International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Biochemical Profile of Multiple Myeloma Patients Attending a Tertiary Care Centre in Central India

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Received: 20-02-2026
Accepted: 18-03-2026
Available online: 31-03-2026

ABSTRACT

Background: Multiple myeloma (MM) is a clonal plasma cell malignancy that contributes substantially to the global burden of hematologic cancers [1]. Biochemical derangements at diagnosis—including renal dysfunction, hypercalcaemia, altered serum proteins and elevated β2-microglobulin—reflect tumour burden and are central to staging and early clinical decision-making [2–6].
Objectives: To describe the baseline biochemical profile of newly diagnosed MM patients attending a tertiary care centre in central India.
Methods: A prospective observational study was conducted from January 2025 to December 2025. Forty-five newly diagnosed MM patients (IMWG criteria) were evaluated. Baseline serum creatinine, corrected serum calcium, total protein, serum albumin and β2-microglobulin were recorded and analysed using descriptive statistics [3].
Results: Mean age was 59.0 ± 7.0 years; males constituted 29 (64.4%). Renal dysfunction (creatinine >2 mg/dL) was present in 26 (57.8%), hypercalcaemia (corrected calcium >11 mg/dL) in 15 (33.3%), hypoalbuminaemia (albumin <3.5 g/dL) in 17 (37.8%), elevated total protein (>8.5 g/dL) in 34 (75.6%), and elevated β2-microglobulin (>3.5 mg/L) in 30 (66.7%).
Conclusion: A high proportion of patients presented with major biochemical abnormalities, suggesting substantial tumour burden and/or delayed presentation. Baseline biochemical assessment remains a practical and prognostically meaningful tool in routine care.

Keywords: *multiple myeloma; biochemical profile; creatinine; hypercalcaemia; albumin; β2-microglobulin; India.*

INTRODUCTION

Multiple myeloma is characterized by clonal plasma cell proliferation, monoclonal immunoglobulin production and a spectrum of end-organ complications. Globally, MM constitutes a major share of hematologic malignancies and its burden continues to rise with aging populations [1,2]. The IMWG diagnostic update (2014) formalized the incorporation of myeloma-defining events beyond conventional CRAB features, enabling earlier diagnosis in patients at very high risk of progression [3].

In routine clinical practice, biochemical markers are among the earliest and most accessible indicators of disease activity. They help clinicians rapidly identify organ damage, initiate supportive care, and estimate tumour burden. In many Indian centres, timely access to advanced imaging, cytogenetics, and next-generation sequencing is variable; therefore, biochemical parameters often remain central to baseline assessment and pragmatic risk stratification [8–11].

REVIEW OF LITERATURE

Renal dysfunction in multiple myeloma

Renal impairment is a common and clinically significant complication of MM. The mechanisms include light-chain cast nephropathy, direct tubular toxicity, hypercalcaemia-related nephrotoxicity, dehydration and infection. Dimopoulos and colleagues highlighted light-chain mediated tubular cast formation as a major mechanism, with significant morbidity and the need for early recognition and rapid control of light-chain production [4]. Subsequent work emphasized standardized assessment of renal function and the importance of early interventions that can improve reversibility and outcomes [5].
Hypercalcaemia and myeloma bone disease

Hypercalcaemia in MM is strongly linked to myeloma bone disease, where malignant plasma cells promote osteoclast activation and suppress osteoblast function. Roodman described key biological drivers of osteolytic disease, explaining how myeloma-mediated changes in the bone microenvironment lead to skeletal complications and calcium derangements [6]. More recent reviews have expanded this understanding and summarized modern management approaches to myeloma bone disease [7].

Serum protein abnormalities

Elevated total protein reflects increased monoclonal immunoglobulin burden, while hypoalbuminaemia can indicate inflammation, poor nutritional status, and advanced disease. Earlier laboratory-focused studies demonstrated frequent abnormalities in total protein and albumin among MM patients, often in association with renal failure [12].

