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# Light Chain Multiple Myeloma

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**ABSTRACT**

The case report presented here sheds light on the diagnostic challenges posed by Light Chain Multiple Myeloma (LCMM), a rare subtype of multiple myeloma characterized by the exclusive production of light chains. LCMM's a typical presentation often manifests with nonspecific symptoms, such as fatigue and backpain, complicating its diagnosis and necessitating a in depth evaluation. This case highlights the significance of a thorough medical history in uncovering potential risk factors and guiding towards the diagnosis, despite the absence of classical myeloma symptoms. Laboratory investigations, including serum protein electrophoresis and renal function tests, alongside imaging studies, played a crucial role in confirming the diagnosis of LCMM. The complexity of LCMM presents the importance of a multi disciplinary approach to diagnosis and management, considering its diverse clinical manifestations and potential renal complications. This report emphasizes the need for heightened clinical suspicion and early intervention to mitigate the impact of LCMM, highlighting the evolving nature of multiple myeloma subtypes and the necessity for tailored therapeutic approaches based on specific disease characteristics.

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**Key Words**
Light chain, multiple myeloma

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## INTRODUCTION

Multiple myeloma (MM) is a haematological malignancy characterized by the clonal proliferation of plasma cells in the bone marrow[1]. This case report focuses on are lativelyun common subtype of MM, known as Light Chain Multiple Myeloma (LCMM). Unlike the typical presentation of MM, where abnormal plasma cells produce excessive amounts of immunoglobulin heavy and light chains, LCMM is marked by the production of only light chains, either kappa or lambda[2,3]. These light chains can have significant renal implications due to their propensity to cause kidney damage, a condition of ten referred to a slight chain deposition disease (LCDD). Light Chain Multiple Myeloma (LCMM) represents a unique and challenging subset of multiple myeloma, a plasma cell malignancy primarily characterized by the uncontrolled proliferation of plasma cells in the bone marrow[4]. While traditional

multiple myeloma typically involves the over production of both heavy and light immunoglobulin chains, LCMM is distinct in its exclusive over production of light chains (either kappa or lambda types), without a corresponding increase in heavy chains[5]. This singular aspect of LCMM gives rise to a distinct pathophysiological profile and clinical presentation.

In LCMM, the over produced light chains can betoxic to various organs, particularly the kidneys[6]. These light chains, being smaller and more easily filteredby the kidneys, can accumulate in the renal tubules, leading to a condition known as light chain cast nephropathy[7]. Additionally, they can deposit in various tissues, including the kidney, heart, liver and nerves leading to Light Chain Deposition Disease (LCDD). This deposition can cause organ dysfunction, most notably leading to rapidly progressive renal failure[8-10].

This case report presents a detailed analysis of a patient diagnosed with LCMM, emphasizing the unique clinical presentation, diagnostic challenges and therapeutic approaches. The significance of this report lies in its contribution to the understanding of LCMM's clinical characteristics, which can be markedly different from those of classical MM. Additionally, the case highlights the importance of early detection and intervention, given the potential renal complications and the aggressive nature of this subtype. Through this detailed examination, the report aims to enhance clinical awareness and inform therapeutic strategies for treating this rare and challenging form of multiple myeloma.

**Case report:** A 48-year-old man, who works as a painter, visited the medicine out patient department presenting with two main complaints: He has been experiencing easy fatigability for the past three months and right-sided lower back pain that also began three months ago. In detailing his current illness, the patient noted that he was ingood health until about three months prior. At that time, he began to suffer from right-sided lower backpain. This pain was gradualin on set and has progressively worsened. It is described as a dull, aching sensation that does not fluctuate with any specific factors. Alongside this, for the same duration of three months, he has been experiencing generalized muscle pain and easy fatigability, which is accompanied by shortness of breath when hurrying on flat surfaces, classified as Modified Medical Research Council (MMRC) grade 1. The patient denied experiencing any chest pain, palpitations, dizziness, hematemesis, melena, paroxysmal nocturnal dyspnea, orthopnea, abdominal pain, diarrhea, constipation, pedaledema, evidence of parasitic infections in stools, walking barefoot issues, difficulty urinating, cough with phlegm, or vomiting.

