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Renal impairment and its clinical predictors among patients with multiple myeloma: a multicenter study with implications for cancer care

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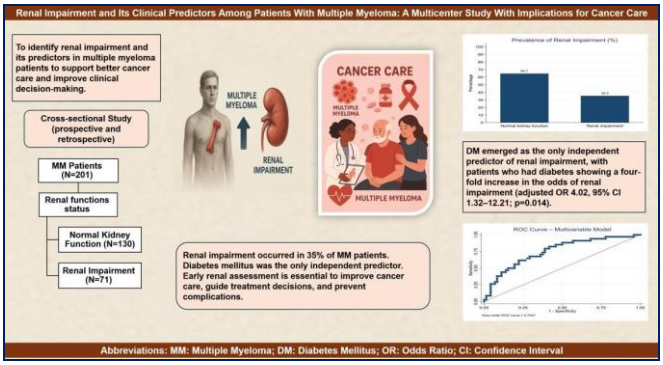
Abstract

Introduction: Renal impairment is a frequent and clinically significant complication of multiple myeloma (MM), influencing treatment choices, toxicity risk, and survival. Evidence from Middle Eastern populations remains limited. **Objective:** This study assessed the prevalence of renal impairment among MM patients and examined clinical and laboratory predictors associated with kidney dysfunction. **Methods:** A cross-sectional study was conducted across major hospitals in the West Bank from 2018 to 2025, including 201 adults with confirmed MM. Demographic, clinical, and laboratory data were collected through retrospective chart review. Renal impairment was defined using sex-specific creatinine thresholds. Univariable and multivariable logistic regression analyses were performed to identify independent predictors. **Results:** Renal impairment was present in 35.3% of patients. Those with impaired kidney function had higher median uric acid, calcium, and inflammatory marker levels and slightly lower albumin levels, although these differences did not remain significant after adjustment. In the multivariable model, diabetes mellitus was the only independent predictor of renal impairment (adjusted OR 4.02; p=0.014). Model performance was acceptable, with an AUC of 0.75. **Conclusion:** Renal impairment is common among MM patients, and diabetes substantially increases the risk. Routine renal monitoring and aggressive management of metabolic comorbidities, particularly diabetes, may improve kidney outcomes and support better overall care.

Keywords: Renal impairment. Multiple myeloma. Survival. Kidney dysfunction. Comorbidities.

Graphical Abstract



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Introduction

Multiple myeloma (MM) is a malignant clonal plasma-cell neoplasm characterized by the accumulation of abnormal plasma cells in the bone marrow and the production of monoclonal immunoglobulin or free light chains [1]. It accounts for

roughly 1% of all cancers and about 10% of hematologic malignancies, with an incidence that rises steeply with age, particularly after the sixth decade of life [1,2]. Despite substantial therapeutic advances, MM remains incurable mainly and continues to impose a considerable global burden in terms of morbidity, mortality, and healthcare resource utilization [2,3]. Organ damage is a defining feature of symptomatic disease, and the classic "CRAB" manifestations, hypercalcemia, renal impairment, anemia, and bone lesions, summarize the principal target organs affected by the myeloma clone [1,3].

Renal involvement is one of the most frequent and clinically consequential complications of MM. Kidney injury arises through multiple mechanisms, including toxic effects of circulating monoclonal free light chains that lead to myeloma cast nephropathy, monoclonal immunoglobulin deposition disease, and AL amyloidosis, as well as non-immunologic factors such as hypercalcemia, dehydration, infections, sepsis, and exposure to nephrotoxic medications [4-7]. Some degree of renal impairment is reported in approximately 20–40% of patients at the time of MM diagnosis, and up to half of patients develop renal dysfunction during the course of their disease, while a smaller but significant subset presents with severe kidney failure requiring dialysis [4,6-9].

Renal impairment is consistently associated with higher tumor burden, more advanced International Staging System (ISS) stage, and inferior outcomes, including increased early mortality and reduced overall survival compared with patients who maintain preserved kidney function [6,8-10]. Although recovery of renal function after anti-myeloma therapy is achievable in a substantial proportion of patients and is associated with better prognosis, it does not fully mitigate the adverse impact of kidney dysfunction on survival [8,9].

