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REVIEW

Epidemiological Landscape and Treatment Access of Multiple Myeloma in Bangladesh: A Review from LMIC

Toma Mehedi

Site Trial Coordinator, Rajshahi Medical College Hospital (RMCH) site, Toxicology Society of Bangladesh, Bangladesh.

Abstract

Introduction: Multiple myeloma (MM) is a malignant clonal plasma cell disorder with a high level of morbidity in the form of anemia, kidney failure, hypercalcemia, and lytic bone disease. Despite the increasing rate of global disease burden, the evidence in the low and middle-income countries is inadequate, especially in Bangladesh. This review aims to present the epidemiological, clinical, laboratory, and disease staging of multiple myeloma patients reported in Bangladesh studies. **Methodology:** The study included the published literature on MM in Bangladesh till November 2025 from observational studies, case series, retrospective analyses, and review articles. The data extraction was about demographics, clinical presentation, laboratory values, and skeletal findings. All data that was included was tabulated and analyzed with the help of MS Excel and SPSS version 20.0. **Results:** In the literature review, the mean/median age was 51.9-58.9 years, and the prevalence was two-thirds male (~55% to 90%) in different publications. The most frequent presenting complaint was bone pain (up to ~70–80%), anemia (≈70–75%), fatigue, with ESR often above 100 mm/hr. Renal impairment (creatinine 2mg/dl and above) was identified in 20% to 34% of patients, hypercalcemia and Bence-Jones proteinuria in approximately 30% to 50%. The presence of lytic bone lesions had been reported in 60-80% of patients, most often of the vertebrae, ribs, and skull. IgG was the major fixation, and 2-microglobulin (>5.5 mg/L) was detected in over half of the patients, with the majority presenting at ISS stage III. Cohort bone marrow plasma cell infiltration was between 40% and 70%. **Conclusion:** The literature reviewed on Bangladesh has repeatedly shown late presentation and high disease burden of MM patients. Access to limited diagnostic opportunities and late diagnosis are contributory factors to the disease at an advanced stage.

Keywords: Multiple Myeloma- ISS Staging- Bone Marrow- Plasma Cell- Hematological Malignancy- Bangladesh

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Introduction

Multiple myeloma (MM) can be defined as an abnormal or clonal plasma cell malignancy characterized by producing monoclonal immunoglobulins, leading to end-organ damage [1]. The atypical proliferation of clonal plasma cells can be severe due to monoclonal cell invasion in the bone marrow [2], causing clinical manifestations including hypercalcemia, renal dysfunction, anemia, or bone pain accompanied by lytic lesions [3]. According to the Global Cancer Observatory, the global incidence of multiple myeloma is 1,87,952 cases till 2022, and the mortality is 1,21,388, whereas in Asia, 39.3% cases were recorded with a decreasing rate of 44.3% [4]. Multiple myeloma is more prevalent in Asia with a rising cases in Korea [5], Taiwan [6], Thailand [7], Turkey [8], and Japan [9]. In Bangladesh, this clonal plasma disease accounts for 1% of malignancies with several co-morbidities leading to death [10, 11]. No exact figures are available to showcase the mortality rate caused by multiple myeloma in this low-and middle-income country, but research suggests that patients with ≥60 are at a high risk [12]. The first-line treatment approaches for multiple myeloma in Bangladesh are melphalan, prednisolone, and dexamethasone, although some other therapeutic approaches are also available, these are costly. In contrast, only symptomatic patients with multiple myeloma opt for cancer therapy, whereas the undiagnosed cases are countless [13]. There is a lack of evidence-based clinical studies on multiple myeloma in Bangladesh. This study aims to compile the

Corresponding Author:
Toma Mehedi
Site Trial Coordinator, Rajshahi Medical College Hospital (RMCH) site, Toxicology Society of Bangladesh, Bangladesh.
Email: toma.mehedi111@gmail.com

existing data to find out the future scopes of research and develop a treatment strategy on this topic.

Pathophysiology

Multiple Myeloma is a type of blood cancer that affects plasma cells of the WBC and originates from the bone marrow [14]. The pathophysiology of MM is a multistep process that leads to a change in body function, including increased risk of hypercalcemia, renal failure, anemia, and bone fracture (CRAB) [1]. The pathogenic features of multiple myeloma start with generating clonal plasma cells or monoclonal gammopathy of undetermined significance (MGUS) or smoldering myeloma (SMM) [15]. A normal bone marrow produces less than 5% of plasma cells [16] that secrete immunoglobulins and antibodies, which are responsible for several immune responses [17]. In case of multiple myeloma, bone marrow produces more than 10% of plasma cells that produce certain antibodies like IgG and IgA [18]. IgA antibody secretes IL-6 and IL-8 by immune cells that activate osteoclasts, which induces bone resorption [19]. Hypercalcemia is another effect caused by demineralization of bone and accumulation of excessive aberrant plasma cells in bone marrow [1]. IgG protein is associated with hypogammaglobulinemia in MM, and it is heterogeneous [20]. In 70% of cases, IgG immunoglobulin produces Monoclonal protein (M-protein), and in 30% cases, it was produced by abnormal IgA [21]. M-protein develops renal diseases by its nephrotoxic effects and physicochemical properties [22]. Anemia in MM is a common feature that can be implicated by the inadequate production of erythropoietin (EPO), suppressed by Interleukin-1 and tumor necrosis factors [23]. Briefly, multiple myeloma involves the abnormal proliferation of plasma cells in bone marrow, leading to abnormal production of M-protein and an imbalance of osteoclast and osteoblast activities that results in CRAB effects.

