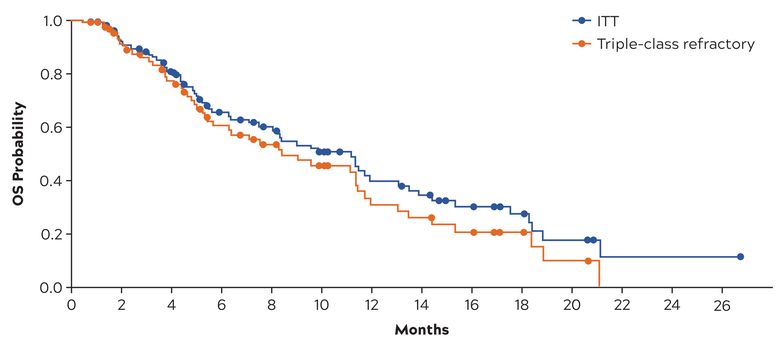
Figure 9. Duration of Response (n=32)



DOR, duration of response.
Data cutoff 06 May 2019.

- Median DOR 4.4 months (95% CI, 3.6-8.3; **Figure 9**)

Figure 10. Overall Survival (N=121)



ITT, intention-to-treat; OS, overall survival.
Data cutoff 06 May 2019.

- Median OS 11.2 months (95% CI, 8.1-13.9) for the intention-to-treat population (N=121), and 8.5 months (95% CI, 6.4-11.8) for triple-class refractory population (n=89; **Figure 10**)

Table 6. Dose Modifications Due to TEAEs

Action Taken With Melflufen (N=121)	n (%)
Dose modification due to TEAE	56 (46)
Dose reduced[a]	27 (22)
Dose delayed[b]	43 (36)
Drug discontinued	29 (24)

TEAE, treatment-emergent adverse event.
[a]Dose modification calculated as the number of patients with a TEAE requiring a dose modification at any time point.
[b]Dose delayed calculated as number of patients with a TEAE leading to a dose delay. Patients may have had more than 1 action taken with melflufen and may be included in more than 1 category.
Data cutoff 06 May 2019.

Table 7. Safety and Tolerability of Melflufen

Treatment-Related AEs, n (%)	Grade 3[a] (N=121)	Grade 4 (N=121)
Any AE	29 (24)	59 (49)
Thrombocytopenia	26 (21)	44 (36)
Neutropenia	31 (26)	37 (31)
Anemia	31 (26)	1 (1)

AE, adverse event; SAE, serious adverse event.
[a]Grade 3 AEs occurring in ≥5% of patients.
Data cutoff 06 May 2019.

- Treatment-related serious AEs in 20% of patients
  - Most commonly, febrile neutropenia (5%) and thrombocytopenia (2%)
- Grade 4 platelet values at day 29 in 4% of cycles
- 6 patients (6%) experienced treatment-related bleeding: grade 1 in 4 patients, grade 3 in 2 patients
- Low overall incidence of nonhematologic AEs
- No treatment-related deaths

CONCLUSIONS

- Melflufen continues to demonstrate promising activity in patients with RRMM (majority with EMD) refractory to lenalidomide- and PI-based regimens and subsequently resistant to daratumumab- and/or pomalidomide-based salvage therapy
  - ORR 28% (≥PR), CBR 40% (≥MR), disease stabilization (≥SD) 86%
    - ORR 55% double-class refractory (including pomalidomide), 22% anti-CD38 refractory, 20% triple-class refractory
    - ORR 29% in patients with EMD
  - PFS 4.0 months; DOR 4.4 months
- Treatment generally well tolerated, with manageable toxicity
  - Nonhematologic AEs infrequent
  - Low rate of discontinuation because of AEs
- OCEAN phase 3 study comparing melflufen/dexamethasone and pomalidomide/dexamethasone in RRMM is ongoing (NCT03151811)

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DISCLOSURES

PGR: consulting/advisory role with Oncopeptides and research funding from Oncopeptides. **AO:** consulting/advisory role with Amgen, Janssen, Celgene, and Takeda. **AL:** honoraria from Amgen, Bristol-Myers Squibb, Celgene, and Janssen-Cilag. **PRO:** honoraria from Celgene and Janssen; consulting/advisory role with Celgene and Janssen; research funding from Celgene and Bristol-Myers Squibb. **MN:** honoraria from Celgene; consulting/advisory role with Novartis, Celgene, Pfizer, and Jazz Pharmaceuticals. **JB:** honoraria from Celgene, Amgen, and Janssen. **MC, AM:** no conflicts of interest to report. **HH:** research funding from Oncopeptides. **XL:** honoraria from Celgene, Takeda, Amgen, Janssen, Gilead, Karyopharm, Mundipharma, Carsgen, Novartis, Oncopeptides, and AbbVie. **AA:** consulting/advisory role with Celgene, Jansen, Amgen, and Takeda. **CM:** honoraria from Amgen, Celgene, Gilead, Janssen, Incyte, Takeda, and Verastem. **AP:** honoraria from Celgene and Amgen; consulting/advisory role with Celgene. **JAZ:** honoraria from Bristol-Myers Squibb and Celgene; consulting/advisory role with Alnylan, Prothena, Amgen, Takeda, Celgene, Caelum, and Oncopeptides; research funding from Bristol-Myers Squibb and Celgene. **NP:** TBD. **JHarran:** TBD. **JHarmenberg, ST, HZ:** employment and equity ownership with Oncopeptides. **MVM:** honoraria from Janssen, Celgene, Amgen, and Takeda; consulting/advisory role with Janssen, Celgene, Amgen, Takeda, GSK, AbbVie, and Oncopeptides.

Placeholder

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