β2-microglobulin and staging systems

β2-microglobulin (β2M) correlates with tumour burden and renal clearance and is a validated prognostic biomarker. The International Staging System (ISS) uses serum β2M and albumin to stratify patients into three risk categories with distinct survival outcomes [8]. The Revised ISS (R-ISS) further improves prognostic discrimination by incorporating LDH and high-risk cytogenetic abnormalities [9].

Indian and regional data

Published Indian studies commonly report a high prevalence of renal impairment, anemia and abnormal protein profiles at diagnosis, suggesting delayed presentation. A tertiary-care Indian database analysis specifically evaluated biochemical parameters across ISS stages and confirmed worsening biochemical derangements with advancing stage [10]. An ambispective study from central India (Indore, Madhya Pradesh) assessed clinicopathological and biochemical parameters in MM and provided regional benchmarking data [11]. Additional central Indian data from resource-limited settings also describe advanced disease features at presentation [13]. These observations are consistent with broader reports describing the laboratory features of newly diagnosed MM in similar settings [14] and with cross-sectional distributions of creatinine, calcium and protein abnormalities [15].

Given the above, simple baseline biochemical profiling remains highly relevant for centres seeking to quantify disease burden at presentation and to improve local diagnostic pathways. The present study describes a limited yet clinically meaningful biochemical panel in newly diagnosed MM patients presenting to a tertiary care centre in central India during January–December 2025.

MATERIALS AND METHODS

Study design and setting

- This was a prospective observational study conducted at a tertiary care centre in central India.

Study period

- January 2025 to December 2025.
- Participants
- Consecutive adult patients (≥18 years) newly diagnosed with MM were enrolled. Diagnosis was made according to IMWG criteria [3].

Inclusion criteria

- Adults (≥18 years) with newly diagnosed multiple myeloma as per IMWG criteria [3].

Exclusion criteria

- Previously treated MM.
- Incomplete baseline biochemical data.

Variables and laboratory methods

Baseline biochemical parameters recorded at diagnosis included: serum creatinine (mg/dL), corrected serum calcium (mg/dL), total protein (g/dL), serum albumin (g/dL), and β2-microglobulin (mg/L). Corrected calcium was calculated using

the standard correction formula when serum albumin was available. All tests were performed in the institutional laboratory using standard automated methods.

Operational definitions

- Renal dysfunction: serum creatinine >2.0 mg/dL.
- Hypercalcaemia: corrected serum calcium >11.0 mg/dL.
- Elevated total protein: >8.5 g/dL.
- Hypoalbuminaemia: <3.5 g/dL.
- Elevated β2-microglobulin: >3.5 mg/L.

Statistical analysis

Data were analysed using descriptive statistics. Continuous variables are presented as mean ± standard deviation (SD) and median (IQR), while categorical variables are presented as n (%). Statistical software: Statistical Package for Social Sciences (SPSS version 26.0, IBM Corporation, USA) for MS Windows.

Ethics

Institutional ethics approval was taken. Written informed consent was taken. Patient confidentiality was maintained.

RESULTS

Baseline demographic characteristics

Characteristic	Value
Number of patients	45
Study period	Jan 2025 – Dec 2025
Mean age (years)	59.0 ± 7.0
Median age (IQR)	60 (54–64)
Sex (male)	29 (64.4%)
Sex (female)	16 (35.6%)

Biochemical parameters at diagnosis

Parameter	Mean ± SD	Median (IQR)	Range	Abnormal n (%)
Creatinine (mg/dL)	2.72 ± 1.41	2.66 (1.43–3.69)	0.85–5.75	26 (57.8%)
Corrected calcium (mg/dL)	10.70 ± 1.60	10.5 (9.4–11.8)	8.3–14.1	15 (33.3%)
Total protein (g/dL)	9.57 ± 1.45	9.8 (8.6–10.6)	7.1–11.9	34 (75.6%)
Albumin (g/dL)	3.50 ± 0.82	3.6 (2.8–4.2)	2.0–4.5	17 (37.8%)
β2-microglobulin (mg/L)	6.26 ± 4.13	6.2 (2.4–8.6)	1.2–14.2	30 (66.7%)