Materials and Methods

The systematic review of multiple myeloma was conducted with the intention of synthesizing the existing research on multiple myeloma in Bangladesh. The focused searching was performed till the publication of MM in Bangladesh till November 2025. Additional items were searched by hand in reference lists of identified papers.

Inclusion criteria

- Prospective or retrospective original studies.
- Case series, hospital-based clinical trial, observational study, or cross-sectional studies.
- Review articles.
- Case report with epidemiologic insight.

Exclusion criteria

- Single case presentation that didn't provide any epidemiologic characteristics.
- The study included the foreign population.
- Study conducted outside of Bangladesh.

The collection of publications will be compiled, including the author's name, study period, design, sample size, demographic details, laboratory findings, patient care management, and the outcome of patients in the study. After the successful arrangement, the data will be represented in a tabular format. MS Excel and SPSS version 20.0 were used for data compilation and arrangement.

Results

This study aims to compile all previous research on multiple myeloma conducted in Bangladesh. In this review article, the goal is to identify related studies that meet the research objectives. Throughout the reviewed Bangladeshi literature, patients with multiple myeloma were mostly diagnosed between their 50s and 60s, with mean or median ages ranging from 51.9 to 58.9 years, and there was a male predominance of 55% to as high as 90%. The most common presenting complaint across all cohorts was bone pain, often accompanied by anemia, fatigue, and renal impairment. Most studies also reported significantly elevated ESR, with many readings exceeding 100 mm in the first hour. Lytic bone lesions were frequently observed in radiology reports, present in approximately 60-80% of patients, most commonly in the vertebrae, ribs, skull, and long bones. Laboratory abnormalities included low hemoglobin levels some studies noted Hb below 8.5 g/dL in about one-third of patients high creatinine levels (ranging from 21.9 to 34, with Cr $\geq$ 2 mg/dL), and a high incidence of hypercalcemia. A notable percentage of patients exhibited Bence Jones proteinuria (~40-50%), and over half had elevated 2-microglobulin levels (5.5 mg/L and above). Bone marrow analysis showed high clonal plasma cell infiltration, with mean values reported up to 62.1%. In all cases, immunofixation electrophoresis identified IgG as the predominant monoclonal protein (~60–75%), followed by IgA (~10–20%), and a lower percentage exhibited free light chain-only disease. Overall, most patients in these Bangladeshi cohorts were diagnosed at advanced ISS stages, particularly stage III, indicating delayed diagnosis and a significant burden of end-organ damage.

Discussion

In this review study, the main focus is to compile all related research articles that were conducted in Bangladesh on multiple myeloma. Several patterns of studies have been noticed for years. Most of the studies conducted on this theme were cross-sectional studies, followed by a retrospective study, a lab-based study, and a review article. The sample size ranged noted 48 to 5013 patients (Table 1 and 2), and most of the studies were single-center studies. The study illustrates the similarities in demographic information, such as the majority of patients are male (~55% to 90%). Bird SA et al., 2019 performed a study on the demographic characteristics of patients with multiple myeloma, found that 58% patients are male and 42% are female [30]. The male-to-female ratio in MM noted in Bangladesh is 5:2 [24] and 2:1 [28], proving that males are more prone to this disease,

Table 1. Summarization of Study Findings with Patients of Multiple Myeloma from Previous Studies

