GSC Advanced Research and Reviews
eISSN: 2582-4597 CODEN (USA): GARRC2
Cross Ref DOI: 10.30574/gscarr
Journal homepage: https://gsconlinepress.com/journals/gscarr/

(RESEARCH ARTICLE)

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Epidemiological profile of monoclonal gammopathies: experience of the Department of Biochemistry and Toxicology at the Avicenne Military Hospital in Marrakesh

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GSC Advanced Research and Reviews, 2026, 27(02), 036-044

Publication history: Received on 25 March 2026; revised on 04 May 2026; accepted on 07 May 2026

Article DOI: https://doi.org/10.30574/gscarr.2026.27.2.0104

Abstract

Introduction: Monoclonal gammopathies constitute a highly heterogeneous group of diseases with different aetiologies. These conditions are linked to the uncontrolled proliferation of a single lymphoplasmacytic or plasmacytic clone within the haematopoietic tissue. The aim of our study is to investigate the epidemiological profile of monoclonal gammopathies at the Biochemistry and Toxicology Laboratory of the Avicenne Military Hospital in Marrakech and to clarify the diagnostic methods.

Materials and methods: This is a retrospective descriptive study covering a 13-month period (January 2025 to January 2026). Data were collected by analysing monoclonal peaks from various electrophoresis tests carried out in the HMA's biochemistry laboratory.

Results: Of all the monoclonal peaks observed on electrophoresis, 62 met the criteria for monoclonal gammopathy. The mean age of the patients was 67.08 years, with a predominance of males. The sex ratio (M/F) was 1.21. In the biochemical assessment, electrophoresis revealed monoclonal peaks estimated at an average of 15.78 g/L, with values ranging from 1.75 g/L to 99.5 g/L. Immunofixation was performed on our patients, revealing the following isotypes: IgG Kappa 51.06%, IgG Lambda 31.91%, IgM Kappa 6.32%, IgM Lambda 4.25%, IgA Kappa 2.12%, Lambda light chains 2.12%. Renal failure was subsequently noted in 18 cases; serum calcium was normal in 39 cases; hyperproteinemia was observed in 17 cases; and elevated levels of CRP, LDH and B2-microglobulin were noted in 25, 15 and 10 cases respectively. In terms of haematological findings, the erythrocyte sedimentation rate was elevated in 19 patients and 41 patients presented with anaemia.

Conclusion: The epidemiological profile of patients in our study appears similar to that observed in other series. This highlights the importance of developing methods for early diagnosis and expanding their use, in order to complement the prognostic assessment of patients. These parameters are crucial for selecting the appropriate treatment strategy and improving the survival of each patient.

Keywords: Epidemiological Profile; Monoclonal Gammopathies; Protein Electrophoresis; Immunofixation; Laboratory Tests

1. Introduction

Monoclonal gammopathies (MG) are clonal proliferations of plasma cells or lymphoplasmocytes, responsible for the secretion of a monoclonal protein or paraprotein. Nowadays, the widespread demand for MGP testing and, above all, advances in electrophoretic and biochemical techniques have made it possible to diagnose MGP more frequently and at earlier stages. [1, 2].

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The diagnosis of MM relies on laboratory tests and is becoming increasingly common in older people. The main diagnostic methods include serum protein electrophoresis (SPE) and urinary protein electrophoresis (UPE), which enable the detection and quantification of monoclonal spikes in serum and urine. Immunofixation is used frequently to confirm the presence and type of monoclonal peak. The measurement of serum free light chains (sFLC) is essential for the diagnosis, monitoring and prognosis of monoclonal gammopathy (MG) [3, 4].

Protein electrophoresis remains a simple, highly useful and essential tool for facilitating the diagnosis and follow-up of affected patients.

The aim of this study is to describe the epidemiological and biochemical profile of monoclonal gammopathies at the Avicenne Military Hospital in Marrakech and to review the contribution of serum or urinary protein electrophoresis to the diagnosis and follow-up of patients with monoclonal gammopathy.