From a clinical standpoint, renal impairment profoundly influences therapeutic decision-making in MM. Reduced glomerular filtration rate limits the use of, or mandates dose adjustments for, several cornerstone agents, including some immunomodulatory drugs, chemotherapeutic agents, and bisphosphonates, and increases the risk of treatment-related toxicity [3,5,6]. In addition, impaired kidney function may restrict eligibility for procedures such as contrast-based imaging and autologous stem-cell transplantation, complicating comprehensive cancer care. Recognizing these challenges, contemporary International Myeloma Working Group recommendations designate prevention, early recognition, and rapid management of myeloma-related renal injury as key therapeutic priorities, emphasizing systematic assessment of renal function at diagnosis and throughout the treatment course [5,6].

Despite this clear clinical importance, the epidemiology and determinants of renal impairment in MM remain incompletely characterized. Existing cohort studies have identified several potential clinical and laboratory correlates, such as older age, advanced ISS stage, heavy light-chain burden, anemia, hypercalcemia, and co-existing comorbidities, including diabetes mellitus and hypertension, but the strength and consistency of these associations vary across populations [4,7,8,10]. Reported prevalence estimates of renal impairment at diagnosis range from around 20% to more than 40%, reflecting differences in case mix, definitions of kidney dysfunction, and access to early myeloma detection [4,6-8]. Furthermore, most of the available data arise from single-center or registry-based cohorts in high-income countries. In contrast, evidence from low- and middle-income settings and from Middle Eastern health systems remains relatively scarce [2,11,12]. In these regions, resource constraints, delays in diagnosis, and limited access to novel myeloma therapies may modify both the burden and the predictors of renal involvement, underscoring the need for context-specific data to guide risk stratification and service planning [11,12].

This study aimed to determine the prevalence of renal impairment among patients with multiple myeloma and to identify clinical and laboratory predictors to support early detection and improve cancer care.

Methods

Study Design and Aim

This cross-sectional observational study was conducted between January 2018 and December 2025. Demographic, clinical, and laboratory data were obtained through a retrospective review of hospital medical records to complement data.

Study Setting and Participants

Participants were recruited from major hospitals in the northern, central, and southern regions of the West Bank, including Al-Watani Hospital and An-Najah National University Hospital (Nablus), the Palestinian Medical Complex (Ramallah), Dura Hospital (Hebron), Beit Jala Hospital (Bethlehem), and Jenin Hospital (Jenin). Eligible patients were aged ≥18 years with a confirmed diagnosis of multiple myeloma according to International Myeloma Working Group criteria, defined by ≥10% clonal plasma cells in the bone marrow or a

biopsy-proven plasmacytoma, together with at least one myeloma-defining event (hypercalcemia, renal insufficiency, anemia, or bone lesions; CRAB features) or specific biomarkers of malignancy **[13]**. All included patients had received at least one prior line of anti-myeloma therapy, such as proteasome inhibitors (e.g., bortezomib), immunomodulatory agents (e.g., lenalidomide or thalidomide), and corticosteroids. Individuals were excluded if they were critically ill, declined participation, or were deceased at the time of data collection. The patient selection process and final sample are summarized in Figure 1.

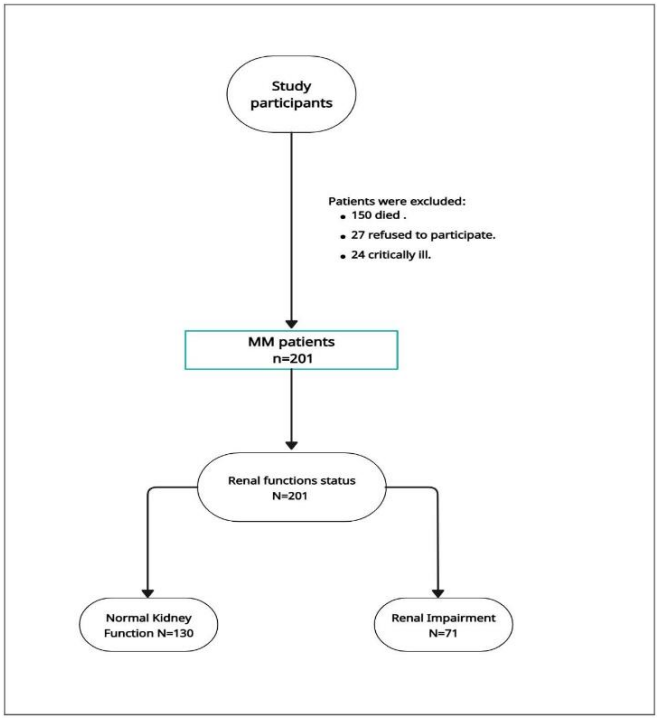

Figure 1. Flowchart of Participant Selection and Renal Function Classification. Source: Own authorship.