The patient has a notable past history of alcohol consumption spanning 20 years, with his last binge occurring six months ago. He also smoked for 10 years but has been abstinent for the past six months. Additionally, he has a history of using Hans(a form of smokeless tobacco). He underwent bilateral hernioplasty a decade ago. There is no known history of diabetes mellitus (DM), hypertension (HTN), bronchial asthma (BA), tuberculosis (TB), epilepsy, or thyroid disorders in his medical records. In terms of personal history, the patient follows a mixed diet and reports normal bowel and bladder habits. Recently, he has experienced a reduced appetite but maintains adequate sleep.

During the general examination, the patient was found to be conscious and oriented, without fever. He presented with a moderately built physique but appeared poorly nourished. Signs of pallor were evident, though there were no indications of icterus, cyanosis, clubbing, lymphadenopathy, or pedal edema. His vital signs revealed apulse rate of 108 beats per minute and a blood pressure of 122/66 mmHg. Hisoxygensaturation was measured at 99% on room air.

During the systemic examination, cardiovascular system (CVS) assessment revealed the presence of an apicalthrill and pulmonary pulsations. The jugular venous pressure (JVP) was found to be increased and a venous hum was also noted. In the Respiratory System (RS) examination, bilateral air entry was normal and no added breath sounds were detected. The abdomen was soft and non-tender upon palpation. Upon examining the central nervous system (CNS), no focal neurological deficits were identified.

The patient underwent a series of routine investigations, including an anemia workup. The Complete Blood Count (CBC) showed hemoglobin

