



Intricacies in the Diagnosis and Management of AL Amyloidosis: Experience from a Tertiary Care Institute in North India

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Authors' contributions

This work was carried out in collaboration among all authors. Author SS designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors FA, IS and MKS performed the literature search and analysed the study. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/ijr2h/2024/v7i2158>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/128114>

Original Research Article

Received: 15/10/2024
Accepted: 17/12/2024
Published: 21/12/2024

ABSTRACT

Aims: Primary (AL) amyloidosis is a form of systemic amyloidosis, causing organ dysfunction, mainly affecting the heart and kidney. Early recognition and diagnosis is critical in AL amyloidosis management. This study aimed to describe the clinical and laboratory profile and treatment pattern and outcomes in adult patients (>18 years) diagnosed with AL amyloidosis.

Study Design: Retrospective observational study.

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Cite as: Saha, Souvik, Ipra Singh, Faraz Ahmad, Manish Kumar Singh, Sanjeev, Khaliqur Rahman, Dinesh Chandra, Ruchi Gupta, and Rajesh Kashyap. 2024. "Intricacies in the Diagnosis and Management of AL Amyloidosis: Experience from a Tertiary Care Institute in North India". *International Journal of Research and Reports in Hematology* 7 (2):215-21. <https://doi.org/10.9734/ijr2h/2024/v7i2158>.

Place and Duration of Study: Department of Hematology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India, between 2007-2018.

Methodology: Retrospectively, 11 year follow-up data (2007-2018) was retrieved from the electronic medical records.

Results: The study population had a median age of 52 years and 60.6% were males. Heart and kidneys were the most frequently affected organs. Cardiac involvement was the most important determinant of clinical outcome in patients with primary amyloidosis in general and was also associated with poor outcome in this cohort of patients. Of the 33 eligible patients included in the study, 9 patients underwent treatment. Bortezomib-based regimen (CyBORd) was the preferred first-line treatment (27.3% patients). Overall, 6.0% of the patients presented a deep response (complete or very good partial response). There is limited real-world evidence data from India regarding the prevalence and treatment outcomes for AL amyloidosis due to underdiagnosis and late presentation.

Conclusion: This study provides vital real-world evidence of prevalence and treatment outcomes in primary amyloidosis patients in India.

Keywords: Primary al amyloidosis; renal amyloidosis; cardiac amyloidosis; treatment outcomes; India.

1. INTRODUCTION

“Primary (AL) amyloidosis is the most common form of systemic amyloidosis” [1,2]. “In AL amyloidosis, amyloid fibrils are formed due to the misfolding of the amyloidogenic light chains, which are produced by the clonal population of plasma cells in the bone marrow” [3]. “The amyloid fibrils accumulate in various tissues and organs, eventually causing malfunction and organ failure. AL amyloidosis is a rare condition, with an estimated prevalence of 51.27 per million individuals worldwide” [2]. “The prognosis of AL amyloidosis is poor, with a median survival of approximately 13 months in untreated patients” [4]. “The heart and kidney are the most commonly affected organs (70%cases) in AL amyloidosis, followed by liver and soft tissue (17%), autonomic nervous system (15%) and gastrointestinal tract (10%)” [5,6,7].

“Treatment of AL amyloidosis aims to promptly reduce the supply of newly formed amyloidogenic monoclonal light chains by suppressing the aberrant amyloidogenic clone, consequently reducing the formation of fibrils which allows gradual organ function recovery and improved survival” [8]. “Currently, there are limited drugs exclusively approved by the health authorities for AL amyloidosis” [9,10]. “The practice guidelines, however, offer a wide range of therapeutic modalities” [11]. “The therapeutic landscape for AL amyloidosis has evolved over the years, since the introduction of melphalan, autologous stem cell transplant (ASCT) and conventional chemotherapies. In this scenario, novel strategies like bortezomib (a proteasome inhibitor), lenalidomide-based regimens, and

most recently, daratumumab—a human IgG1k monoclonal antibody that targets the CD38 surface antigen on the plasma cells—have become important therapeutic options. Also, the Food and Drug Administration (FDA)—the US health regulatory agency—recently approved the first treatment combination specifically indicated for AL amyloidosis treatment (daratumumab plus cyclophosphamide, bortezomib and dexamethasone)” [12].