Data Collection Procedure

Patients with confirmed multiple myeloma were identified during routine clinic visits and through oncology departments at the participating hospitals. Additional information was abstracted from hospital records. Collected variables included sociodemographic characteristics (e.g., sex, age, place of residence, body habitus) and comorbid conditions. Comorbidities comprised non-communicable diseases and other chronic conditions, including inflammatory bowel disease, thyroid disorders, and additional relevant diagnoses. Symptom history over the disease course was also recorded (e.g., weight loss, abdominal pain, bone pain, change in bowel habits). Laboratory data extracted from the records comprised general hematologic and biochemical parameters (hemoglobin, white blood cell [WBC] count, creatinine, electrolytes) as well as myeloma-specific investigations (beta-2 microglobulin, kappa and lambda light chains, and bone marrow plasma cell percentage, where available). Treatment information was documented for each patient, including the main regimen received: bortezomib, cyclophosphamide, dexamethasone, the VCD protocol (bortezomib–cyclophosphamide–dexamethasone), or autologous bone marrow transplantation. Participants were informed about the study objectives and reassured regarding data confidentiality.

Outcome Definition

The primary outcome of this study was renal impairment, defined using sex-specific serum creatinine thresholds in accordance with commonly used clinical criteria. Renal impairment was coded as a binary variable (1 = impaired kidney function, 0 = normal kidney function). For male patients, renal impairment was defined as a serum creatinine level ≥1.3 mg/dL, while for female patients, renal impairment was defined as serum creatinine ≥1.1 mg/dL **[14]**. Participants with creatinine values below these thresholds were classified as having normal kidney function.

Ethical Considerations

The study protocol was approved by the Institutional Review Board (IRB) of An-Najah National University prior to data collection. Only individuals deemed mentally capable of understanding the study and providing informed consent were invited to participate. Informed consent was obtained from all participants after they received an explanation of the study aims, procedures, and their rights. Participation was voluntary, with explicit assurance that refusal or withdrawal at any stage would not affect their care. Confidentiality was rigorously maintained: no direct identifiers were collected on study forms, all data were anonymized, and electronic files were stored on password-protected devices accessible only to the research team. Statistical analyses were performed on de-identified datasets to safeguard privacy.

Sample Size Justification

Sample size estimation was based on the 5-year prevalence of multiple myeloma in the West Bank, reported as 251 cases in GLOBOCAN 2022 **[15]**. Assuming a 95% confidence level, 5% margin of error, and a conservative response distribution of 50%, the minimum required sample size for proportion estimation was calculated to be 153 patients. The final sample comprised 201 individuals with multiple myeloma, exceeding this requirement and thereby enhancing the precision of prevalence estimates and

enabling exploratory subgroup analyses. This sample size also provides adequate power (>80%) to support multivariable modeling with 10 or more predictors, assuming mediumto-large effect sizes ($f^2 \geq 0.15$).

Statistical Analysis

All statistical analyses were performed using Stata version 17 (StataCorp LLC, College Station, TX, USA). Continuous variables were assessed for normality using descriptive distributional checks and were summarized as median and interquartile range (IQR) due to their non-normal distribution. Categorical variables were presented as frequencies and percentages. A two-step logistic regression approach was used to identify factors associated with renal impairment. First, univariate logistic regression models were constructed for each predictor to obtain crude odds ratios (ORs), 95% confidence intervals (CIs), and p-values. Variables with clinical relevance **[7,8,16,17]** or $p < 0.20$ in univariate analysis were subsequently included in the multivariable logistic regression model to determine adjusted ORs and assess independent predictors of renal impairment. These included age, sex, hypertension, diabetes mellitus, osteoporosis, anemia, gout, autoimmune disease, albumin, uric acid, calcium, and ESR.