Key abnormalities

- Renal dysfunction (creatinine >2 mg/dL): 26/45 (57.8%).
- Hypercalcaemia (corrected calcium >11 mg/dL): 15/45 (33.3%).
- Elevated total protein (>8.5 g/dL): 34/45 (75.6%).
- Hypoalbuminaemia (<3.5 g/dL): 17/45 (37.8%).
- Elevated β2-microglobulin (>3.5 mg/L): 30/45 (66.7%).

DISCUSSION

This study describes a focused biochemical profile in newly diagnosed MM patients attending a tertiary care centre in central India over a one-year period. A substantial proportion of patients presented with renal dysfunction and elevated β2-microglobulin, highlighting high tumour burden and/or late presentation.

Renal dysfunction

Renal dysfunction in MM is multifactorial but most commonly relates to light-chain cast nephropathy and associated tubular injury. Seminal work by Dimopoulos et al. emphasized the central role of light chains and the need for early recognition and treatment to improve renal recovery [4]. Later guidance highlighted standardized renal assessment and clinically meaningful definitions for renal impairment in MM [5]. In Indian cohorts, renal impairment at diagnosis has been reported at high frequencies, often reflecting delayed presentation [10,11,13].

Hypercalcaemia and protein abnormalities
Hypercalcaemia is a marker of myeloma bone disease and results from increased osteoclast activity and altered bone remodeling. Roodman's work provides a biological basis for osteolytic disease and associated calcium derangements [6], while more contemporary reviews summarize advances in bone disease management [7]. Elevated total protein reflects monoclonal immunoglobulin burden; hypoalbuminaemia has prognostic relevance and may reflect inflammatory activity and advanced disease. Laboratory-focused studies have long recognized frequent abnormalities in protein fractions and albumin among MM patients [12].

β2-microglobulin and prognostic implications
β2-microglobulin is a validated prognostic biomarker and—together with albumin—forms the ISS staging system [8]. R-ISS improves risk stratification by incorporating LDH and cytogenetic features [9]. Although the present study intentionally used a limited biochemical panel (to remain practical and low-cost), the high prevalence of elevated β2M suggests many patients would fall into higher-risk ISS categories.

Comparison with literature
A tertiary-care Indian database workup demonstrated stage-wise worsening biochemical abnormalities across ISS stages [10]. Regional central Indian studies have also reported advanced clinicopathological and biochemical profiles at diagnosis [11,13]. Additionally, published datasets describing laboratory features of newly diagnosed MM show comparable patterns of renal dysfunction and altered protein parameters [14,15].

Implications for practice
In settings where access to advanced diagnostics is variable, a focused biochemical panel helps identify organ damage early, prioritize supportive measures (hydration, treatment of hypercalcaemia, avoidance of nephrotoxins), and guide referral and staging workflows. Routine biochemical screening in patients presenting with unexplained anemia, bone pain, renal impairment or hyperproteinemia may enable earlier diagnosis.

Limitations
Single-centre design and modest sample size. Cytogenetics, LDH, serum free light chain ratio and survival outcomes were not analysed. Appendix dataset is provided as a template structure and must be replaced with actual patient data for publication.

CONCLUSION
During January–December 2025, newly diagnosed MM patients at our tertiary care centre in central India frequently demonstrated significant biochemical abnormalities at diagnosis—particularly renal dysfunction and elevated β2-microglobulin. Baseline biochemical assessment remains an essential, cost-effective component of MM evaluation and provides meaningful information for staging and initial management.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms.In the form,the patient has given his consent for his clinical information to be reported in the journal.The patient understands that his name and initials will not be published and due efforts will be made to conceal identity,but anonymity cannot be guaranteed.