2. Materials and methods

This is a retrospective descriptive study, Data collection was carried out by analysing monoclonal peaks from various electrophoresis tests performed within the HMA's biochemistry and toxicology laboratory (62 cases of monoclonal gammopathies were identified) over a 13-month period from January 2025 to January 2026. For each patient, several parameters were recorded: age, gender, referring department, diagnosis, biochemical profile including creatinine, CRP, LDH, serum calcium and β2-microglobulin levels; other parameters from serum or urinary protein electrophoresis and immunofixation; the haematological profile was limited to ESR and CBC,

Capillary electrophoresis and serum protein immunofixation assays were performed on the Capillarys 3octa (Sebia) and HYDRASYS 2 (Sebia) instruments. In cases of light-chain gammopathy only. Urinary immunofixation was assessed by gel electrophoresis on the HYDRASYS 2 (Sebia). Biochemical parameters were analysed using the Abbott Architect ci8200 and Alinity systems. Diagnosis was established according to the updated criteria of the International Myeloma Working Group (IMWG) for multiple myeloma (MM), smouldering multiple myeloma (SMM) and monoclonal gammopathy of undetermined significance (MGUS).

Text and data were entered using Microsoft Word, and graphs were created using Microsoft Excel. Statistical analysis of the data was performed using Microsoft Excel.

3. Results

During our study period, we identified 62 cases of monoclonal gammopathies. The mean age of the patients was 67.08 years, ranging from 26 to 92 years. Our series comprised 34 men and 28 women, representing 54.83% and 45.16% respectively. The sex ratio (men/women) was 1.21, we found that 38 patients, or 61.29%, were out patients and 11 patients were hospitalised in the Clinical Haematology Department of the HMA (17.74%), 4 patients were referred by the Nephrology Department (6.45%), 3 patients by the Cardiology and Internal Medicine Departments (4.83% each), 2 by the Rheumatology Department (3.22%) and 1 patient by the Oncology Department (1.61%).

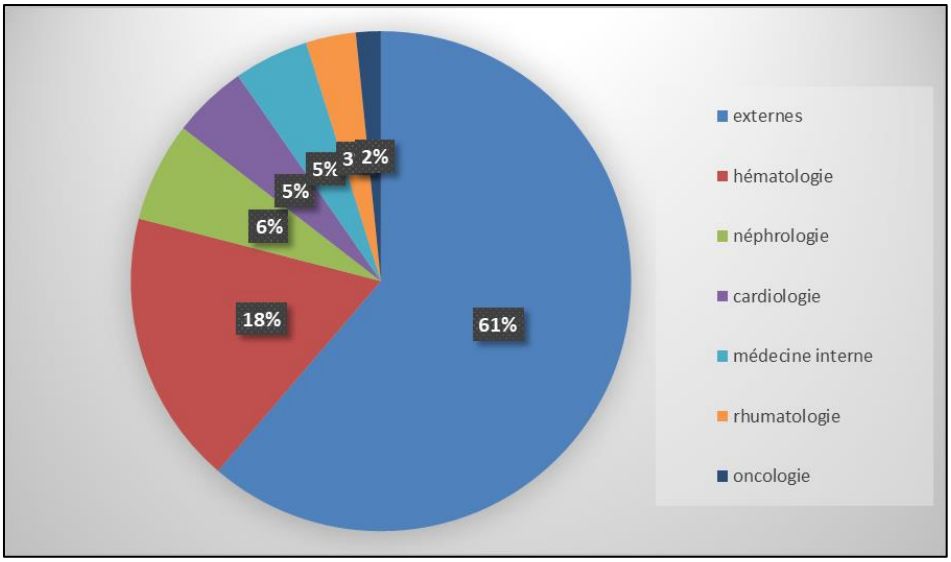

Figure 1 Breakdown of patients by department of origin

All these patients had presented with monoclonal peaks identified via serum or urine protein electrophoresis; these peaks were estimated to average 15.78 g/L, with a range of 1.75 g/L to 99.5 g/L, and were distributed as follows:

- 24 isolated monoclonal peaks,
- 35 peaks associated with hypergammaglobulinaemia with an average of 26.15 g/L,
- 1 double peak in the beta and gamma globulins,
- 1 biclonal peak,
- 1 band of monoclonal appearance.

An immunofixation test was performed and revealed the following isotypes:

- IgG Kappa 51.06%,
- IgG Lambda 31.91%,
- IgM Kappa 6.32%,
- IgM Lambda 4.25%,
- IgA Kappa 2.12%,
- Lambda light chains 2.12%.