Model fit was evaluated using the likelihood ratio chi-square test and pseudo-R^2. The discriminatory ability of the final multivariable model was assessed using a receiver operating characteristic (ROC) curve, and the area under the curve (AUC) was calculated to quantify model performance. The prevalence of renal impairment was calculated as a proportion of the total study population, and a bar graph was generated to display the distribution of renal function status visually. A two-tailed p-value < 0.05 was considered statistically significant for all analyses.

Results

A total of 201 patients with multiple myeloma were included in the analysis, of whom 71 (35.3%) had renal impairment and 130 (64.7%) had normal kidney function. As shown in Table 1, the median age was slightly higher in patients with renal impairment (65 years **[IQR 57–71]**) compared with those with normal kidney function (62.5 years **[IQR 53–70]**). Female sex was more common among patients with renal impairment (73.2%) than among those with normal kidney function (36.9%). Regarding residency, 37.7% of patients with normal kidney function and 31.0% of those with renal impairment resided in urban areas, while rural residency was reported in 22.3% and 31.0%, respectively.

Figure 2 shows the rate of renal impairment in the study group. Out of the 201 patients, 64.7% had normal kidney function, while 35.3% met the criteria for renal impairment based on sex-specific creatinine thresholds. The bar chart emphasizes the high number of patients with compromised renal function at diagnosis, highlighting the importance of early detection and monitoring of kidney involvement in multiple myeloma.

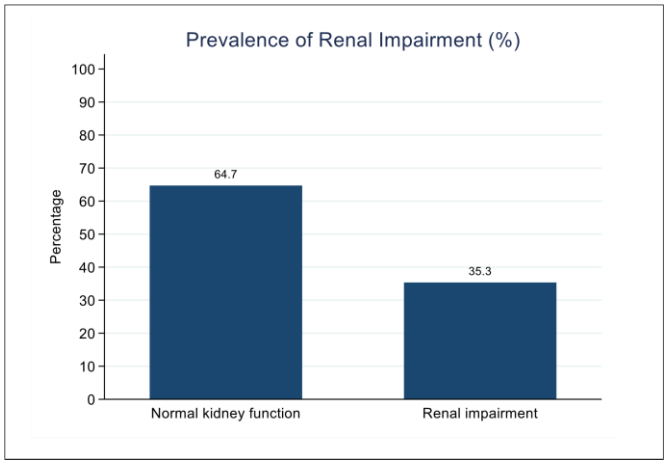

Figure 2. Prevalence of Renal Impairment Among Patients with Multiple Myeloma. Source: Own authorship.

Table 1. Baseline Characteristics by Renal Impairment.

Variable	Normal Kidney Function N=130(%)	Renal Impairment N=71(%)
Age, years, median (Q1-Q3)	62.5 (53-70)	65 (57-71)
Female	48 (36.9%)	52 (73.2%)
Residency – City	49 (37.7%)	22 (31.0%)
Residency – Rural area	29 (22.3%)	22 (31.0%)
Residency – Campus	4 (3.1%)	1 (1.4%)

Source: Own authorship.

The distribution of presenting symptoms is described in Table 2. Weight loss was reported in 54.6% of patients with normal kidney function and in 60.6% of those with renal impairment. Abdominal pain occurred in 43.1% vs. 45.1%, and headache in 46.9% vs. 38.0% of the two groups, respectively. Joint pain (71.5% vs. 67.6%) and bone pain (70.0% vs. 62.0%) were among the most reported symptoms in both groups. Lower back pain was also highly prevalent, affecting 72.3% of patients with normal kidney function and 76.1% of those with renal impairment. Swelling/edema, constitutional symptoms, and pathological fractures showed comparable distributions between the groups.

Table 2. Symptoms of Renal Impairment.

Symptom	Normal Kidney Function N=130(%)	Renal Impairment N=71(%)
Weight loss	71 (54.6%)	43 (60.6%)
Abdominal pain	56 (43.1%)	32 (45.1%)
Headache	61 (46.9%)	27 (38.0%)
Joint pain	93 (71.5%)	48 (67.6%)
Chest pain	51 (39.2%)	28 (39.4%)
Bone pain	91 (70.0%)	44 (62.0%)
Lower back pain	94 (72.3%)	54 (76.1%)
Swelling/edema	57 (43.8%)	33 (46.5%)
Constitutional symptoms	83 (63.8%)	36 (50.7%)
Pathological fracture	31 (23.8%)	19 (26.8%)

Source: Own authorship.

