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Original Article

Retrospective evaluation of prognostic factors and survival in patients with multiple myeloma: A single-center experience

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Abstract

Aim: Multiple myeloma (MM) is a malignant plasma cell disorder. Prognosis varies according to several factors, including laboratory parameters, comorbidities, and treatment strategies. The aim of this study was to evaluate prognostic markers and survival outcomes in patients with MM.

Materials and Methods: A retrospective study was conducted on 180 patients diagnosed with MM at Mersin University Hospital between 2005 and 2017. Demographic, clinical, laboratory, and treatment data were collected at diagnosis. Patients were staged according to the International Staging System (ISS) and the Durie–Salmon classification. Prognostic and mortality analyses included demographic characteristics, laboratory parameters (e.g., hemoglobin, renal function, calcium, platelet count), disease stage, and treatment modalities.

Results: Median overall survival (OS) was significantly longer in patients under 65 years of age compared to those aged 65 years and older (41.3 vs. 20.7 months, $p<0.001$), and in patients with hemoglobin levels ≥10 g/dL compared to those with lower levels (38.5 vs. 23.0 months, $p<0.001$). Renal dysfunction, hypercalcemia, and platelet counts <140.000/µL were associated with shorter OS. Thrombocytopenia was identified as an independent predictor of mortality (OR 6.29, $p<0.001$). Patients who underwent autologous stem cell transplantation (ASCT) had significantly improved OS compared to those who did not (50 vs. 25.5 months, $p<0.001$). Radiotherapy was associated with better survival, whereas the presence of osteolytic lesions and the need for dialysis were associated with poorer outcomes. Among first-line therapies, VAD-based regimens demonstrated superior OS compared to thalidomide-based regimens ($p=0.004$).

Conclusion: In our study, we showed that low hemoglobin (<10 g/dL), impaired renal function (creatinine ≥2 mg/dL) , hypercalcemia (calcium ≥11.5 mg/dL), and low platelet count (<140.000/µL) were associated with poorer survival in MM. Age was also a significant prognostic factor. Patients who underwent ASCT had significantly better survival compared to those who did not, highlighting the prognostic impact of treatment strategies.

Keywords: Multiple myeloma, prognostic factors, survival analysis

INTRODUCTION

Multiple myeloma (MM) is a clonal plasma cell malignancy (1). More than 60% of cases are diagnosed in adults over the age of 65, whereas fewer than 15% occur in individuals under 55. The median age at diagnosis is 69 years (2). MM accounts for approximately 1.1% of cancer-related deaths worldwide and is about 1.5 times more common in males than in females (3,4).

The clinical presentation of MM ranges from incidental findings to life-threatening complications. Fatigue, bone pain, and recurrent infections are among the most common manifestations. Renal impairment occurs in approximately 20–50% of cases, primarily due to light chain cast nephropathy or other mechanisms of tubular dysfunction. Hypercalcemia is observed in 20–30% of patients during the disease course. Less common secondary complications include hyperviscosity syndrome (3–5%), bleeding tendencies, and radicular pain (2,5). Extramedullary disease is present in 1–2% of patients at diagnosis and develops

in about 8% during follow-up (6).

In 2014, the International Myeloma Working Group (IMWG) updated the diagnostic criteria for MM. Three new markers—collectively known as "SLiM" (≥60% clonal plasma cells in the bone marrow, a serum free light chain [FLC] ratio >100, or ≥1 focal lesion ≥5 mm on whole-body MRI)—were added to the previously used CRAB (hypercalcemia, renal failure, anemia, and bone lesions) criteria. Together, these constitute the Myeloma Defining Events (MDE), which determine whether treatment is required. These revised criteria enable earlier diagnosis and treatment before irreversible end-organ damage occurs (7).

Prognostic factors include age, sex, genetic background, ethnicity, disease stage at diagnosis, cytogenetic abnormalities, treatment response, and comorbidities (8,9). The primary goals of MM management are to prolong survival and prevent end-organ damage caused by the disease or its treatment (10). In addition, routine laboratory parameters such as hemoglobin, serum calcium, and creatinine levels provide valuable prognostic information. Anemia reflects extensive bone marrow infiltration and is associated with advanced disease stage, while hypercalcemia and impaired renal function are well-recognized indicators of high tumor burden and end-organ damage (2,5,8,9).