Study Reference	Setting	Study Period	Method	Sample size	Key Findings
Rahman MM et al., 2010 [13]	-	-	Review Article	-	Describes treatment considerations in Bangladesh, reports a low barrier to the availability/cost of novel agents, including standard Chemotherapeutic regimens, Immunomodulatory Drugs, Proteasome Inhibitors, Monoclonal Antibodies, and Autologous Stem Cell Transplantation (ASCT).
Choudhury S et al., 2013 [25]	Single tertiary-centered study	November 2002 to December 2011	cross-sectional study	835	Male-to-female ratio of MM is 5:2; Mean age 63.25 years; the highest frequency of MM was found in patients admitted to the department of Orthopaedic Surgery (20.8%), followed by the Department of Nephrology (16.7%).
Hossain SM et al., 2014 [26]	Tertiary multi-centered study	January 2008 to December 2012	Retrospective descriptive study	5013	Men are prone to Hematological malignancy in Bangladesh; the male-to-female ratio is 2.2:1; multiple myeloma has mostly occurred among older patients, over 50 years of age.
Chowdhury MRK et al., 2018 [27]	Binary tertiary center-based study	October 2005 to January 2010	Clinical and laboratory-based study	32	29 male patients were included, where female patients were only 3; mean age 51.94 ± 10.09 years; the ESR of all the study patients was more than 100 mm in 1st hour; S. creatinine was noted ≥2 mg/dL and hemoglobin level<8.5 gm/dL in 13 patients; S. albumin was <30 mg/L in 14 patients and serum 2 microglobulin >5.5 mg/L in 7 patients. In 15 patients, 3 patients were hypercalcemic, and radiologically most common lesions were lytic.
Haque S et al., 2022 [28]	Binary tertiary center-based study	January 2017 to December 2020	Small-scale observational study	159	Among 159 newly diagnosed MM cases, 64.8% were male with a mean age of 56±12 years, and 35.2% were female with a mean age of 57±11 years; the most common site of the lytic lesion was the skull (33.3%); femur, humerus, manubrium, maxilla, tibia, and ulna were other sites involved with lytic lesions.
Masud DA et al., 2022 [12]	Single tertiary-centered study	July 2021 to June 2022	Cross-sectional study	58	Mostly patients were aged where ≥60 years 46.6% were female and 62.1% were male; 56.9% were from urban population; the most common symptoms were bone pain (82.8%), anemia (69.0%) and fatigue (62.1%); mean hemoglobin level was diagnosed 8.9 ± 1.4 g/dL; anemia (69.0%); Elevated ESR was 75 ± 20 mm/hr in mean; in 79.3% of cases, rouleaux formation were common; elevated S. creatinine was found in 37.9% cases (>1.5 mg/dL); hypercalcemia (34.5%); Lytic lesion was found in 75.9% of cases; 89.7% patients were observed with monoclonal bands; bence Jones proteinuria were found in 31.0%.
Alam MM et al., 2024 [29]	Single tertiary-centered study	January 2019 to July 2020	Cross-sectional study	81	Mean age calculated 58.9±12.0 years and male female ratio was 2:1; 43.2% patients has history of smoking while 2.5% patients has family history of haematological malignancies; Bone pain (72.8%) was the most prevalent presenting feature, while 59.1% of patients presented hypertension, diabetes mellitus (29.5%), respiratory illness (11.3%) and cardiac disease (11.4%); 48.1% patients has ECOG-1 status; Hematologic & Biochemical Results: The mean Hb was 9.4 ± 2.3 g/dL, ESR 89.5 ± 42.1 mm/1 st hour; mean serum creatinine 2.0 ± 1.85 mg/dL, 42 (34.2) with creatinine 2.0 mg/dL. LDH was elevated in 36.0% cases; the mean serum calcium was 9.6 + 1.8mg/dl, with 10 (14.5) exceeding calcium >11.0mg/dl. Serum albumin <3.5 g/dL was found in 37 (49.3%), and 2-microglobulin >5.5 mg/dL in 37 (57.8%). ISS stage III was present in 59.4%; Bence Jones Protein was present in 46.7% patients. Lytic lesions were present in 75%; they were distributed in vertebrae 38 (74.5%), ribs 18 (35.2%), skull 14 (27.5%), and femur/humerus/sternum/scapula 3 (5.9%). Bone Marrow and Immunotype: The mean plasma cell infiltration was 62.1 24.9. Immunofixation electrophoresis revealed IgG 72.7, IgA 18.2, FLC 9.1, FLC ratio 100 and above in 29.0%; Clinically significant S. creatinine with Hb ($p<0.05$) was found with ISS stage III. Creatinine and S. calcium associations were observed significantly ($p<0.05$). There was no significant relationship between BJP status and creatinine (p-value>0.05); typical manifestations included pain in the bones, tiredness, fever, neurological deficiency; significant discoveries: anemia, renal failure, skeletal lytic lesions.
Ahmed D et al., 2024 [30]	Binary binary-centered study included a tertiary care hospital and a private hospital	April 2023 to March 2024	Retrospective observational study	48	mean age of participants was 58 ± 8.5 years, with 62.5% male and 37.5% female patients; most familiar skeletal deformities included bone pain (87.5%), lytic lesions (62.5%), and vertebral collapse (41.7%); Skeletal deformities were related significantly to clinical parameters including low hemoglobin, high serum calcium, kidney malfunction, and high-stage disease (p-value < 0.05); the improvement of bone pain in 79.2% and fracture stabilization in 62.5% of patients after the treatment; 0.8% exhibited deformation progression and 16.7% perished in follow-up.