Comorbid conditions by renal impairment status are summarized in Table 3. Diabetes mellitus was more frequent among patients with renal impairment (35.2%) compared with those with normal kidney function (26.9%). Hypertension was also common in both groups (40.0% vs. 43.7%). Inflammatory bowel disease was rare and reported only in patients with normal kidney function (3.8%). Osteoporosis, anemia, arthritis, autoimmune diseases, cerebrovascular disease, neurological deficit, gout, and peptic ulcer showed varying but generally comparable distributions across renal function groups.

Table 3. Comorbidities by Renal Impairment.

Comorbidity	Normal Kidney Function N=130(%)	Renal Impairment N=71(%)
Diabetes Mellitus	35 (26.9%)	25 (35.2%)
Hypertension	52 (40.0%)	31 (43.7%)
Inflammatory bowel disease	5 (3.8%)	0 (0.0%)
Osteoporosis	56 (43.1%)	25 (35.2%)
Anemia	46 (35.4%)	25 (35.2%)
Arthritis	22 (16.9%)	8 (11.3%)
Autoimmune diseases	4 (3.1%)	2 (2.8%)
Cerebrovascular disease	3 (2.3%)	3 (4.2%)
Neurological deficit	16 (12.3%)	5 (7.0%)
Gout	12 (9.2%)	10 (14.1%)
Peptic ulcer	10 (7.7%)	2 (2.8%)

Source: Own authorship.

Laboratory findings are presented in Table 4. Median WBC and ESR values were higher among patients with renal impairment compared with those with normal kidney function. Serum albumin levels were modestly lower in patients with renal impairment (median 3.60 g/dL [IQR 3.09–4.08]) compared with the normal kidney function group (3.94 g/dL [IQR 3.26–4.38]). Conversely, levels of total protein, calcium, and uric acid tended to be higher among patients with renal impairment. As expected, serum creatinine was markedly elevated in the renal impairment group (median 1.46 mg/dL [IQR 1.43–1.78]) relative to those with normal kidney function (0.92 mg/dL [IQR 0.73–1.18]).

Table 4. Laboratory Parameters by Renal Impairment.

Laboratory Marker	Normal Kidney Function (Median, IQR)	Renal Impairment (Median, IQR)
WBC (×10⁹/L)	6.00 (4.90-8.20)	6.95 (5.55-9.20)
ESR (mm/h)	91 (35-120)	100 (77-140)
Albumin (g/dL)	3.94 (3.26-4.38)	3.60 (3.09-4.08)
Total protein (g/dL)	7.96 (7.03-9.70)	8.00 (6.68-10.10)
Calcium (mg/dL)	9.23 (8.80-9.96)	9.58 (8.90-10.30)
Uric acid (mg/dL)	5.70 (4.60-7.30)	6.93 (5.20-8.60)
Creatinine (mg/dL)	0.92 (0.73-1.18)	1.46 (1.43-1.78)

Source: Own authorship.

Multivariable logistic regression analysis was performed to identify independent predictors of renal impairment among patients with multiple myeloma (Table 5). In the unadjusted models, higher uric acid levels (OR 1.22, 95% CI 1.02–1.45; p=0.029) and higher serum calcium (OR 1.31, 95% CI 1.00-1.72; p=0.047) were significantly associated with increased odds of renal impairment. Female sex appeared strongly associated with renal impairment in the crude analysis (OR 0.21, 95% CI 0.11-0.40; p<0.001), but this association lost significance after adjustment.

In the fully adjusted model, diabetes mellitus emerged as the only independent predictor of renal impairment, with patients who had diabetes showing a four-fold increase in the odds of renal impairment (adjusted OR 4.02, 95% CI 1.32-12.21; p=0.014). Other variables including age, hypertension, osteoporosis, anemia, gout, autoimmune diseases, albumin, uric acid, calcium, and ESR did not remain statistically significant after adjustment.