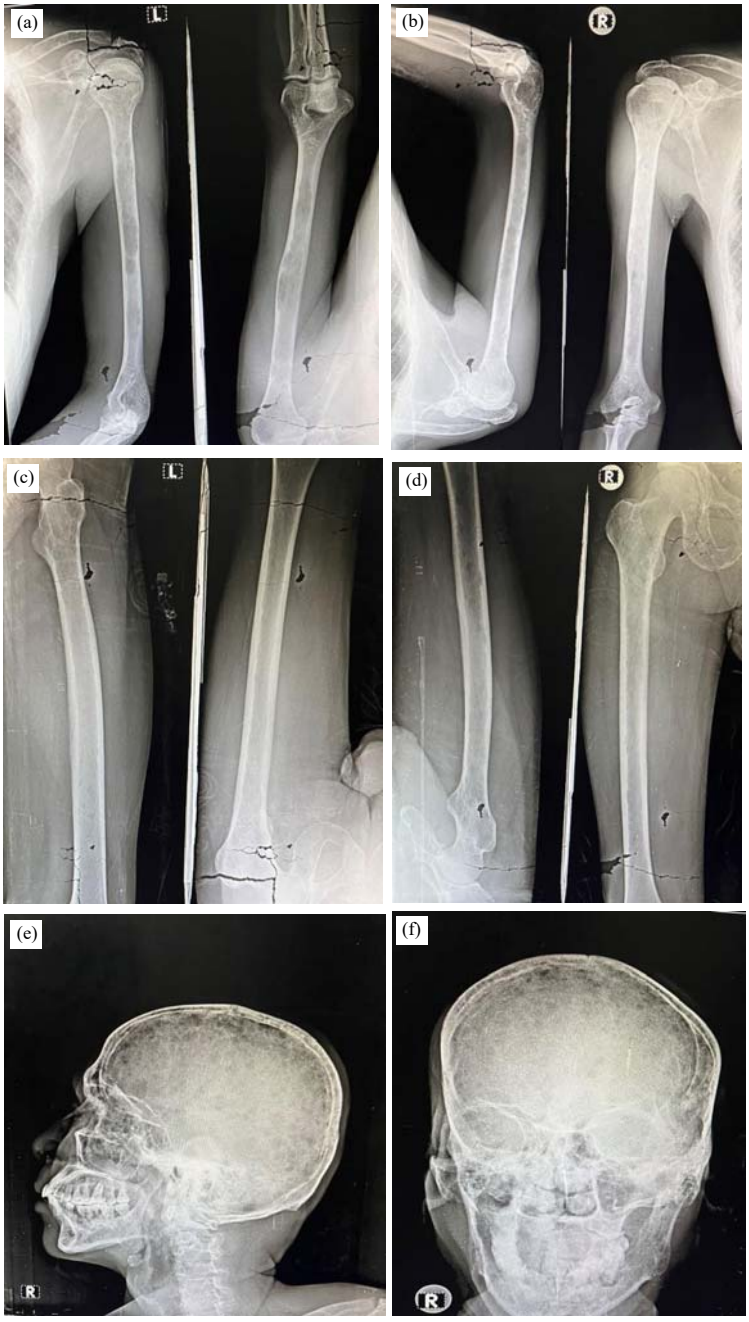


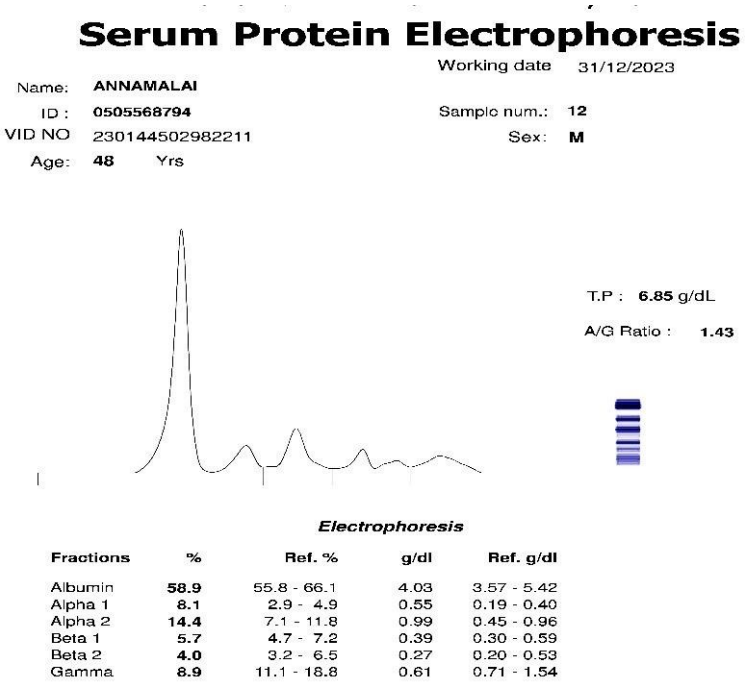

Fig. 1(a-d): (a) L upper limb, (b) R upper limb, (c) L Lower limb and R lower limb

(Hb) at 5.5 g%, red blood cell (RBC) count at 1.8 million/cumm and packed cell volume (PCV) at 15.9%. His white blood cell (WBC) count was 5600/cumm, with mean corpuscular hemoglobin (MCH) at 29.6 pg and mean corpuscular hemoglobin concentration (MCHC) at 34.6g%. The platelet count was 175,000/cumm, neutrophils were at 69% and lymphocytes at 26%. The reticulocyte count was less than 0.5% with a Reticulocyte Production Index (RPI) of 0.11 and erythrocyte sedimentation rate (ESR) at 45 mm/hr. The peripheral smear revealed normocytic normochromic anemia with neutrophilic coarse granules and no other significant findings.

Renal function tests (RFT) indicated urea levels at 70 mg/dL and creatinine at 3.4 mg/dL. Liver Function Tests (LFT) showed total bilirubin at 0.5 mg/dL (direct bilirubin at 0.2), total protein at 5.6 g/dL (albumin at 4.2), AST at 47, ALT at 17 and alkaline phosphatase (ALP) at 103.

The patient's calcium level was elevated at 12.5 mg/dL, phosphorous at 3 mg/dL and uric acid at 10.3 mg/dL. Electrolyte levels were as follows: Sodium (Na) at 139 Meq/L, potassium (K) at 3.0 Meq/L and chloride (Cl) at 108 Meq/L.

A urine routine examination revealed the presence of amorphous phosphate with 40 to 50 pus cells/HPF,



**Serum Protein Electrophoresis**

Working date 31/12/2023

Name: ANNAMALAI
ID : 0505568794
VID NO 230144502982211
Age: 48 Yrs

Sample num.: 12
Sex: M

T.P : 6.85 g/dL
A/G Ratio : 1.43

*Electrophoresis*

| Fractions | % | Ref. % | g/dl | Ref. g/dl |
|---|---|---|---|---|
| Albumin | 58.9 | 55.8 - 66.1 | 4.03 | 3.57 - 5.42 |
| Alpha 1 | 8.1 | 2.9 - 4.9 | 0.55 | 0.19 - 0.40 |
| Alpha 2 | 14.4 | 7.1 - 11.8 | 0.99 | 0.45 - 0.96 |
| Beta 1 | 5.7 | 4.7 - 7.2 | 0.39 | 0.30 - 0.59 |
| Beta 2 | 4.0 | 3.2 - 6.5 | 0.27 | 0.20 - 0.53 |
| Gamma | 8.9 | 11.1 - 18.8 | 0.61 | 0.71 - 1.54 |

Fig. 2: Kidney see serum immunofixation result

3 to 5 epithelial cells/HPF and 2 to 3 RBCs. No albumin or sugar was detected. The urine albumin-creatinine ratio was around 1500 mg/g of creatinine ratio. Serum ferritin was measured at 232.81 ng/mL. Stool analysis revealed no occultblood, ova, orcysts.