Treatment selection is guided by eligibility for autologous stem cell transplantation (ASCT). First-line regimens include bortezomib–lenalidomide–dexamethasone (VRd) and combinations with cyclophosphamide (VCd) or thalidomide (VTd). In younger patients, carfilzomib–lenalidomide–dexamethasone (KRd), daratumumab–lenalidomide–dexamethasone (DRd), and the addition of daratumumab to VRd are commonly used (11,12). Maintenance therapy typically involves lenalidomide and/or bortezomib (13). For relapsed disease, effective daratumumab-based combinations include daratumumab–bortezomib–dexamethasone (DVd) and daratumumab–pomalidomide–dexamethasone (DPd) (14). Other agents for relapsed/refractory MM include elotuzumab, ixazomib, pomalidomide, and venetoclax (15–17).

The aim of this study was to evaluate the clinical characteristics, prognostic markers, treatment regimens, and survival outcomes of patients with MM, and to investigate the impact of different clinical and laboratory factors on prognosis and survival. Data were retrospectively analyzed from patients followed at the Adult Hematology Clinic of Mersin University between 2005 and 2017.

MATERIALS AND METHODS

This retrospective study was conducted at the Adult Hematology Clinic of Mersin University Faculty of Medicine. A total of 212 patients diagnosed with MM between 2005 and 2017 were identified from the institutional database. Of these, 32 patients were excluded due to incomplete medical records, uncertain diagnostic information, or insufficient follow-up data. The final study population included 180 patients (100 males and 80 females). Among them, 96 patients were younger than 65 years and 84 patients were 65 years or older, and all had adequate follow-up data for survival analysis.

Patients were staged at the time of diagnosis using the Durie–Salmon staging system (DS) and the International Staging System (ISS) (18,19). Demographic characteristics, paraprotein type, comorbidities, bone involvement, disease stage, treatment protocols, and baseline laboratory values (hemoglobin, white blood cell count, platelet count, corrected calcium, creatinine, beta-2 microglobulin, and erythrocyte sedimentation rate) were recorded. The number of patients with available data for each variable was noted. Missing data were excluded from analyses. Missing data rates ranged from 0% to approximately 10% depending on the variable.

Patients were categorized according to the line of therapy received (first to fifth line). Those receiving third-, fourth-, or fifth-line therapy included patients with relapsed or refractory disease, as well as those undergoing maintenance therapy. Patients who did not receive treatment consisted of individuals with asymptomatic MM under observation and those who died shortly after diagnosis. Treatment lines and regimens were documented for all patients.

The study was approved by the Mersin University Human Research Ethics Committee (Date: 08/12/2016; No: 22-369).

Statistical Analysis

The normality of data distribution was assessed using the Shapiro–Wilk test. Descriptive statistics were expressed as mean ± standard deviation for normally distributed variables and as median with interquartile ranges for non-normally distributed variables. Categorical variables were compared using the Chi-square test. Survival analyses were performed to evaluate the relationship between treatment modalities and survival outcomes. Kaplan–Meier analysis was used to estimate survival, and the log-rank test was applied to compare survival distributions between groups. Logistic regression analysis was performed to identify independent risk factors for mortality. All statistical analyses were conducted using SPSS version 11.5. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 180 patients diagnosed with MM were included in the survival analysis. Overall survival (OS) differed significantly according to age, with patients younger than 65 years showing longer OS than those aged 65 years and older ($p<0.001$). In contrast, no significant difference in OS was observed between male and female patients ($p=0.786$).

Baseline hemoglobin level was significantly associated with OS, with lower hemoglobin levels associated with reduced OS ($p<0.001$). Serum creatinine levels ≥2 mg/dL and serum calcium levels ≥11.5 mg/dL at diagnosis were also significantly associated with OS ($p=0.003$ and $p=0.040$, respectively).

There was no statistically significant association between OS and white blood cell count or platelet count in univariate analyses (p>0.05 for both).

Hemoglobin, platelet count, white blood cell count, beta-2 microglobulin, corrected calcium, creatinine, and erythrocyte sedimentation rate at diagnosis were subsequently evaluated in a multivariable model. In this analysis, platelet count emerged as an independent prognostic factor, with thrombocytopenia (platelet count <140×10³/μL) associated with an increased risk of all-cause mortality (OR: 6.29, 95% CI: 2.84–13.9, p<0.001).

Osteolytic lesions were significantly associated with OS, with shorter survival observed in patients with osteolytic disease compared to those without such lesions (p=0.001). Similarly, the requirement for dialysis was associated with reduced OS (p=0.01). Extramedullary plasmacytoma was not significantly associated with OS (p=0.578), whereas receipt of radiotherapy was associated with longer OS (p=0.026).