Table 2. Clinical Features of Study Patients Involved in Previous Articles

Clinical parameter	Reported values/ranges across studies (Bangladesh)
Median/mean age at diagnosis	~51.9 to 58.9 years (most series report median/mean in the 50–59 year range).
Male proportion	~55% to 90% (most studies report male predominance; examples: 62.1%, 2:1 M: F, 29/32).
Bone pain (presenting symptom)	The majority of patients reported frequencies commonly ~70–80% in several series.
Anemia (clinical / Hb findings)	Reported frequently; examples: Hb <8.5 g/dL in 13/32 (Chowdhury MRK et al., 2018), and high anemia rates (≈70–75%) in some series.
ESR	Often markedly elevated; e.g., many patients with ESR >100 mm/ hr; other reports show high mean/median ESR.
Renal impairment (serum creatinine ≥2.0 mg/dL)	Reported proportions vary; examples: 7/32 (21.9%); some series report higher proportions up to ~34% in larger cohorts.
Lytic bone lesions/fractures	High prevalence — reported ~60–80% across cohorts; Haque (n=159) emphasizes frequent vertebral fractures and widespread lytic disease.
Bence Jones protein (urine) positivity	Reported variably; many series report substantial proportions (ranges differ by test sensitivity), for example, ~40–50% in some cohorts.
β2-microglobulin (>5.5 mg/L)	Several series report elevated β2-microglobulin in a large fraction (example: ~>50% in some reports).
ISS stage III at presentation	Many patients present in the advanced stage (ISS II/III); reported ISS III proportions vary (some reports >50%).
Immunotype (serum IFE) - IgG / IgA / FLC	Studies report IgG is the commonest (~60–75%), IgA ~10–20%, FLC / light-chain only cases variable (single-study lists: IgG 72.7%, IgA 18.2%, FLC 9.1% in a cohort).
Bone marrow plasma cell percentage	Reported means in cohorts vary widely — mean ~40–70% in published hospital series (examples: mean 62.1% reported in some cohorts).

whether it is in Bangladesh or abroad [31]. The mean age of multiple myeloma was reviewed as 51.9±10.1 years [26] and 58.9±12.0 years [28] in Bangladesh, and most of the patients were diagnosed beyond 60 years of age [12]. Landgren O et al., 2021 mentioned that the average age of multiple myeloma in the United States is 69 years, and ~95% of newly diagnosed patients are aged ≥50 years [3]. Another review article showed that the median age of MM patients at diagnosis is 69 in the USA and 59 in China [32], which in Bangladesh is 56 years; the age ranged from 24 to 85 years [27]. Serin İ et al., 2021 agreed with this Bangladeshi review by finding the median age of 54 years in their study, where the age range was 34 to 59 years [33]. The majority of patients complained about bone pain in Bangladesh, which is similar to other study findings [34]. Hameed A et al., 2014 illustrated that 80%–90% patients of multiple myeloma suffers with osteolytic bone lesions and other associated causes of Myeloma bone disease (MBD) are bone pain (70%–80%), fractures (50%–60%), hypercalcemia (15%), and spinal cord compression (2%–3%) which can be defined a common presenting symptoms of MM worldwide [35]. Bangladeshi researchers found that blood hemoglobin level usually decreases to <8.5 g/dL during multiple myeloma [26]. Mittelman M et al., 2003 stated that suppression of erythropoietin (EPO) production by Interleukin-1 and tumor necrosis factor can be a major cause of MM-related anemia [23]. A similar study claimed that anemia is a common complication of MM among two-thirds of the total population [36]. Birgegård G et al., 2004 found that the mean Hb level decreases to >8.0 g/dL in 4.6% patients with MM, 8.0–9.9 g/dL was found in 25.1% of cases, 10.0–11.9 g/dL in 39.5% of patients, and in 30.8% patients showed normal range (≥12 g/dL) [37]. A case control study in 2018 found that 85% of patients have abnormal ESR in patients with MM, where only 46% have elevated ESR [38]. Watson J et al., 2012 found ESR ≤12mm/hr in only 10% of patients with multiple myeloma, which is the ideal range, whereas 48% of patients had ESR ≤60mm/hr, and 70% of patients had ESR ≤100mm/hr at time of diagnosis, that allies with the country-based review article [39]. Creatinine is basically a by-product of creatine phosphate that is excreted by the kidney, and the serum creatinine range is commonly known as the endogenous marker for the glomerular function of renal function [40]. The normal range of S. creatinine for males is considered to be 0.6 to 1.2 mg/dL, and for females, it is 0.5 to 1.1 mg/dL [41]. Choi T et al., 2021 demonstrated that proteinuria led by increased creatinine is a major complication of patients with multiple myeloma [42]. S. creatinine increased higher than 2.0 mg/dL in almost 20-30% cases of MM globally [43] [44]. Bangladeshi scientists also found serum creatinine ≥2.0 mg/dL in 21%~34% cohorts. Bence Jones protein is the immunoglobulin light chains present in the urine, which is usually correlated with multiple myeloma and other B-cell malignancies, and their presence may signify the dysfunction of the kidneys and can be the cause of different diseases of the kidneys [45]. Perry MC et al., 1975 decoded that multiple myeloma accounts for 68% of Bence Jones Proteinuria (BJP) [46], which partially agrees with Bangladeshi literature that shows ~40–50% BJP in MM cases. β2-microglobulin (β2M) is a reliable marker to trace tumor mass and prognosis of patients with MM [47]. The reference value for β2-microglobulin is 0.95-2.73 mg/L for a healthy adult person [48]. In the present review article, it was shown that β2M was found >5.5 mg/L in ~>50% of the population. Previous research