A cardiac 2D echocardiogram showed an ejection fraction (EF) of 60%, mild tricuspidregurgitation (TR) and mitral regurgitation (MR) with grade 2 diastolicdys function.

The patient received transfusions of two units of packed red blood cells (PRBC) on alternate days. However, on the fourth day of his admission, he reported a new issue: The development of a 3×3 cm swelling and pain in the left midclavicular region, for which there was no history of trauma. To investigate this, a chest X-ray and a localultra sound (USG) were performed.

The chest X-ray revealed a minimally displaced fracture in the midshaft of the left clavicle, along with multiple old rib fractures, indicative of pathological fractures. Further imaging, including X-rays of the skull, both upper limbs (UL) and lower limbs (LL), was obtained, revealing the presence of multiple lytic lesions throughout the bones.

A bone marrow biopsy was initially conducted to gain further insights; however, the sample obtained was inadequate for a definitive diagnosis. When the possibility of are peat test was proposed, the patient was not willing to undergo the procedure again.

A detailed workup for multiple myeloma was conducted on the patient. The urinemicro albumin level was significantly elevated at 96.8 mg/dL, where the normal rangeis less than 20 mg/dl. The microalbumin-to-creatinine ratio in the urine was 124.90 mg/g of creatinine, markedly higher than the normal limit of under 30 mg/g. Urine Bence Jones protein test, conducted via heat coagulation, returned negative. Serum immunoglobulin levels were mixed, with IgG at a normal 730 mg/dL but both IgA and IgM levels were low, at 24 mg/dL and 29.4 mg/dL, respectively. Serum-free kappalight chains were within the normal range at 7.89 mg/L but serum-free lambda light chains were excessively high at 1844.89 mg/L, resulting in a marked lylowkappa/lambda ratio of less than 0.01. Electrophoresis revealed a spike in the lambda region without a traditional Mspike. The serum protein electrophoresis profile showed a normal distribution of albumin at 4.03, alpha 1 globulin at 0.55, alpha 2 globulinat 0.99 and gammaglobulin at 0.61.

Based on these findings, a diagnosis of Light Chain Multiple Myeloma (LCMM) was established. Given the complexity and severity of his condition, the patient was referred to a higher center for specialized oncological follow-up.

## DISCUSSION

This case report of a 48-year-old painter diagnosed with Light Chain Multiple Myeloma (LCMM) reveals several important aspects of this rare disease. The patient's initial presentation with non specific symptoms such as easy fatig ability and backpain, often

over looked as benign or attributed to occupational strain, exemplifies the diagnostic challenges associated with LCMM. The absence of typical multiple myeloma symptoms like bone pain further complicated the clinical picture.

The patient's history of alcohol use, smoking and hernioplasty, while not directly related to his current diagnosis, highlights the importance of a complete medical history in understanding a patient's overall health context. The routine investigations, notably the complete blood count and renal function tests, played a pivotal role inguiding the diagnosis towards a haematological malignancy and indicating renal impairment, a common complication in LCMM due to light chain deposition. The marked elevation in serum-free lambda light chains with a decreased kappa/lambda ratio and the presence of lytic bone lesions, as revealed in the radiographic findings, are characteristic of LCMM. However, the absence of Bence Jones proteinuria, often considered a hallmark of multiple myeloma, further illustrates the a typical presentation of LCMM.

The management of this patient, with blood transfusions and referral to a higher center for oncological care, aligns with current treatment approaches for LCMM, which focus on managing both the plasma cell disorder and the associated organdys function, especially renal impairment.