According to the ISS, OS differed significantly across disease stages, with progressively shorter OS observed from stage I to stage III (p<0.001). Similarly, staging based on the DS system showed a significant association with OS, with more advanced stages associated with reduced survival (p<0.001). A comprehensive summary of median survival according to clinical and laboratory parameters is presented in Table 1.

Table 1. Comparison of clinical and laboratory variables according to median overall survival in patients with multiple myeloma

Variable	Number (%)	Median overall survival (months)	p-value
Gender [a]			
Female	80 (44.4)	32.4	0.786
Male	100 (55.6)	31.2	
Mortality [a]			
Female	45 (44.1)	4.2	0.920
Male	57 (55.9)	0.9	
Age [a]			
<65	96 (53.3)	41.3	**<0.001**
≥65	84 (46.7)	20.7	
Mortality [a]			
Age <65	49 (48.0)		0.104
Age ≥65	53 (52.0)		
Comorbidity			
None	82 (45.6)		
Hypertension	74 (41.1)		
Diabetes mellitus	6 (3.3)		
Coronary artery disease	5 (2.8)		
Osteoporosis	6 (3.3)		
Chronic renal failure	3 (1.7)		
Coexisting malignancies	3 (1.7)		

Abbreviations: N/A: Not Applicable, IgG: Immunoglobulin G, IgA: Immunoglobulin A, Light chain: Light chain myeloma, Non-secretory: Myeloma without detectable monoclonal protein in serum or urine, WBC: White Blood Cell count, β2-Microglobulin: Beta-2 Microglobulin, ESR: Erythrocyte Sedimentation Rate, ISS: International Staging System, DS: Durie-Salmon system. (a) represents median (interquartile range) and (b) represents mean±standard deviation. Note: The number of patients with available data for each variable is indicated in the table. Missing data ranged from 0% to approximately 10%, depending on the variable. Variation in total patient numbers reflects incomplete data or applicability to subgroups. p<0.05, Kaplan-Meier test

Table 1. Comparison of clinical and laboratory variables according to median overall survival in patients with multiple myeloma

Variable	Number (%)	Median overall survival (months)	p-value
Presenting complaint			
Bone pain	119 (66.1)		
Infection	24 (13.3)		N/A
Renal failure	35 (19.4)		
Bleeding	2 (1.1)		
Paraprotein subtype [a]			
IgG	81 (45)	29 (1–132)	
IgA	63 (35)	36.8 (1–126)	0.169
Light chain	33 (18.3)	26.2 (1–91)	
Non-secretory	3 (1.67)	67 (62–72)	
Hemoglobin [a]			
<10 g/dL	79 (43.9)	23	**<0.001**
≥10 g/dL	101 (56.1)	38.5	
WBC [a]			
<4500 /µL	58 (32.2)	26 (1–108)	0.203
4500–10500 /µL	105 (58.3)	34.7 (1–132)	
≥10500 /µL	17 (9.4)	32.5 (3–126)	
Calcium [a]			
<11.5 mg/dL	145 (80.6)	34	**0.040**
≥11.5 mg/dL	35 (19.4)	22.5	
Creatinine [a]			
<2 mg/dL	135 (75)	35.5	**0.003**
≥2 mg/dL	45 (25)	20.2	
Platelet [a]			
<140.000 /µL	70 (38.9)	28.2	0.210
≥140.000 /µL	110 (61.1)	34	

Abbreviations: N/A: Not Applicable, IgG: Immunoglobulin G, IgA: Immunoglobulin A, Light chain: Light chain myeloma, Non-secretory: Myeloma without detectable monoclonal protein in serum or urine, WBC: White Blood Cell count, β2-Microglobulin: Beta-2 Microglobulin, ESR: Erythrocyte Sedimentation Rate, ISS: International Staging System, DS: Durie-Salmon system. (a) represents median (interquartile range) and (b) represents mean±standard deviation. Note: The number of patients with available data for each variable is indicated in the table. Missing data ranged from 0% to approximately 10%, depending on the variable. Variation in total patient numbers reflects incomplete data or applicability to subgroups. $p<0.05$, Kaplan-Meier test

Table 1. Comparison of clinical and laboratory variables according to median overall survival in patients with multiple myeloma