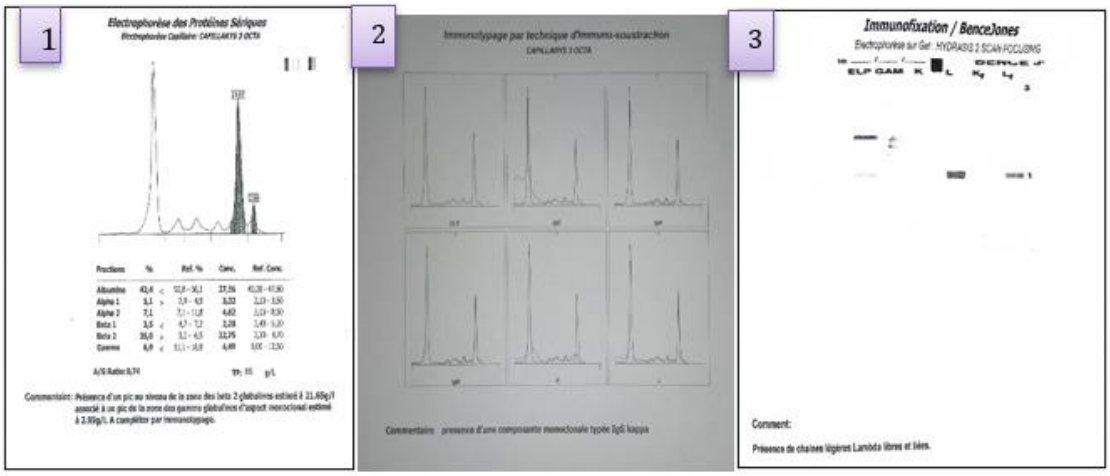

Figure 2 (1) Serum protein electrophoresis showing a double peak at the beta and gamma globulin levels / (2) Immunotyping revealing the presence of a monoclonal component of the IgG kappa type / (3) Bence Jones proteinuria showing the presence of free lambda light chains

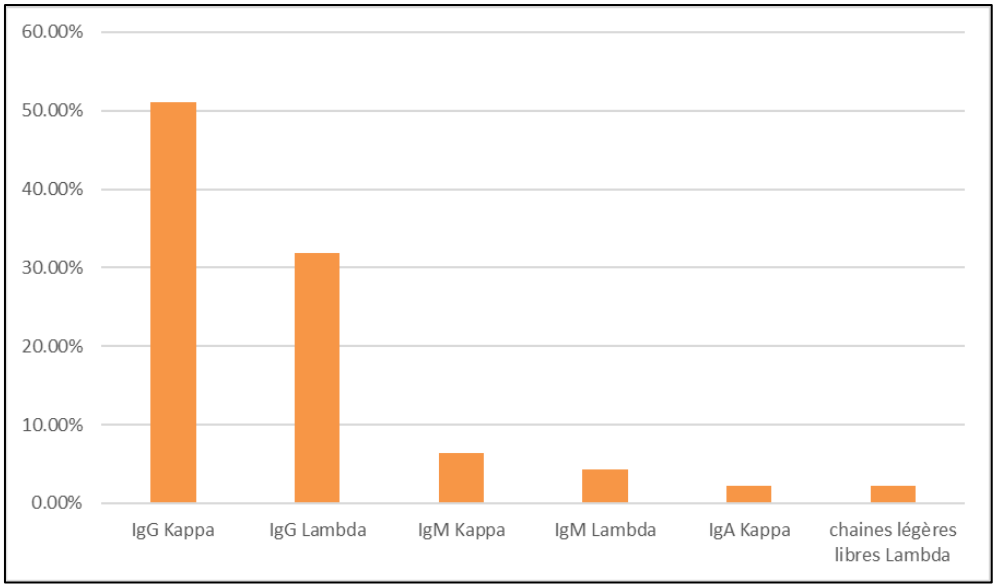

Figure 3 Distribution of monoclonal peaks by isotype

From a diagnostic perspective, multiple myeloma was the most common condition, accounting for 56.45% of cases, followed by Waldenström's macroglobulinaemia (9.67%), MGUS (8.06%), plasmacytoma (3.22%), plasmacytoma, MGRS, SMD with acute transformation to AML, large B-cell lymphoma, cardiac amyloidosis, ITP and LGM, each accounting for 1.61%, and rheumatoid arthritis and renal failure in 4.83%,