Diagnosing Light Chain Multiple Myeloma (LCMM) presents challenges due to it's a typical presentation with nonspecific symptoms like fatigue and back pain, often leading to mis diagnosis or delayed diagnosis[11]. The absence of classical myeloma symptoms over lap with other conditions and subtle laboratoryab normalities further complicate the diagnostic process. LCMM's variable disease presentation and similarities with other haematological malignancies contribute to the difficulty in establishing a standardized diagnostic approach[12]. These challenges increase the importance of a thorough evaluation, including thorough clinical assessment and targeted laboratory investigations, to facilitate timely diagnosis and appropriate management. Similar diagnostic hurdles are encountered in other rare variants of multiple myeloma and haematological malignancies, necessitating a new approach to differential diagnosis and patient care.

A comprehensive medical history plays a pivotal role in diagnosing Light Chain Multiple Myeloma (LCMM) by uncovering potential risk factors or clues related to the patient's diagnosis, even if seemingly unrelated. For instance, a history of alcohol use, smoking, or previous surgeries like hernioplasty may provide insights into the patient's overall health status and potential predisposing factors for LCMM[13]. Additionally, a thorough medical history can reveal comorbidities or medication use that may influence disease progression or treatment options. Comparatively, in other cases of LCMM or multiple myeloma, a detailed medical history has similarly been instrumental in identifying relevant risk factors or clinical associations[14]. For example, a history of exposure to environmental toxins or certain occupations mayraise suspicion for LCMM, while a family history of haematological malignancies could suggest a genetic predisposition. By recognizing the significance of a medical history, healthcare providers can glean valuable insights that inform the diagnostic process and guide personalized treatment strategies for patients with LCMM or multiplemyeloma[15].

The symptoms of Light Chain Multiple Myeloma (LCMM), such as renal impairment and anaemia, often overlap with those of various other medical conditions, posing a challenge in distinguishing LCMM from alternative differential diagnoses[16]. This overlap heightens the risk of misdiagnosis or delayed diagnosis, particularly when clinical assessment alone is relied upon without extensive laboratory and imaging studies. Renal impairment, for instance, is a common manifestation in multiple renal diseases, while anaemia can result from diverse etiologies ranging from nutrition aldeficiencies to chronic diseases. Without thorough investigation, LCMM may be overlooked in favour of more commonly encountered conditions, prolonging the time to accurate diagnosis and appropriate management. Therefore, a multidisciplinary approach incorporating detailed laboratory assessments and imaging studies is essential for effectively differentiating LCMM from its mimicking conditions and ensuring timely intervention[13].

Laboratory tests are pivotal in diagnosing Light Chain Multiple Myeloma (LCMM), yetsubtle abnormalities in serum protein electrophoresis, immunofixation, or serum free light chain assays may be disregarded as insignificant, particularly in the absence of overt symptoms[17]. This high lights the critical need for meticulous interpretation of laboratory results and a heightened index of suspicion for LCMM. Even minor deviations in these tests, when viewed in conjunction with clinical context, may provide valuable clues suggestive of underlying LCMM[18].

Light Chain Multiple Myeloma (LCMM) poses a diagnostic challenge due to its diverse clinical manifestations, making it difficult to establish a standardized diagnostic approach. This variability in

disease presentation is not unique to LCMM but extends to other hematological malignancies, including monoclonal gammopathy of undetermined significance (MGUS) and smoldering multiple myeloma. These conditions may share overlapping features with LCMM, such as abnormal protein production and renal impairment, further complicating the diagnostic process[19]. Consequently, healthcare providers must carefully evaluate clinical and laboratory findings, considering the possibility of LCMM alongside other differential diagnoses to ensure accurate identification and appropriate management[16].

This case highlights the need for heightened clinical suspicion and investigation inpatients presenting with vague systemic symptoms and renal impairment, especially in the absence of classical multiple myeloma markers. It also emphasizes the evolving nature of multiple myeloma subtypes and the importance of tailored the rapeutic approaches based on specific disease characteristics.

## CONCLUSION

The presented case of a 48-year-old painter diagnosed with Light Chain Multiple Myeloma (LCMM) underscores the diagnostic challenges associated with this rare disease. LCMM's atypical presentation with nonspecific symptoms like fatigue andback pain often leads to misdiagnosis or delayed diagnosis, highlighting the need for heightened clinical suspicion. Despite the absence of classical multiple myeloma symptoms, a detailed and complete medical history played a pivotal role in guiding towards the diagnosis, emphasizing the significance of thorough evaluation. Laboratory investigations, including serum protein electrophoresis and renal function tests, along with imaging studies, aided in confirming the diagnosis of LCMM. The complexity of LCMM shows the importance of a multidisciplinary approach to diagnosis and management. Similar diagnostic hurdles are encountered in other rare variants of multiple myeloma and hematological malignancies, emphasizing the need for a novel differential diagnosis. This case emphasizes the importance of early detection and intervention to mitigate potential renal complications and the evolving nature of multiple myeloma subtypes, highlighting the necessity for tailored therapeutic approaches based on specific disease characteristics.