Variable	Number (%)	Median overall survival (months)	p-value
β2-Microglobulin [a]			
<3.5 mg/L	74 (41.1)	43.9 (3–132)	**<0.001**
3.5–5.5 mg/L	55 (30.6)	27.9 (1–104)	
>5.5 mg/L	51 (28.3)	20.8 (1–86)	
ESR a			
<50 mm/hr	97 (53.9)	37.9 (1–126)	**0.007**
50–100 mm/hr	67 (37.2)	26.1 (1–132)	
>100 mm/hr	16 (8.9)	17.5 (1–82)	
Osteolytic lesions [b]			
Present	147 (81.7)	28.2	**0.001**
Absent	33 (18.3)	47.4	
Dialysis requirement [b]			
Present	24 (13.3)	17	**0.01**
Absent	156 (86.7)	34	
Extramedullary plasmacytoma [b]			
Yes	46 (25.6)	34	**0.578**
No	134 (74.4)	31	
Radiotherapy requirement [b]			
Yes	43 (23.9)	40.6	**0.026**
No	137(76.1)	29	
ISS stage[a]			
I	42 (23.7)	43.8 (8–132)	**<0.001**
II	79 (44.6)	33.5 (1–126)	
III	56 (31.6)	20.5 (1–86)	
DS Stage[a]			
I	24 (13.3)	51.4 (8–120)	**<0.001**
II	115 (63.9)	33.8 (1–132)	
III	38 (21.1)	13.3 (1–86)	

Abbreviations: N/A: Not Applicable, IgG: Immunoglobulin G, IgA: Immunoglobulin A, Light chain: Light chain myeloma, Non-secretory: Myeloma without detectable monoclonal protein in serum or urine, WBC: White Blood Cell count, β2-Microglobulin: Beta-2 Microglobulin, ESR: Erythrocyte Sedimentation Rate, ISS: International Staging System, DS: Durie-Salmon system. (a) represents median (interquartile range) and (b) represents mean±standard deviation. Note: The number of patients with available data for each variable is indicated in the table. Missing data ranged from 0% to approximately 10%, depending on the variable. Variation in total patient numbers reflects incomplete data or applicability to subgroups. $p<0.05$, Kaplan-Meier test

First-line treatment regimens were planned for all 180 patients. The majority of patients received VAD-based regimens, followed by thalidomide-based and bortezomib-based regimens, while a small proportion received other therapies or did not initiate treatment due to asymptomatic disease or early mortality after diagnosis.

OS differed among first-line treatment regimens. Patients treated with VAD-based therapy showed longer OS compared to those receiving thalidomide-based regimens (p=0.004), whereas no significant difference was observed between VAD- and bortezomib-based regimens (p=0.552) or between thalidomide- and bortezomib-based regimens (p=0.407).

Second-line therapy was administered to 121 patients (67.2%). OS varied according to second-line treatment regimens; however, no significant difference in survival was observed between thalidomide- and bortezomib-based therapies (p=0.771).

Third-line therapy was received by 69 patients. OS differed across third-line treatment regimens. A significant difference in survival was observed between bortezomib-based regimens and other regimens (p=0.046), while no significant differences were identified in the remaining pairwise comparisons.

Thirty-three patients underwent fourth-line therapy. OS varied across fourth-line treatment regimens; however, no statistically significant differences were observed between the evaluated regimens (p=0.316).

Fifth-line therapy was received by 9 patients. Statistical comparisons were not performed due to the limited sample size. The most commonly used treatment regimens and their associated survival outcomes are summarized in Table 2.

Table 2. Summary of chemotherapy regimens by treatment line

Treatment Line	Regimen	n (%)	Median OS (months)	p-value
1st-line	VAD	106 (58.8)	35.5	
	Thalidomide-based (MPT, TD)	28 (15.5)	14	0.004[a]
	Bortezomib-based (VCD, VD, MVP)	23 (12.7)	8	0.552[a]
	Other (MP)	3 (1.6)	72	N/A
	No treatment	20 (11.1)	N/A	N/A
2nd-line	VAD	2 (1.6)	81.5	
	Thalidomide-based (MPT, T, TD)	26 (21.4)	35	0.771[a]
	Bortezomib-based (VCD, VD, MVP)	86 (71)	37	0.771[a]
	Lenalidomide-based (RD)	7 (5.7)	13	N/A
3rd-line	Thalidomide-based (TCD)	6 (8.6)	45	
	Bortezomib-based (VCD, VD)	35 (50.7)	46	0.286[a]
	Lenalidomide-based (RCD, RD)	23 (33.3)	32	0.928[a]
	Other (DT-PACE, COEP, VRD, VTD)	5 (7.2)	36	0.046[a]
4th-line	Thalidomide-based (T, TD)	2 (6.06)	37	
	Bortezomib-based (VCD, VD)	8 (24.2)	46.5	0.316[a]
	Lenalidomide-based (RD)	20 (60.6)	39	0.316[a]
	Other (VRD, Carfilzomib)	3 (9.09)	78	N/A
5th-line	Bortezomib-based (VCD)	2 (22.2)	46	N/A
	Lenalidomide-based (R, RD)	5 (55.5)	59	N/A
	Other (DT-PACE, Carfilzomib)	2 (22.2)	58	N/A