“Since patients with AL amyloidosis are typically prone to treatment-related toxicities, an individualized treatment approach is essential while managing these patients. Initial treatment with high dose melphalan and ASCT showed improvement in the quality of life (QoL) and survival outcomes in patients with AL amyloidosis” [13]. “However, this treatment is not recommended for all patients due to the cardiac involvement. Cardiac involvement and the extent of cardiac involvement are the major determinants of poor outcomes, but other factors such as age, systolic blood pressure, creatinine levels, Eastern Cooperative Oncology Group (ECOG) performance status” [14], “presence of large pleural effusions and dependency on oxygen” [15,16] have also been identified as prognostic factors related to poor outcomes. “In such patients, conventional chemotherapy or bortezomib-based therapy is the preferred option” [17]. “Treatment with bortezomib, melphalan and dexamethasone demonstrates higher rates of complete response (CR) than melphalan and dexamethasone (42% versus 19%) in the AL amyloidosis patients” [18]. “Bortezomib-alkylator-steroid combination is preferred for patients with advanced disease—

cardiac involvement, renal impairment, severe hypoalbuminemia, fluid retention -as they need a more rapid response" [11]. "Bortezomib is very effective but still has a significant toxicity profile for advanced cardiac stage patients. Daratumumab demonstrates a significant rapid and deep hematological response in patients with newly diagnosed AL amyloidosis along with an acceptable safety profile" [12,17], especially in advanced cardiac stage (IIIa, IIIb) [12].

A risk-adapted and response-tailored approach, accounting for the patient characteristics, organ involvement and cardiac biomarkers is critical in the management of AL amyloidosis. The description of treatment patterns for AL amyloidosis patients and the assessment of survival and treatment outcomes in a real-world clinical setting are necessary to identify the trends and gaps in the standard of care.

Given the paucity of data on amyloidosis incidence, clinical and laboratory profile and treatment outcomes from India, present study was aimed to study the clinical and laboratory profile along with the outcome in Indian patients with primary AL Amyloidosis.

2. MATERIALS AND METHODS

This was a retrospective observational study conducted at Sanjay Gandhi postgraduate institute of medical sciences, Lucknow, India in the department of hematology. Thirty-three (33) study subjects were added to the study as per inclusion & exclusion criteria.

Inclusion criteria: All patients diagnosed with systemic amyloidosis as per guidelines were included in the study. The clinical and laboratory data of all the patients were retrieved from their electronic medical records from May 2007 till June 2018 and was further analysed.

Exclusion criteria: Patients diagnosed with other forms of amyloidosis (amyloid A [AA], transthyretin-related hereditary [TTR] amyloidosis, localized amyloidosis), were excluded from the study.

Statistical analysis: Descriptive statistics is presented as mean and standard deviation for continuous data and as numbers and proportions categorical data. Data analysis was done using IBM-SPSS statistics software ver. 23.0.

Diagnosis of AL amyloidosis was confirmed by the presence of amyloid fibrils in the biopsy tissue by abdominal fat aspiration using Congo

red staining, in addition to the demonstration of a monoclonal plasma cell proliferative disorder and the presence of amyloid-related systemic syndrome [19]. Renal amyloidosis was confirmed by light chain restriction by immunofluorescence and histopathological examination. Demonstration of plasma cell dyscrasia was demonstrated by measuring serum M protein through serum electrophoresis test. The electronic medical records include data for baseline demographics, medical history, comorbidities, physical examinations, laboratory, and imaging exams. Treatments were prescribed according to the hospital protocols.