Table 5. Univariable and Multivariable Logistic Regression Model.

Variables	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	Adjusted p-value
Age	1.02 (1.00–1.05)	0.065	1.02 (0.98–1.07)	0.332
Sex (Female)	0.21 (0.11–0.40)	<0.001	0.72 (0.27–1.95)	0.523

HTN	1.16 (0.65–2.09)	0.614	0.51 (0.17–1.50)	0.221
DM	1.48 (0.79–2.75)	0.221	4.02 (1.32–12.21)	0.014
Osteoporosis	0.72 (0.39–1.31)	0.278	0.87 (0.32–2.36)	0.780
Anemia	0.99 (0.54–1.82)	0.980	1.37 (0.53–3.54)	0.516
Gout	1.61 (0.66–3.94)	0.295	1.54 (0.41–5.71)	0.521
Autoimmune disease	0.91 (0.16–5.11)	0.918	0.37 (0.03–4.77)	0.449
Albumin	0.68 (0.43–1.08)	0.102	1.15 (0.58–2.29)	0.684
Uric acid	1.22 (1.02–1.45)	0.029	1.20 (0.97–1.49)	0.093
Calcium	1.31 (1.001–1.72)	0.047	1.14 (0.78–1.66)	0.500
ESR	1.01 (0.99–1.01)	0.179	1.01 (0.99–1.02)	0.314

Source: Own authorship.

Figure 3 illustrates the receiver operating characteristic (ROC) curve for the multivariable logistic regression model predicting renal impairment among patients with multiple myeloma. The model demonstrated acceptable discriminative ability, with an area under the curve (AUC) of 0.7537, indicating that the model can correctly classify patients with and without renal impairment approximately 75% of the time. The curve shows improved sensitivity across a range of specificity values compared with the reference diagonal line, highlighting the model's predictive performance.

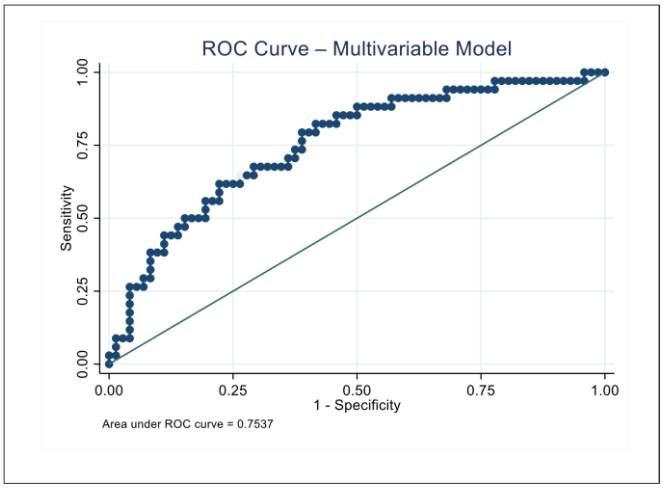

Figure 3. Receiver Operating Characteristic (ROC) Curve for the Multivariable Logistic Regression Model. Source: Own authorship.

Discussion

In this cross-sectional cohort of 201 patients with multiple myeloma, we found that renal impairment, defined by sex-specific creatinine thresholds, was common, affecting more than one-third (35.3%) of participants. Patients with impaired kidney function showed a consistent trend toward higher inflammatory and metabolic marker, including elevated ESR, uric acid, and calcium, together with modestly lower serum albumin, although these parameters did not remain independently associated with renal dysfunction in the multivariable model. Instead, diabetes mellitus emerged as the sole independent predictor, conferring approximately four-fold higher adjusted odds of renal impairment, while other clinical comorbidities and symptom patterns (such as bone pain, lower back pain, and constitutional symptoms) were similarly distributed between patients with and without renal involvement. Together, these findings highlight a substantial burden of creatinine-defined kidney dysfunction in our setting and underscore the vulnerability of patients with co-existing diabetes.