Abbreviations: VAD: Vincristine, Adriamycin, Dexamethasone, MPT: Melphalan, Prednisone, Thalidomide, TD: Thalidomide, Dexamethasone, VCD: Bortezomib, Cyclophosphamide, Dexamethasone, VD: Bortezomib, Dexamethasone, MVP: Melphalan, Vincristine, Prednisone, MP: Melphalan, Prednisone, T: Thalidomide, RD: Lenalidomide, Dexamethasone, TCD: Thalidomide, Cyclophosphamide, Dexamethasone, RCD: Lenalidomide, Cyclophosphamide, Dexamethasone, DT-PACE: Dexamethasone, Thalidomide, Cisplatin, Doxorubicin, Cyclophosphamide, Etoposide, COEP: Cyclophosphamide, Vincristine, Etoposide, Prednisone, VRD: Bortezomib, Lenalidomide, Dexamethasone, VTD: Bortezomib, Thalidomide, Dexamethasone. [a] p-values were calculated using the log-rank test, representing pairwise survival comparisons of each treatment regimen against VAD within the same treatment line.

Autologous stem cell transplantation (ASCT) was performed in 46 patients (25.5%) and was associated with significantly longer OS compared to patients who did not undergo transplantation (p<0.001).

During follow-up, 101 patients (56.1%) died. Among patients with available data on the cause of death, infections were the most common cause, followed by bleeding, acute renal failure, and other causes, while the cause of death was unknown in a proportion of cases.

Adverse events were reported in 56 patients (31.1%), most commonly peripheral neuropathy and thrombosis. Data on causes of death and treatment-related side effects are summarized in Table 3.

Table 3. Summary of Chemotherapy Regimens by Treatment Line

Category	n	% of total (n=180)	% Within Group
Causes of death			
Total deaths	101	56.1	
Deaths with documented cause	76	42.2	
Infections	55	30.6	72.4
Bleeding	3	1.7	3.9
Acute renal failure	2	1.1	2.6
Other causes	16	8.9	21.1
Unknown cause	25	13.9	24.8
Adverse events	56	31.1	
Peripheral neuropathy	49	27.2	87.5
Thrombosis	7	3.9	12.5

DISCUSSION

The present study provides a comprehensive retrospective evaluation of the clinical characteristics, prognostic factors, treatment regimens, and survival outcomes of patients with MM treated at a single tertiary care center. Age, hemoglobin level, renal function, calcium level, and platelet count were identified as significant prognostic indicators. Thrombocytopenia was found to be an independent predictor of mortality, while autologous stem cell transplantation was associated with significantly improved survival. VAD-based regimens were associated with better survival compared to thalidomide-based treatments, and infections were the most common cause of death during follow-up.

In this cohort of 180 patients with MM, several important prognostic factors and treatment responses were observed. Age was a significant determinant of OS, with younger patients (<65 years) demonstrating a significantly better prognosis. This finding is consistent with previous studies reporting longer survival in younger patient groups, which may be attributed to factors such as better treatment tolerance and fewer comorbidities (20,21).

The outcomes in our study were significantly better for patients with hemoglobin levels ≥10 g/dL at diagnosis. Findings from the IMWG have shown that anemia at diagnosis is associated with a greater disease burden and more advanced stage. Although hemoglobin levels are not directly included in the R-ISS, anemia is linked to poorer outcomes and reflects extensive bone marrow infiltration or renal impairment (22). Renal dysfunction and hypercalcemia were also associated with poorer survival in our analysis, consistent with findings from multiple other MM survival studies (1,5,20).