3. RESULTS AND DISCUSSION

In a study period from 2007 to 2018, thirty-three cases of primary amyloidosis were diagnosed according to the guidelines. Majority of cases belonged to 50-59 years age group (48.5%) followed by 40-49 years (21.2%), 60-69 years (18.2%) and 70-79 years (9.1%). 3% of patients belonged to >80 years. The male:female ratio was 1.5:1. All the patients had edema at presentation. Other most common signs & symptoms were pallor (45.5%) followed by breathlessness (30.3%), diarrhea (21.2%), weakness (18.2%), fever & cough (15.2%). On Laboratory investigations, Ultrasound showed hepatomegaly and splenomegaly in 12.1% of patients. 2D-Echo showed 15.2% cases with restrictive cardiomyopathy. The baseline clinical characteristics are shown in Table 1.

Out of 33 amyloid patients, M-Band was detected in 48.5% patients. Immunofixation results were negative in 48.5%. 10 patients (30.3%) were found with IgG Lambda type monoclonal protein followed by IgA Lambda type monoclonal protein & Lambda light chain type monoclonal protein in 9.1% each (Table 2).

All patients had renal involvement. Renal failure was observed in 42.4% patients. Cardiac plus renal involvement was found in 5 patients (15.2%) and 1(3%) patient had a GI (duodenum) involvement along with renal involvement. The 5 patients having cardiac involvement had Revised Mayo stage IV (Table 3).

27.3% patients had received 4-6 cycles of CyBORD (Bortezomib+ cyclophosphamide+ Dexamethasone) based regimen. None of the patients underwent autologous hematopoietic stem cell transplant either because of being transplant

Table 1. Demographic and clinical profile of patients at diagnosis

Parameters	Frequency	Percent
Age group		
40-49	7	21.2
50-59	16	48.5
60-69	6	18.2
70-79	3	9.1
>80	1	3.0
Sex		
Male	20	60.6
Female	13	39.4
Signs and symptoms		
Proteinuria (frothy urine)	33	100
Fever	5	15.2
Weakness	6	18.2
Joint pain	4	12.1
Bleeding episodes	3	9.1
Difficulty in swallowing	1	3.0
Diarrhoea	7	21.2
Paraesthesia and numbness	3	9.1
Breathlessness	10	30.3
Cough	5	15.2
Nausea & vomiting	3	9.1
Edema	33	100
Pallor	15	45.5
Macroglossia	3	9.1
Petechiae or ecchymosis	1	3.0
Peripheral neuropathy or thickened peripheral nerves	3	9.1
Arrhythmia	1	3.0
Hepatomegaly	4	12.1
Splenomegaly	4	12.1
Restrictive cardiomyopathy	5	15.2

Table 2. Distribution of patients according to serum immunofixation

Serum Immunofixation	Frequency	Percent
Kappa light chain type monoclonal protein	1	3.0
IgA Lambda type monoclonal protein	3	9.1
IgG Lambda type monoclonal protein	10	30.3
Lambda light chain type monoclonal protein	3	9.1
Negative immunofixation	16	48.5
Total	33	100.0

Table 3. Distribution according to organ involvement

Organ Involvement	Frequency	Percent
Renal involvement only	27	81.8
Renal plus GI involvement (duodenum)	1	3.0
Renal plus Cardiac involvement	5	15.2

ineligible or due to financial constraints. Out of 33 patients, 13 (39.4%) were lost to follow-up. 11(33.3%) patients died. In this 1 patient died of cardiac arrhythmia and another with cardiac failure, 4 (12.1%) patients died of COVID-19 and 5 (15.2%) died due to gram negative septic shock. 9 (27.3%) patients were alive. Among live

patients, 1 was in complete remission, 1 was in partial remission, 1 was stable, 2 patients were ESRD/dialysis dependent. 4 patients (12.1%) had progression of disease (Table 4).