The prevalence of renal impairment in our cohort (35.3%) is broadly consistent with international data, although it lies toward the lower end of published estimates. Yadav et al. **[7]** reported renal impairment at diagnosis in around 50% of patients with multiple myeloma, with up to 5% requiring dialysis, underscoring the substantial global burden of myeloma-related kidney disease. Similarly, Dimopoulos et al. **[16]**, on behalf of the International Myeloma Working Group, summarized that approximately 20–50% of newly diagnosed patients present with some degree of renal dysfunction, with variability largely explained by differences in case mix and in the creatinine- or eGFRbased thresholds used to define renal impairment.

In terms of predictors, several cohorts have emphasised disease-related factors rather than comorbidities. Yadav et al. **[17]** demonstrated that higher serum free light chain concentrations at diagnosis are strongly associated with more advanced renal dysfunction, and a subsequent multicentre study by the same group **[18]** showed that very high free light chain levels at presentation are closely linked to the development of myeloma cast nephropathy, reinforcing the pathogenic role of light-chain burden in myeloma-related renal injury. Royal et al. **[19]** further identified the extent of intratubular casts and chronic tubulointerstitial damage on renal biopsy as key determinants of longterm renal outcome in light chain cast nephropathy.

Song et al. **[20]** reported baseline hypercalcaemia as an independent factor influencing renal response in patients with newly diagnosed myeloma and renal impairment, supporting the traditional view of hypercalcaemia as a clinically relevant contributor to myeloma kidney injury. In contrast to these disease-

centred predictors, our multivariable analysis found that classical myeloma-related variables such as calcium, uric acid and light-chain surrogates did not retain significance, whereas pre-existing diabetes mellitus emerged as the only independent predictor of renal impairment.

This observation is biologically plausible and aligns with survivorship and supportive-care literature. Faiman et al. **[5,21]** and the International Myeloma Foundation Nurse Leadership Board emphasise that diabetes and hypertension are the leading causes of end-stage renal disease and that almost half of new dialysis patients have diabetes, while Issa et al. describe renal insufficiency as a common complication in both diabetes and multiple myeloma **[22]**. Differences in comorbidity profiles, underlying burden of light-chain disease, and the use of a creatinine-based definition of renal impairment in our study, compared with eGFR-based or dialysis-requiring definitions in many prior series, are likely to contribute to the discrepancies in prevalence and predictor patterns observed across studies.

With respect to predictors of renal involvement, our data diverge in some respects from the classical picture described in many prior studies. Several cohorts have identified disease-related variables such as elevated free light chain burden, hypercalcemia, anemia, and higher β2-microglobulin as dominant correlates of renal dysfunction at diagnosis. In a large Korean study of newly diagnosed myeloma, Park et al. reported renal insufficiency in roughly one-third of patients and found that hypercalcemia and elevated β2-microglobulin were independently associated with impaired kidney function after adjustment for other factors. Similarly, a recent Eastern European cohort of patients with myeloma-related kidney impairment highlighted the strong association between light-chain restricted myeloma, higher ionized calcium, and more severe renal involvement at presentation **[10]**.

Other work has emphasized the prognostic importance of histologic patterns and free light chain levels in predicting renal recovery and survival **[23]**. In our study, uric acid and calcium were significantly associated with renal impairment in crude analyses, and albumin tended to be lower among patients with impaired kidney function, but none of these markers retained statistical significance in the fully adjusted multivariable model. The absence of independent associations for these classical myeloma-related factors may reflect the modest sample size, the cross-sectional design, and the fact that many patients had already received anti-myeloma therapy, potentially attenuating the impact of tumor-related burden on renal function at the time of assessment.

By contrast, our findings underscore the role of diabetes mellitus as a key host-related determinant of renal vulnerability in patients with multiple myeloma. In the final model, diabetes was associated with a four-fold increase in the odds of renal impairment, even after adjusting for age, hypertension, gout, other comorbidities, and laboratory parameters. Although relatively few myeloma-specific cohorts have identified diabetes as an independent predictor of renal dysfunction, our results resonate with broader nephrology data and with emerging myeloma literature highlighting the cumulative burden of metabolic comorbidities. Savuliak et al. **[24]** recently summarized that kidney damage occurs in 20-50% of myeloma patients at initial presentation and noted that combined hypertension and type 2 diabetes mellitus are important additional risk factors for chronic kidney disease in this population.