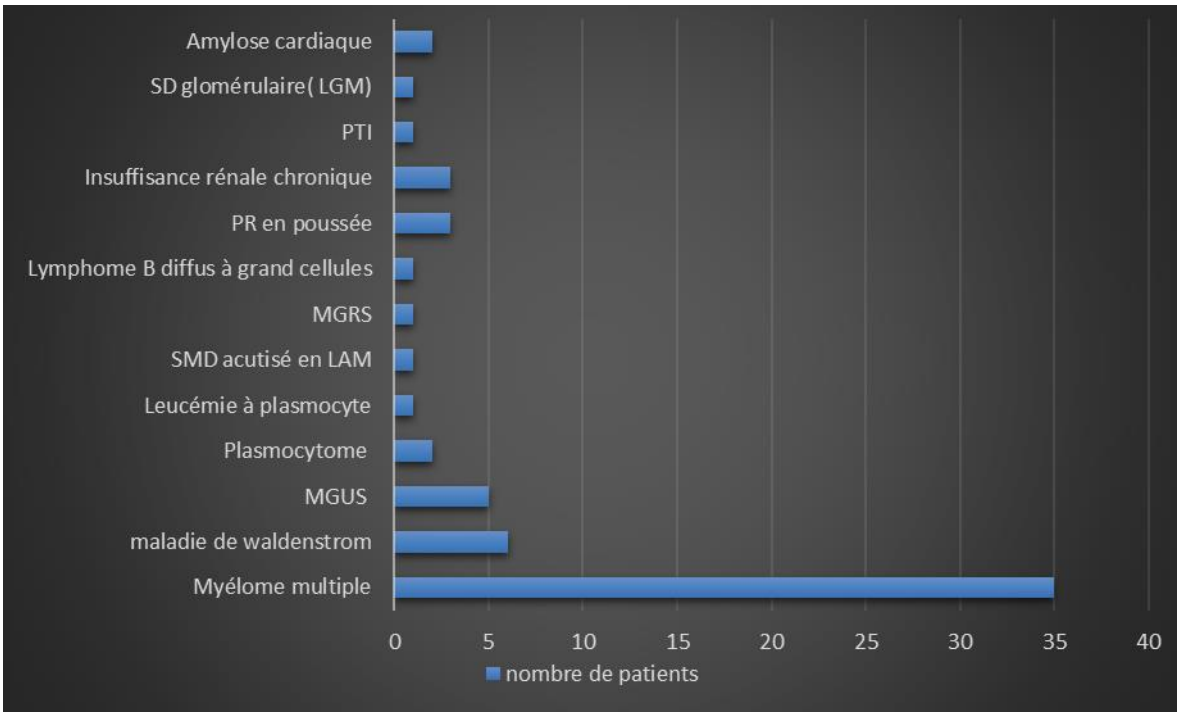

Figure 4 Breakdown of patients by diagnosis

Biochemical tests revealed normal serum calcium levels in 39 patients (79.59%), with hypocalcaemia in 10 patients (20.40%). However, no cases of hypercalcaemia were found.

Renal failure was noted in 18 cases (31.03%), with a median serum creatinine level of 184.14 µmol/L [30.1–964.6 µmol/L]; mean creatinine clearance was estimated at 75.18 ml/min/1.73 m^2.

CRP was elevated in 25 patients (40.32%), with a median of 38.83 mg/L.

Hyperproteinemia was noted in 17 cases (27.41%). Hypoproteinaemia was found in 5 patients, whilst normal protein levels were observed in 40 patients, with a mean concentration of 76.56 g/L.

Hypoalbuminaemia was found in 28 patients (45.16%), with a mean concentration of 41.99 g/L. Beta-2 microglobulin was elevated in 10 patients (16.28%), with a mean of 41.03 mg/L. LDH was elevated in 15 patients (24.19%), with a mean concentration of 208.97 U/L.

In the haematological assessment, the erythrocyte sedimentation rate (ESR) was elevated in 19 patients (30.64%), with a mean value of 44.95 mm at 1 hour. The complete blood count was normal in 21 patients (33.87%); 41 (66.12%) of the patients had anaemia; this was normocytic in 29.32% of cases, microcytic in 19.35%, and macrocytic in 17.74%. The anaemia was normochromic in 46.77% of cases and hypochromic in 17.74%. No abnormalities in white blood cells or platelets were found.