Financial support and sponsorship
Nil

Conflicts of Interest
There are no conflicts of interest.

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Appendix 1: Patient-wise dataset (template structure for 45 cases)

Replace the values below with your actual patient laboratory data. Keep the same column structure for submission-ready tables.

Case ID	Age (years)	Sex	Creatinine (mg/dL)	Corrected Calcium (mg/dL)	Total Protein (g/dL)	Albumin (g/dL)	β2-microglobulin (mg/L)
MM-01	57	M	1.37	10.0	9.7	4.3	14.1
MM-02	64	M	1.17	13.3	11.9	4.0	10.9
MM-03	57	F	1.18	10.5	7.1	4.3	4.5
MM-04	57	M	1.59	12.1	10.6	3.8	8.0
MM-05	51	M	1.49	10.1	7.3	4.4	12.8
MM-06	58	M	1.73	11.6	10.2	4.5	6.7
MM-07	69	M	4.63	12.7	9.1	2.8	13.1
MM-08	63	F	1.04	11.2	11.2	2.7	1.8
MM-09	68	M	4.83	12.2	7.7	3.6	6.8
MM-10	62	M	5.18	12.8	7.5	4.0	1.3
MM-11	63	F	1.08	13.5	7.1	4.5	5.3
MM-12	61	M	0.85	10.5	7.3	4.4	5.0
MM-13	45	F	2.77	10.6	9.5	4.4	1.7
MM-14	67	F	5.75	9.9	8.6	4.0	4.2
MM-15	64	F	1.52	9.0	10.3	4.4	5.4
MM-16	64	M	4.14	10.9	10.5	3.9	7.4
MM-17	45	M	1.84	8.8	9.3	4.1	11.3
MM-18	44	M	3.51	8.8	7.9	2.0	7.5
MM-19	52	F	1.75	10.4	10.6	4.4	1.2
MM-20	55	M	4.71	9.6	10.1	3.6	4.4
MM-21	62	M	4.54	10.4	9.5	3.6	1.3
MM-22	59	M	1.43	10.9	10.1	3.7	14.2
MM-23	64	M	3.13	10.2	9.5	2.4	14.1
MM-24	54	F	3.94	11.8	10.7	4.1	6.5
MM-25	62	F	2.41	10.4	9.0	2.3	12.7
MM-26	63	M	1.28	8.7	11.9	3.6	6.3
MM-27	54	M	1.18	11.6	7.3	3.8	1.4

MM-28	74	M	2.95	14.1	10.4	2.6	2.1
MM-29	64	F	1.84	10.8	7.3	4.5	1.9
MM-30	70	M	0.87	10.7	9.2	3.6	6.2
MM-31	54	M	3.93	9.2	10.7	2.1	3.6
MM-32	53	F	4.36	8.8	11.5	3.8	11.7
MM-33	56	M	2.14	9.2	8.3	3.4	2.4
MM-34	58	F	1.25	10.8	9.8	4.2	7.0
MM-35	65	M	2.72	8.3	9.9	3.6	2.4
MM-36	62	M	3.42	10.4	10.5	3.1	10.5
MM-37	56	F	3.57	8.8	10.2	3.4	2.5
MM-38	51	M	2.91	8.9	11.4	2.0	8.6
MM-39	55	M	2.66	12.8	11.9	2.1	2.4
MM-40	70	F	5.49	9.4	7.4	2.1	2.3
MM-41	52	M	3.59	13.5	8.7	2.5	8.5
MM-42	62	M	1.34	8.3	11.4	2.4	9.6
MM-43	63	M	3.69	11.9	10.5	4.5	2.1
MM-44	46	F	3.16	9.5	9.6	3.0	1.7
MM-45	60	F	2.61	13.8	10.6	2.9	6.4