Furthermore, survivorship guidance from the International Myeloma Foundation Nurse Leadership Board emphasizes that diabetes and hypertension are the leading causes of end-stage renal disease in the general population and can substantially amplify the risk and severity of renal complications in patients with myeloma **[5]**. In this context, our data add quantitative evidence from a Middle Eastern cohort that diabetes is not merely a background comorbidity but a strong, independent correlate of creatinine-defined renal impairment in patients with myeloma.

Clinically, these findings have several important implications. First, the high prevalence of renal impairment in our cohort reinforces that systematic assessment of kidney function should remain a core component of routine care for all patients with multiple myeloma, not only at diagnosis but throughout the disease trajectory. Persistent or newly developed creatinine elevations are common and may arise from an interplay between myeloma-related mechanisms (cast nephropathy, immunoglobulin deposition, hypercalcemia, hyperuricemia) and non-myeloma factors such as diabetes, dehydration, infections, and exposure to nephrotoxic medications **[5]**. Second, the strong association between diabetes and renal impairment suggests that myeloma patients with diabetes constitute a particularly high-risk subgroup who may benefit from more intensive surveillance. This could include lower thresholds for checking renal biochemistry, closer monitoring during initiation or escalation of nephrotoxic or renally cleared agents, and early involvement of nephrology when even modest creatinine elevations are detected.

Third, our results highlight the need to integrate renal considerations into treatment planning, especially in resource-constrained settings. Renal dysfunction

limits the use or necessitates dose modification of key myeloma therapies such as certain immunomodulatory drugs and bisphosphonates and may restrict eligibility for autologous stem cell transplantation or contrast-based imaging [5]. In patients with diabetes and myeloma, careful optimization of glycemic control and blood pressure, avoidance of unnecessary nephrotoxic exposures (e.g., non-steroidal anti-inflammatory drugs, high-dose intravenous contrast), and early initiation of effective anti-myeloma therapy are likely to be especially critical to preserve renal reserve. The cross-sectional associations we observed between higher uric acid and calcium levels and renal impairment in unadjusted models also suggest that meticulous correction of hyperuricemia and hypercalcemia, alongside hydration and tumor debulking, remains an important component of supportive care, even though these variables did not emerge as independent predictors in our multivariable analysis.

Strength

Our study has several strengths. It draws on real-world data from a relatively large cohort of patients with multiple myeloma treated in routine clinical practice, providing insight into the burden and correlates of renal dysfunction in a Middle Eastern setting where epidemiologic data are scarce. The dataset incorporates a broad range of demographic, symptomatic, comorbidity, and laboratory variables, enabling a more comprehensive assessment of both tumor-related and host-related factors than is possible in administrative datasets. In addition, the use of multivariable logistic regression allowed us to account for potential confounding and to identify diabetes as an independent predictor of renal impairment after adjusting for other clinically relevant covariates. Model performance, as reflected by the reported area under the ROC curve, suggests good discrimination for a simple clinical model based on readily available variables, supporting its potential utility as a pragmatic risk stratification tool in everyday practice.

Limitations

Nonetheless, several limitations merit consideration when interpreting these findings. First, the cross-sectional design precludes any causal inference regarding the directionality of the association between diabetes and renal impairment; chronic kidney disease may both result from and exacerbate metabolic dysregulation, and our data cannot distinguish longstanding diabetic nephropathy from myeloma-related renal injury superimposed on pre-existing diabetic kidney disease.

Conclusion

Renal impairment was frequent in this cohort of patients with multiple myeloma. It was strongly associated with the presence of diabetes mellitus, whereas other symptoms, comorbidities, and laboratory abnormalities showed only crude or non-independent relationships with impaired kidney function. Our findings support systematic, early, and repeated evaluation of renal function as an integral part of myeloma care, with particular attention to patients with co-existing diabetes. Embedding structured renal assessment and aggressive management of metabolic comorbidities into routine myeloma care pathways may help preserve kidney function, expand therapeutic options, and ultimately improve outcomes for this vulnerable patient population.

CRediT

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Ethical Approval

The study protocol was approved by the Institutional Review Board (IRB) of An-Najah National University prior to data collection.

Informed Consent

Informed consent was obtained from all participants.

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No additional data are available.

Conflict of Interest

The authors declare no conflict of interest.

Similarity Check

It was applied by Ithenticate®.

Application of Artificial Intelligence (AI)

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