In the context of treatment adherence, or in cases of relapse or remission, 8, 6 and 5 electrophoretic tests were performed on 2 patients each, 4 tests on 4 patients, 3 on 5 patients and 2 tests on 14 patients.

4. Discussion

Monoclonal immunoglobulinopathies (MIG), also known as monoclonal gammopathies (MG), encompass a range of conditions that constitute a public health problem both globally and in Morocco [5]. They are being detected with increasing frequency in laboratories due, on the one hand, to an ageing population, requests for serum protein electrophoresis in the presence of any inflammatory or pseudo-rheumatic condition, and, on the other hand, to considerable improvements in diagnostic techniques. Their presence is not always symptomatic [6, 7].

The age of patients in our study ranged from 26 to 96 years, with a mean age of 67.08 years. This distribution confirms the hypothesis that older people constitute the target group for GM, which can affect up to 8% of the elderly population [8]. In children, MM is rare [9]. With an ageing population and the development of more effective electrophoresis methods, the number of MM cases is expected to rise gradually in the coming years. Furthermore, the male predominance (male-to-female sex ratio: 1.21) observed in our study is consistent with data published in the literature [10, 11].

The diagnosis of malignant monoclonal gammopathies is based on a combination of clinical, radiological and biological findings, incorporating molecular biology and genetics.

Over the past few decades, new serum biomarkers have been developed for routine laboratory practice, such as the measurement of free serum and urinary light chains and, more recently, the measurement of heavy and light chain isotypes of immunoglobulins (Hevylite test) [12].

Electrophoresis is recommended for the detection of qualitative or quantitative protein abnormalities in serum. It is a screening step to detect any monoclonal disorder. It is also used to screen for other pathological conditions such as cirrhosis, inflammation, etc. It is frequently used for diagnosis and for monitoring patients whether or not they are undergoing treatment, in order to improve their care [13].

Serum protein immunofixation enables the characterisation of Ig detected as peaks during conventional serum protein electrophoresis. It is a step for confirming and identifying the monoclonal presence of an Ig; whether or not associated with EPS, and it contributes to the diagnosis of monoclonal gammopathies. Immunofixation of urinary proteins enables the detection of monoclonal Ig in urine (Bence-Jones proteins) as well as complete monoclonal Ig. [14].

In our study, 100% of patients (n = 62) exhibited a monoclonal peak. In 98.38% of cases (n = 61), this peak was located in the γ-globulin region; in 1.61% of cases (n = 1), a double peak was observed in the β and γ globulin regions.

The distribution of MGs by isotype was as follows, in order of frequency: IgG Kappa, IgG Lambda, IgM Kappa, IgM Lambda, IgA Kappa and free Lambda light chains. These results are consistent with those of studies from the Maghreb, as reported by Ouzzif et al. in Morocco, Mseddi et al. in Tunisia, and Belouni et al. in Algeria [15–16].

However, MM represents a highly heterogeneous group of diseases with different aetiologies. They can, in fact, be broadly categorised into three main nosological groups:

Malignant monoclonal gammopathies (MMGs), comprising primarily multiple myeloma (MM), Waldenström's macroglobulinaemia (WM), heavy-chain diseases, amyloidosis and other chronic B-cell lymphoproliferative syndromes, Monoclonal gammopathies of undetermined significance (MGUS), which may progress to malignancy. These account for over 50% of MG cases. Certain non-lymphoid conditions, described as promoting the development of MG [17, 18, 19].

The distribution of patients according to the different types in our series shows a strong predominance of multiple myeloma (56.45%) compared with the other diagnosed monoclonal gammopathies: MGW (9.67%), plasmacytoma (3.22%) and plasma cell leukaemia (1.61%). These results are consistent with those found in several North African and European series [20–24]. Conversely, other series [25–28] show that MGUS represents the most common nosological category. In our series, MGUS accounts for 8.06%. Several factors may influence these results, notably the method of patient recruitment. Indeed, the number of MGUS cases in our study is explained by the exclusive recruitment of symptomatic hospitalised patients, in contrast to other international series (European and American) where most of the recruited patients were asymptomatic and detected as part of a routine health check-up.

As part of follow-up, electrophoretic monitoring will be carried out every 6 months for the first two years following diagnosis, then annually if the condition remains stable [29,30].

In our series, monitoring was excessive in a few patients, but the majority underwent checks 2–3 times during the year.