conducted in other countries also reported similarities with Bangladeshi studies, where S. β2M was recorded <3.5 mg/L in stage-1 of MM, 3.5 to 5.5 in stage-2, and ≥5.5 mg/dL in stage-3 of multiple myeloma cases [49]. >50% of Bangladeshi patients presented to hospital with ISS stage III where in the neighbor country, India observed 38.3% of the patients were in stage III of MM in a single-centered study [50], in South Korea, 66.1% patient admitted to hospital with stage-III at 2025 [51], 56.2% population in China [52], 18% patients with stage-III MM was recorded in between 2007 to 2014 internationally [53] and 22% presented according to the international database at 2016 [54]. Multiple Myeloma is related to plasma cells, and in the case of MM, the malignant cells produce a large amount of single immunoglobulins only (IgG, IgA, IgM, IgD, IgE) and suppress the production of normal and diverse immunoglobulins that are essential immune system [55]. According to foreign articles, 52% to 65% of MM are IgG Myeloma, 21% to 26% are IgA Myeloma, and 16-20% are Free Light Chain (FLC) Myeloma [56]. Although a few Bangladeshi studies have been conducted on this subject but IgG is the most prevalent variant (~60–75%) among the residents. At least 10% of bone marrow plasma cell (BMPC) percentage was reported in multiple myeloma cases in earlier studies [57]. In the current review, an average of ~40–70% Bone marrow plasma cell concentration was noted. A case series from 2004 to 2013 presented 5%-10% plasma cells in their bone marrow biopsies in patients with MM [58], while Saleh ASA et al., 2021 described BMPC% ≥ 60% in 35% of patients with multiple myeloma [59]. In the case of multiple myeloma, abnormal proliferation of plasma cells occurs, which can exceed, resulting in a life-threatening condition for the patients.

Limitation

This review article discusses the previous research on multiple myeloma in Bangladesh that contains the epidemiology, pathogenesis, and disease progression only. The major drawback of this paper is that it did not give any insights into the treatment protocol of MM from the Bangladeshi perspective.

In conclusion, multiple myeloma is a grossly underdiagnosed and late-presenting disease in Bangladesh, and patients only seek treatment at advanced stages of ISS and end-organ failures. This review reveals the same trends of increasing age of diagnosis, male predominance, debilitating anemia, renal impairment, and extensive lytic bone lesions in all the studies of Bangladesh. Laboratory abnormalities such as a significant increase in ESR levels, 2-microglobulin, and monoclonal preeminence of IgG are indicators of a high tumor burden and late clinical diagnosis. The results highlight the urgency of better diagnostic centers, in particular immunofixation, 2-microglobulin, and skeletal imaging in peripheral centers. Finally, the systematic review identifies severe gaps that must be considered when developing future studies, national registries, and interventions aimed at early detection of MM in Bangladesh.

Abbreviations

MM: Multiple Myeloma, MGUS: Monoclonal Gammopathy of Undetermined Significance, SMM: Smoldering Multiple Myeloma, CRAB: Hypercalcemia, Renal impairment, Anemia, Bone lesions, ESR: Erythrocyte Sedimentation Rate, Hb: Hemoglobin, EPO: Erythropoietin, LDH: Lactate Dehydrogenase, BJP: Bence Jones Proteinuria, β2M: Beta-2 Microglobulin, ISS: International Staging System, FLC: Free Light Chain, BMPC: Bone Marrow Plasma Cell, ASCT: Autologous Stem Cell Transplantation, ECOG: Eastern Cooperative Oncology Group.

Conflicts of interest

The authors declare no conflicts of interest regarding this publication.

References

1. Sara A. Albagoush, C. S. (2023). Multiple Myeloma. In Treasure Island (FL). StatPearls Publishing. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK534764/.
2. Udongwo N, Douedi S, Odak M, Alshami A, Patel SV, Farooq T. Atypical Presentation of Plasma Cell Neoplasm of the Sternum. Cureus. 2021 07 02;. https://doi.org/10.7759/cureus.16106.
3. Landgren O, Kyle RA, Rajkumar SV. From Myeloma Precursor Disease to Multiple Myeloma: New Diagnostic Concepts and Opportunities for Early Intervention. Clinical Cancer Research. 2011 03 15;17(6):1243-1252. https://doi.org/10.1158/1078-0432.CCR-10-1822.
4. GLOBOCAN. MULTIPLE MYELOMA. Geneva: International Agency for Research on Cancer and WHO. Retrieved from https://gco.iarc.who.int/media/globocan/factsheets/cancers/35-multiple-myeloma-fact-sheet.pdf. 2022.
5. Lee JH, Lee DS, Lee JJ, Chang YH, Jin JY, Jo D, Bang SM, et al. Multiple myeloma in Korea: past, present, and future perspectives. Experience of the Korean Multiple Myeloma Working Party. International Journal of Hematology. 2010 07;92(1):52-57. https://doi.org/10.1007/s12185-010-0617-6.
6. Tang C, Hou H, Huang K, Qiu H, Liu Y. Treatment evolution and improved survival in multiple myeloma in Taiwan. Annals of Hematology. 2020 02;99(2):321-330. https://doi.org/10.1007/s00277-019-03858-w.
7. Tothong W, Tantiworawit A, Norasetthada L, Chai-Adisaksopha C, Punnachet T, Hantrakun N, Piriyakhuntorn P, et al. Prevalence, Outcomes and Impact of Disease-Related Complications in the Survival of Multiple Myeloma Patients. Hematology Reports. 2024 02 21;16(1):89-97. https://doi.org/10.3390/hematolrep16010009.
8. Ozbas-Gerceker F, Bozman N, Gezici S, Pehlivan M, Yilmaz M, Pehlivan S, Oguzkan-Balci S. Association of TAP1 and TAP2 Gene Polymorphisms with Hematological Malignancies. Asian Pacific Journal of Cancer Prevention. 2013 09 30;14(9):5213-5217. https://doi.org/10.7314/APJCP.2013.14.9.5213.
9. Usui Y, Ito H, Koyanagi Y, Shibata A, Matsuda T, Katanoda K, Maeda Y, Matsuo K. Changing trend in mortality rate of multiple myeloma after introduction of novel agents: A population-based study. International Journal of Cancer. 2020 Dec;147(11):3102-3109. https://doi.org/10.1002/ijc.33135.
10. Sharmin M, Kabir AL, Irshadullah NM, Alam MS, Kabir