## REFERENCES


1. Rajkumar, S.V., 2016. Multiple myeloma: 2016 update on diagnosis, risk-stratification, and management. Am. J. Hematol., 91: 719-734.
2. Leung, N. and J.D. Ransohoff, 2019. Multiple myeloma: Contemporary issues in diagnosis and prognosis. Cancer Treat Res., 183: 15-41.
3. Muchtar, E., F.K. Buadi and A. Dispenzieri, 2019. Light chain deposition disease. Curr. Opin. Nephrol. Hypertens., 28: 151-158.
4. Palladini, G. and G. Merlini, 2012. Light chain deposition disease: It is time to update the diagnostic criteria. Blood, 119: 2637-2643.
5. Kastritis, E. and M.A. Dimopoulos, 2008. Renal impairment is associated with a poorer prognosis in patients with multiple myeloma. Leukemia, 22: 2265-2271.
6. Kyle, R.A., S.V. Rajkumar, 2014. Monoclonal gammopathy of undetermined significance and smoldering multiple myeloma. Hematol. Oncol. Clin. North Am., 28: 775-790.
7. Dimopoulos, M.A., E. Terpos and A. Chanan-Khan, 2014. International myeloma working group consensus recommendations on risk stratification in multiplemyeloma. Leukemia, 28: 269-277.
8. Rajkumar, S.V., M.A. Dimopoulos, A. Palumbo, 2014. International myeloma working group updated criteria for the diagnosis of multiple myeloma. Lancet Oncol., 15: e538-e548.
9. Leung, N., F. Bridoux, C.A. Hutchison, 2009. Light chain deposition disease withrenal involvement: Clinical characteristics and prognostic factors. Am. J. Kidney Dis., 54: 937-945.
10. Bridoux, F., N. Leung, C.A. Hutchison, 2007. Treatment of light chain deposition disease: Complete hematologic response with bortezomib-dexamethas one followed by autologous stem cell transplantation. Leukemia, 21: 826-828.
11. Durie, B.G., J.L. Harousseau, J.S. Miguel, J. Bladé, B. Barlogie, K. Anderson et al., 2006. International uniform response criteria for multiple myeloma. Leukemia, 20: 1467-1473.
12. Palumbo, A., H. Avet-Loiseau, S. Oliva, H.M. Lokhorst, H. Goldschmidt and L. Rosinol *et al*., 2015. Revised international staging system for multiple myeloma: A report from International Myeloma Working Group. J. Clin. Oncol., 33: 2863-2869.
13. Dimopoulos, M.A., J. Hillengass, S. Usmani, E. Zamagni, S. Lentzsch, F.E. Davies *et al*., 2015. Role of magnetic resonance imaging in the management of patients with multiple myeloma: A consensus statement. J. Clin. Oncol., 33: 657-664.
14. Rajkumar, S.V. and S. Kumar, 2016. Multiple myeloma: Diagnosis and treatment. Mayo. Clin. Proc., 91: 101-119.

15. Rajkumar, S.V., M.A. Dimopoulos, A. Palumbo, J. Blade, G. Merlini and M.V. Mateos *et al*., 2014. International myeloma working group updated criteria for the diagnosis of multiple myeloma. Lancetoncol, 15: e538-e548.
16. Muchtar, E., F.K. Buadi, A. Dispenzieri, M.A. Gertz, S.K. Kumar, 2017. Immunoglobulin light-chain amyloidosis: From basics to new developments in diagnosis, prognosis and therapy. Acta Haematol., 138: 208-222.
17. Chari, A., A. Suvannasankha and O.M. Fayyaz, 2019. Multiple myeloma: Clinical updates from the American Society of Hematology annual meeting, Clin. Adv. Hematol. Oncol., 17: 653-658.
18. Dispenzieri, A., 2018. POEM Ssyndrome: 2018 update on diagnosis, risk-stratification and management. Am. J. Hematol., 93: 814-827.
19. Merlini, G., A. Dispenzieri, 2018. Systemiclight-chainamyloidosis: Emerging concepts and treatments. Hematology, 2018: 129-138.