In present study, majority of Primary amyloidosis cases belonged to 50-59 years age group

(48.5%) followed by 40-49 years (21.2%) ,60-69 years (18.2%) and 70-79 years (9.1%). 3% of patients belonged to >80 years. Median age was 52 years. But in a study conducted by Sivaprakasam Y et al. [20] median age was 59 years which was higher compared to present study.

All patients had Proteinuria on urinalysis and had peripheral edema on clinical exam. Other most common signs & symptoms were pallor, breathlessness, diarrhea, weakness. Ultrasound showed hepatomegaly and splenomegaly in 12.1% of patients. 2D-Echo showed 15.2% cases with restrictive cardiomyopathy.

Out of 33 amyloid patients, immunofixation results were negative in 48.5%. 10 patients (30.3%) were found with IgG Lambda type monoclonal protein followed by IgA Lambda type monoclonal protein & Lambda light chain type monoclonal protein in 9.1%. 3% were found with kappa light chain type monoclonal protein. In a report by Sivaprakasam Y et al. [20]. Lambda monoclonal light chain was seen in 22/27 (81.5%) and kappa monoclonal light chain in 5/27 (18.5%) of patients.

In present study, all patients had renal involvement. Renal failure was observed in 42.4% patients. Cardiac plus renal involvement was found in 5 patients (15.2%) and GI plus renal involvement was found in 1 (3%) patient. These 5 patients of cardiac involvement had Revised Mayo stage IV. Six (18.2%) patients had

more than one system involved while 27 (81.8%) patients had a single system involvement. Similar to this, previous studies have shown most common system involved was renal in 16 (59.2%), followed by cardiac in 13 (48.1%) and gastro-intestinal in 9 (33.3%). Fifteen (55.6%) had two or more system involvement while 12 (44.4%) had single system involvement. 27.3% patients received CyBORD (Bortezomib+ cyclophosphamide+ Dexamethasone) based chemotherapy regimen. In a study by Sivaprakasam Y et al. [20] fourteen patients were treated; cyclophosphamide, bortezomib and dexamethasone (CyBORD) in 10/14 (71.4%) and bortezomib + dexamethasone in 4/14 (28.6%). In the same study, among 14 patients followed up with median follow up of 13 months (range 6-60 months), 5 expired; 3 due to COVID, one due to cardiac arrhythmia (during first cycle) and one due to relapse and rest 9 were alive. Among the 9 patients who were alive 6 were in complete hematological response and 3 were in partial response after 6 cycles of therapy. Similar to these results, in present study 1 patient died with cardiac arrhythmia and another with cardiac failure, 4 patients died of COVID-19 and 5 patients died due to septic shock.

In present study, 9 (27.3%) patients were alive. Among live patients, 1 was in complete response, 1 in very good partial response, 1 was stable, 2 patients were ESRD/dialysis dependent. 4 patients (12.1%) had progression of disease.

Table 4. Treatment and outcomes

Treatment Received	Frequency	Percent
CyBORD (Bortezomib+cyclophosphamide+Dexamethasone) based regimen	9	27.3
Autologous stem cell transplant	0	0
Deaths and Cause		
COVID19	4	12.1
Gram negative Septic shock	5	15.2
Arrhythmia	1	3.0
Cardiac failure	1	3.0
Follow up		
Alive	9	27.3
Dead	11	33.3
Lost to follow up	13	39.4
Condition of the Patients		
Complete response	1	3.0
Very good Partial response	1	3.0
Stable	1	3.0
Progression of disease	4	12.1
ESRD/dialysis dependent	2	6.0

4. CONCLUSION

This study highlights the importance of early diagnosis and treatment for patients with AL amyloidosis. It provides vital real-world evidence for the diagnosis and treatment outcomes for patients with AL amyloidosis in the Indian population, which would be useful for clinical decision making and help revolutionize the treatment for patients with AL amyloidosis. More real-world evidence data is required to further improve the patient care, and meet the unmet need, in terms of management of AL amyloidosis.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Under review by Institute Ethics Committee (IEC). Waiver of consent has also been applied for to the IEC since this was a retrospective observational study.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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