ASMA, Aziz A, Rahman H. Hematological and Biochemical Changes in Patients with Multiple Myeloma Treated with Bortezomib Based Triple Drug Combination Chemotherapy. American Journal of Cancer Prevention. 2020 07 04;8(1):1-6. https://doi.org/10.12691/ajcp-8-1-1.
11. Hussain SMA. Comprehensive update on cancer scenario of Bangladesh. South Asian Journal of Cancer. 2013 Oct;2(4):279-284. https://doi.org/10.4103/2278-330X.119901.
12. Adnan Hasan Masud DA. Clinical and Hematological Profile of Patients with Multiple Myeloma. Journal of Population Therapeutics & Clinical Pharmacology. 2022 03 13;29(5). https://doi.org/10.53555/mpf6ac22.
13. Mizanur Rahman DM. Multiple Myeloma: Treatment Options for Newly Diagnosed Patients in Bangladesh Perspective. Dinajpur Med Col J. 2010;3(1):39-44.
14. Faysal Fardin MA. Review on Blood Cancer and their Types. Journal of Molecular Pharmaceuticals and Regulatory Affairs. 2021;3(1):18-25.
15. Bird SA, Cairns D, Davies FE, Boyd K, Cook G, Drayson MT, Gregory WM, et al. Sex Differences in Multiple Myeloma Biology and Clinical Outcomes: Results from 3894 Patients in the Myeloma XI Trial. Blood. 2019 Nov 13;134(Supplement_1):4374-4374. https://doi.org/10.1182/blood-2019-128041.
16. Choi S, Park S, Lee CH, Jung S, Koshiaris C, Ramasamy K, Han S, Min C. Improved survival in multiple myeloma following prior detection of precursor conditions: a nationwide real-world study. Blood Cancer Journal. 2025 Oct 30;15(1):185. https://doi.org/10.1038/s41408-025-01395-6.
17. Wei A, Juneja S. Bone marrow immunohistology of plasma cell neoplasms. Journal of Clinical Pathology. 2003 06;56(6):406-411. https://doi.org/10.1136/jcp.56.6.406.
18. Hunter C, Allen PS. Histology, Plasma Cells. In Treasure Island (FL). StatPearls Publishing. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK556082/#. 2022.
19. Barwick BG, Gupta VA, Vertino PM, Boise LH. Cell of Origin and Genetic Alterations in the Pathogenesis of Multiple Myeloma. Frontiers in Immunology. 2019 05 21;10:1121. https://doi.org/10.3389/fimmu.2019.01121.
20. Breedveld AC, Van Gool MMJ, Van Delft MAM, Van Der Laken CJ, De Vries TJ, Jansen IDC, Van Egmond M. IgA Immune Complexes Induce Osteoclast-Mediated Bone Resorption. Frontiers in Immunology. 2021 07 01;12:651049. https://doi.org/10.3389/fimmu.2021.651049.
21. Papadea C, Reimer CB, Check IJ. IgG subclass distribution in patients with multiple myeloma or with monoclonal gammopathy of undetermined significance. Annals of Clinical and Laboratory Science. 1989;19(1):27-37.
22. Sethi S, Rajkumar SV, D'Agati VD. The Complexity and Heterogeneity of Monoclonal Immunoglobulin–Associated Renal Diseases. Journal of the American Society of Nephrology. 2018 07;29(7):1810-1823. https://doi.org/10.1681/ASN.2017121319.
23. Yadav P, Merz M, Mai EK, Försti A, Jauch A, Goldschmidt H, Hemminki K. Cytogenetic aberrations in multiple myeloma are associated with shifts in serum immunoglobulin isotypes distribution and levels. Haematologica. 2018 04;103(4):e162-e164. https://doi.org/10.3324/haematol.2017.184226.
24. Mittelman M. The Implications of Anemia in Multiple Myeloma. Clinical Lymphoma. 2003 08;4:S23-S29. https://doi.org/10.3816/CLM.2003.s.005.