Regarding other biological parameters:

In the present study, renal failure was noted in 18 cases, or 31.03%, with a median serum creatinine level of 184.14 µmol/L [30, 1–964.6 µmol/L]. The results of our series are similar to those reported in the literature [31, 32]. However, a study conducted in Abidjan [33] showed a higher prevalence. Renal failure leads to significant morbidity and mortality in these patients. Myeloma-associated cylindruria is the main cause of severe acute renal failure associated with malignant monoclonal gammopathy, particularly multiple myeloma [34].

In our study, serum calcium levels were normal in 39 patients (79.59%), with hypocalcaemia in 10 patients (20.40%); however, hypercalcaemia was not observed in this series.

Serum calcium measurement forms part of the routine investigations in the initial assessment and monitoring of MM. Data in the literature regarding hypercalcaemia in the course of myeloma are varied [35,36].

In the present series, hyperproteinemia was noted in 17 cases (27.41%), hypoalbuminaemia in 5 patients, and normal serum protein levels were observed in 40 patients with a mean concentration of 76.56 g/L, ranging from 37 to 131 g/L. In the literature, a high percentage of hyperalbuminaemia is reported, reaching up to 71% in the series by N. Gougaou [32].

Hypoalbuminaemia below 30 g/L indicates advanced disease. This parameter correlates with tumour mass [37]. In line with the study by Bouatay et al. [35], which found hypoalbuminaemia in 87% of patients, our series showed that hypoalbuminaemia was found in 28 patients, or 45.16%, with a mean concentration of 35.99 g/L.

β2-microglobulin and CRP are independent prognostic factors linked to tumour burden. There is a correlation between their levels and survival in MM [35]. In our study, CRP was above 6 mg/L in 40.32% of cases and β2-microglobulin was above 6 mg/L in 16.28% of cases.

The ISS (International Staging System) is an international prognostic index based on a combination of β2-microglobulin and albumin levels. It adds LDH (lactate dehydrogenase) levels to the previous parameters. LDH was elevated in 15 patients (24.19%), with a mean concentration of 208.97 IU/l.

The erythrocyte sedimentation rate (ESR) was elevated in 19 patients (30.64%), with a mean value of 44.95 mm at 1 hour. This is suggestive of myeloma if it is very high in the absence of proven inflammation or infection; in an elderly patient, this finding should raise suspicion of myeloma and prompt further laboratory investigations in this direction [38].

The complete blood count may also be revealing, most commonly showing normochromic, normocytic or macrocytic, non-regenerative anaemia [39]. In our series, the complete blood count was normal in 21 patients (33.87%); 41 (66.12%) of patients presented with anaemia, which was normocytic in (29.32%) of cases, microcytic in (19.35%), and macrocytic in (17.74%). Normochromic anaemia was present in 46.77% of cases and hypochromic in 17.74%.

Furthermore, none of our patients presented with abnormalities in white blood cells or platelets. This is similar to the results of a Tunisian study, which reported a frequency of normochromic normocytic non-regenerative anaemia of 75.9% [40], and 60% in the Moroccan study [31]. Numerous mechanisms may explain the anaemia, notably bone marrow failure due to infiltration of the bone marrow by malignant plasma cells, or a haemodilution phenomenon linked to hyperproteinaemia, or a decrease in erythropoietin (EPO) secretion secondary to renal impairment [41, 42, 40].

5. Conclusion

Monoclonal gammopathies represent a common problem in clinical practice. It seems important to establish a simple and cost-effective diagnostic and monitoring strategy. Our study within the Biochemistry and Toxicology Laboratory at the Avicenne Military Hospital in Marrakech highlights the value of electrophoresis as an essential tool in the detection of monoclonal gammopathies, as well as its contribution to the monitoring of monoclonal peaks and treatment adherence, although it should not be overused. Electrophoretic monitoring is recommended 2–3 times a year following diagnosis. Other biochemical or haematological parameters are also of great value in the diagnosis of various monoclonal gammopathies. Their incidence has been rising significantly worldwide in recent years. This highlights the need to gain a better understanding of the pathophysiological mechanisms of each condition, to improve diagnostic methods and ensure their proper implementation, and to develop management strategies tailored to the Moroccan context and adopted by all healthcare professionals treating these diseases, which carry a poor long-term prognosis.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study by signing the Free and Informed Consent Form.

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