One of the notable findings of our study was that thrombocytopenia (platelet count <140.000/μL) was identified as an independent prognostic factor, increasing all-cause mortality by 6.29-fold. Numerous studies have investigated the impact of platelet count and platelet indices on prognosis. In a retrospective study of 122 newly diagnosed MM patients treated with bortezomib-based chemotherapy, the effect of the platelet–lymphocyte ratio (PLR) at diagnosis on OS and progression-free survival (PFS) was evaluated. Patients in the low PLR group had significantly shorter OS and PFS compared to those in the high PLR group (23). However, the lack of an association between platelet count and overall survival in univariate analysis suggests that this finding should be interpreted with caution and may reflect underlying disease burden, bone marrow involvement, or confounding clinical factors rather than a direct causal relationship.

Significantly worse outcomes were associated with osteolytic lesions and the need for dialysis, which is consistent with previous research linking end-organ damage and high tumor burden to poorer survival (24,25). Conversely, patients who

received radiotherapy demonstrated better OS, which may be explained by the important role of radiotherapy in achieving local disease control and providing symptom relief (26).

Treatment comparisons showed that, in this cohort, median OS differed among first-line treatment regimens, with longer OS observed in patients treated with VAD-based therapy compared to thalidomide- or bortezomib-based regimens. Although VAD is now largely obsolete and has been replaced by proteasome inhibitors and immunomodulatory drugs, this finding should be interpreted with caution. The observed differences may reflect factors related to the treatment era, patient selection, or earlier disease stage at the time of treatment initiation rather than a true therapeutic advantage. Accordingly, current guidelines recommend bortezomib-based triplet regimens as the standard first-line therapy (27).

In the second and third lines, survival outcomes were comparable across regimens, although bortezomib demonstrated a significant advantage over other regimens in the third line ($p=0.046$). Fourth- and fifth-line results were heterogeneous and lacked statistical power due to the small sample sizes. These findings highlight the variability of salvage therapy and support the growing emphasis on individualized treatment strategies (28).

According to our study results, ASCT played a significant role by substantially increasing OS (50 months versus 25.5 months, $p<0.001$), and this result is consistent with the literature (29).

In our study, adverse events, mainly peripheral neuropathy and thrombotic complications, were observed at rates consistent with the expected toxicity profile of bortezomib- and thalidomide-based therapies. This finding is in line with prior clinical trials, emphasizing that these adverse effects remain a significant limitation to the long-term use of these agents (30,31). Awareness of such toxicities is crucial not only for guiding treatment selection but also for tailoring supportive interventions, including thromboprophylaxis and early recognition of neuropathy, which may help to minimize morbidity and improve treatment adherence (32).

In our cohort, median OS was 35.5 months with first-line VAD regimens, 14 months with thalidomide-based regimens, and 8 months with bortezomib-based regimens. These results are significantly lower than the survival rates reported in large international studies. For example, in the IFM 2009 study, median PFS reached 50 months in the transplantation arm, and 4-year overall survival rates were reported as 81% and 82% in the transplantation and lenalidomide–bortezomib–dexamethasone (RVd)-only groups, respectively (33). These differences can be explained by variations in the treatment era, access to new agents, and supportive care conditions.

This study has several limitations. First, as a single-center retrospective analysis, it is subject to inherent selection and information biases, which may limit the generalizability of the findings. Second, treatment heterogeneity across different time periods and physician preferences may have influenced survival outcomes. Third, the relatively small sample size in the later lines of therapy reduced the statistical power of some subgroup analyses. Finally, cytogenetic and molecular risk stratification data were not available for most patients, which prevented a more detailed assessment of high-risk disease features and their prognostic implications.

CONCLUSION

Age, hemoglobin level, kidney function, calcium level, and platelet count are important prognostic indicators in MM. Specifically, younger age, higher hemoglobin levels (≥10 g/dL), preserved kidney function, normal calcium levels, and higher platelet counts are associated with better survival. Our findings emphasize the importance of these clinical and laboratory variables in risk stratification. Furthermore, real-world survival outcomes across treatment lines highlight the value of early and effective therapy, as well as ASCT, in improving prognosis. Evaluating pretreatment anemia, renal dysfunction, hypercalcemia, and thrombocytopenia may help improve survival and predict treatment response. Prospective follow-up studies are required to better elucidate these associations.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that there is no financial support.

Ethical Approval
The study protocol received approval from the Clinical Research Ethics Committee of the Mersin University Rectorate by its decision dated 08/12/2016 and numbered 22/369.

Patient Consent
Not necessary for this manuscript.

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