25. Choudhury S, Sultana TA, Islam MS, Islam MA, Khanam PA. Multiple Myeloma - A hospital based cross sectional study in Bangladesh. Journal of the Asiatic Society of Bangladesh, Science. 2013 07 07;38(2):189-198. https://doi.org/10.3329/jasbs.v38i2.15609.
26. Hossain MS, Iqbal MS, Khan MA, Rabbani MG, Khatun H, Munira S, et al. Diagnosed hematological malignancies in Bangladesh - a retrospective analysis of over 5000 cases from 10 specialized hospitals. BMC Cancer. 2014 Dec;14(1):438. https://doi.org/10.1186/1471-2407-14-438.
27. Chowdhury MRK. A Clinical and Laboratory Profile of Multiple Myeloma. Journal of Enam Medical College. 2018 Oct 28;8(3):159-164. https://doi.org/10.3329/jemc.v8i3.38366.
28. Haque S, Chowdhury ZZ, Ahmed KI, Islam AKMM, Ali M, Ferdouse J, Ara T, Rahman MM. Spectrum of Bone Complications in Newly diagnosed Multiple Myeloma patients. Haematology Journal of Bangladesh. 2022 07 25;6(02):08-12. https://doi.org/10.37545/haematoljbd202290.
29. Alam MM, Khan MA, Akter M, Wasim M, Rahman MH, Alam MN, Nahar R, et al. Clinico-Pathological Profiles of Multiple Myeloma Patients in a Tertiary Care Hospital. Mymensingh medical journal: MMJ. 2024 07;33(3):840-847.
30. Ahmed D, Islam DMK, Kabir PAL, Rahman D. Bone Involvement in Multiple Myeloma: A Study of Skeletal Deformities in Newly Diagnosed Cases. ARC Journal of Cancer Science. 2024;9(1):16-20. https://doi.org/10.20431/2455-6009.0901004.
31. Derman BA, Langerman SS, Maric M, Jakubowiak A, Zhang W, Chiu BC. Sex differences in outcomes in multiple myeloma. British Journal of Haematology. 2021 02;192(3). https://doi.org/10.1111/bjh.17237.
32. Li L, Wang L. Multiple Myeloma: What Do We Do About Immunodeficiency?. Journal of Cancer. 2019;10(7):1675-1684. https://doi.org/10.7150/jca.29993.
33. Serin İ, Doğu MH. Subgroup Analysis in Multiple Myeloma Patients under Sixty Years: A Single-Center Study. Istanbul Medical Journal. 2021 02 01;22(1):73-77. https://doi.org/10.4274/imj.galenos.2021.62593.
34. Coluzzi F, Rolke R, Mercadante S. Pain Management in Patients with Multiple Myeloma: An Update. Cancers. 2019 Dec 17;11(12):2037. https://doi.org/10.3390/cancers11122037.
35. Hameed A, Brady JJ, Dowling P, Clynes M, O'Gorman P. Bone Disease in Multiple Myeloma: Pathophysiology and Management. Cancer Growth and Metastasis. 2014 01;7:CGM.S16817. https://doi.org/10.4137/CGM.S16817.
36. Ludwig H, Pohl G, Osterborg A. Anemia in multiple myeloma. Clinical Advances in Hematology & Oncology: H&O. 2004 04;2(4):233-241.
37. Birgegård G, Gascón P, Ludwig H. Evaluation of anaemia in patients with multiple myeloma and lymphoma: findings of the European CANCER ANAEMIA SURVEY. European Journal of Haematology. 2006 Nov;77(5):378-386. https://doi.org/10.1111/j.1600-0609.2006.00739.x.
38. Koshiaris C, Van Den Bruel A, Oke JL, Nicholson BD, Shephard E, Braddick M, Hamilton W. Early detection of multiple myeloma in primary care using blood tests: a case–control study in primary care. British Journal of General Practice. 2018 09;68(674):e586-e593. https://doi.org/10.3399/bjgp18X698357.
39. Watson J, Round A, Hamilton W. Raised inflammatory markers. BMJ. 2012 02 03;344(feb03 1):e454-e454. https://doi.org/10.1136/bmj.e454.
40. Verena Gounden HB. Renal Function Tests. In Treasure Island (FL). StatPearls Publishing. Retrieved from https://

www.ncbi.nlm.nih.gov/books/NBK507821/. 2024.
41. Hosten AO. BUN and Creatinine. In H. W. Walker HK, Clinical Methods: The History, Physical, and Laboratory Examinations (3rd ed.). Butterworths. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK305/. 1990.
42. Choi T, Ahn W, Shin DW, Han K, Kim D, Chun S. Association between Kidney Function, Proteinuria and the Risk of Multiple Myeloma: A Population-Based Retrospective Cohort Study in South Korea. Cancer Research and Treatment. 2022 07 15;54(3):926-936. https://doi.org/10.4143/crt.2021.951.
43. Dimopoulos MA, Kastritis E, Rosinol L, Bladé J, Ludwig H. Pathogenesis and treatment of renal failure in multiple myeloma. Leukemia. 2008 08;22(8):1485-1493. https://doi.org/10.1038/leu.2008.131.
44. Dimopoulos MA, Terpos E. Renal Insufficiency and Failure. Hematology. 2010 Dec 04;2010(1):431-436. https://doi.org/10.1182/asheducation-2010.1.431.
45. Gupta N, Sharma A, Sharma A. Emerging biomarkers in Multiple Myeloma: A review. Clinica Chimica Acta. 2020 04;503:45-53. https://doi.org/10.1016/j.cca.2019.12.026.
46. Perry MC, Kyle RA. The clinical significance of Bence Jones proteinuria. Mayo Clinic Proceedings. 1975 05;50(5):234-238.
47. Bataille R, Grenier J, Sany J. Beta-2-microglobulin in myeloma: optimal use for staging, prognosis, and treatment--a prospective study of 160 patients. Blood. 1984 02;63(2):468-476.
48. Matoković D, Hašpl M, Petrić P, Škorvaga S, Rajić MT. Value of β₂ -Microglobulin in the Serum of Healthy Subjects Older Than 40 Years. Therapeutic Apheresis and Dialysis. 2011 06;15(3):315-318. https://doi.org/10.1111/j.1744-9987.2011.00908.x.
49. Greipp P, Katzmann J, O'Fallon W, Kyle R. Value of beta 2-microglobulin level and plasma cell labeling indices as prognostic factors in patients with newly diagnosed myeloma. Blood. 1988 07 01;72(1):219-223. https://doi.org/10.1182/blood.V72.1.219.219.
50. Mohammed N, Baba KS, B Y, Gundeti S, Raju SB. Biochemical Characterization of Multiple Myeloma Patients across ISS Stages – A Data Base Workup from a Tertiary Care Hospital in India. Asian Pacific Journal of Cancer Care. 2019 05 01;4(3):77-82. https://doi.org/10.31557/apjcc.2019.4.3.77-82.
51. Lee SH, Cho H, Moon JH, Jung JY, Kim MK, Heo MH, Do YR, et al. The characteristics of Korean elderly multiple myeloma patients aged 80 years or over. The Korean Journal of Internal Medicine. 2025 01 01;40(1):115-123. https://doi.org/10.3904/kjim.2024.041.
52. Yang S, Teng H, Hong Y, Liu C, Yu Y, Yang C, Gau J, et al. International Staging System predicts prognosis of Chinese patients with multiple myeloma across different calendar periods with application of novel agents. Annals of Hematology. 2012 01;91(1):93-102. https://doi.org/10.1007/s00277-011-1251-y.
53. Kastritis E, Terpos E, Roussou M, Gavriatopoulou M, Migkou M, Eleutherakis-Papaiakovou E, Fotiou D, et al. Evaluation of the Revised International Staging System in an independent cohort of unselected patients with multiple myeloma. Haematologica. 2017 03;102(3):593-599. https://doi.org/10.3324/haematol.2016.145078.
54. Palumbo A, Avet-Loiseau H, Oliva S, Lokhorst HM, Goldschmidt H, Rosinol L, Richardson P, et al. Revised International Staging System for Multiple Myeloma: A Report From International Myeloma Working Group. Journal of Clinical Oncology. 2015 09 10;33(26):2863-2869. https://doi.org/10.1200/JCO.2015.61.2267.
55. Lim KJC, Quach H. The Role of Intravenous Immunoglobulin (IVIG) in Reducing Infection Risk in Multiple Myeloma (MM) Patients Receiving Immune-Based Therapies: A Single Center Experience. Blood. 2023 Nov 02;142(Supplement 1):6671-6671. https://doi.org/10.1182/blood-2023-173893.
56. Ansari NA, Owais M, Usha N. Immunoglobulin heavy and light chain isotypes in multiple myeloma patients. Asian Pacific journal of cancer prevention: APJCP. 2007;8(4):593-596.
57. Guan T, Zheng M, Su L. Study on the Bone Marrow Plasma Cell Percentage in Predicting Survival in Newly Diagnosed Multiple Myeloma. Blood. 2024 Nov 05;144(Supplement 1):6984-6984. https://doi.org/10.1182/blood-2024-206521.
58. Majid S. Diagnostic utility of miRNAs in cancer A review. Multidisciplinary Cancer Investigation. 2018 09 01;02(03):01-11. https://doi.org/10.30699/acadpub.mci.2.3.1.
59. Al Saleh AS, Parmar HV, Visram A, Muchtar E, Buadi FK, Go RS, Dispenzieri A, et al. Increased Bone Marrow Plasma-Cell Percentage Predicts Outcomes in Newly Diagnosed Multiple Myeloma Patients. Clinical Lymphoma Myeloma and Leukemia. 2020 09;20(9):596-601. https://doi.org/10.1016/j.clml.2020.03.012.