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Case Report

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# Sensorineural Hearing Loss as a First Presentation of Multiple Myeloma: A Successful Management with Therapeutic Plasma Exchange

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**Running Title** Sensorineural Hearing Loss Due to Hyperviscosity Syndrome



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## ABSTRACT

Sudden sensorineural hearing loss (SSNHL) as the initial manifestation of multiple myeloma (MM) is rare. We present a 45-year-old woman with hyperviscosity syndrome (serum viscosity of 10.2 cP) from MM who presented with hearing disturbance that responded dramatically to plasma exchange with saline and intratympanic steroid treatment. Serum protein electrophoresis confirmed the presence of a monoclonal band, and bone marrow biopsy showed a hypercellular marrow with 90% plasma cells, which demonstrated lambda monoclonal restriction.

## Introduction

Serum hyperviscosity syndrome, primarily due to monoclonal hypergammaglobulinemia, occurs in 2-6% of patients with multiple myeloma and up to 30% of those with Waldenström's macroglobulinemia. Symptoms of hyperviscosity usually manifest when viscosity exceeds 4 centipoise (cP) [1]. Here, we present a case of a young woman who presented with sudden sensorineural hearing loss (SSNHL) as the first presenting sign of hyperviscosity syndrome due to multiple myeloma.

## Case presentation

A 45-year-old woman presented to the emergency department of Imam Khomeini Hospital Complex with

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acute left-sided hearing loss, which had started three days prior, and recent headaches. Six months earlier, she had chicken pox and recovered well after receiving supportive care. However, after that, she experienced mild, nonspecific, generalized musculoskeletal pain, particularly in her lower back, which was not substantially affected by movement or rest. During this period, she experienced approximately 8 kg of unintentional weight loss. Recently, she reported tension headaches during the past few months and postnasal drip during the preceding week, which was complicated by acute unilateral hearing loss, tinnitus, mild vertigo, and profound weakness.

Her medical history included subclinical hypothyroidism, for which she did not take any medication. She also had a history of gestational diabetes (GDM) approximately 10 years prior but had not sought any follow-up care. Additionally, she underwent a right-sided unilateral oophorectomy due to severe complicated ovarian hyperstimulation syndrome (OHSS) roughly 11 years prior.

Upon examination, her vital signs were normal, and she appeared non-ill and non-toxic, although her conjunctiva was pale. The otoscopy examination of both ears appeared normal, except for a tiny waxy impaction in the left ear. Tuning fork tests showed that Weber lateralized to the right side. Examinations of other cranial and peripheral nerves were normal. Heart, lung, and abdominal examinations were all normal, with no evidence of masses or organomegaly.

**Table 1.** Laboratory data

| Variable | | Normal range | value |
|---|---|---|---|
| Sodium (meq/l) | | 135-145 | 128 |
| Potassium (meq/l) | | 3.5-5 | 3.8 |
| Magnesium (mg/dl) | | 1.8-2.5 | 1.6 |
| Calcium (mg/dl) | | 8.5-10.5 | 8.5 |
| Phosphorus (mg/dl) | | 2.5-5 | 7.5 |
| Uric acid (mg/dl) | | 2.3-6.6 | 5.5 |
| Urea(mg/dl) | | 21-52 | 30 |
| Creatinine (mg/dl) | | 0.8-1.3 | 1.4 |
| Fasting blood sugar (mg/dl) | | 70-99 | 334 |
| HbA1C | | <5.6 | 9.6 |
| Aspartate aminotransferase (U/l) | | 10-45 | 20 |
| Alanine aminotransferase (U/l) | | 10-45 | 18 |
| Alkaline phosphatase (U/l) | | 50-250 | 128 |
| Bilirubin (total, direct) mg/dl | | <1.2, <0.3 | 0.6, 0.3 |
| Lactate dehydrogenase (U/l) | | <480 | 250 |
| Iron | | 50-170 | 86 |
| TIBC (µg/dl) | | 250-450 | 296 |
| Ferritin (ng/ml) | | <73 | 83 |
| Total protein (gr/dl) | | 6-7.8 | 14.5 |
| Albumin (gr/dl) | | | 2.4 |
| ESR (mm/hr) | | | 94 |
| CRP (mg/L) | | <6 | 110 |
| 25 (OH) vitamin D (ng/ml) | | Suff:30-100 | 8.4 |
| iPTH (pg/ml) | | 15-68 | 12.4 |
| TSH (mcIU/ml) | | 0.5-5 | 8.7 |
| T4 (mcg/dl) | | 5-12.5 | 7.2 |
| T3 (ng/dl) | | 80-200 | 92.4 |
| White blood cell count (/µl) | | 4-10 ×$10^3$ | 6.1 |
| Lymphocyte percent (%) | | 20-40 | 27 |
| Neutrophil percent (%) | | 40-70 | 68 |
| Hemoglobin (gr/dl) | | 13-17 | 5.7 |
| Mean corpuscular volume (fl) | | 81-99 | 92 |
| Platelet count (/µl) | | 150-400 ×$10^3$ | 261 |
| reticulocyte count (%) | | | 2.3 |
| Prothrombin time (sec) | | 11-15 | 23 |
| International normalized ratio | | 0.9-1.2 | 1.8 |
| partial thromboplastin time (sec) | | 25-40 | 35 |
| Fibrinogen (mg/dl) | | 200-400 | 450 |
| Blood gas | PH | 7.36-7.44 | 7.46 |
| | Pco2 (mmhg) | 35-45 | 33.3 |
| | HCO3 (mmhg) | 22-26 | 23 |
| Urinalysis | | Protein: ++ Glucose: + | |

Other examinations were n ormal, a nd there was no bone tenderness.

Initial laboratory tests revealed normocytic anemia, elevated inflammatory markers, elevated creatinine levels, hyponatremia, and hyperglycemia. There was a marked discrepancy between albumin and total protein levels. Other laboratory results are shown in (Table 1). The laboratory technician noted an abnormally rapid clotting of blood sample. Peripheral blood smear showed marked rouleaux formation. One unit packed red cell transfused to reach hemoglobin level to 7 gr/dl.

Paranasal sinus CT scan revealed mucosal hypertrophy in the maxillary sinuses, with a few air bubbles compatible with sinusitis, so antibiotic treatment was initiated.

Audiometry confirmed the clinical findings and indicated left-sided severe to profound sensorineural hearing loss and mild hearing loss on the right side. Following a diagnosis of sudden SNHL (SSNHL), intratympanic dexamethasone was administered every other day for five sessions in the left ear. Oral or intravenous corticosteroids were not prescribed to the patient due to high blood sugar levels. Magnetic resonance imaging (MRI) of the brain and temporal bone was obtained for the patient, and the results were normal.

Abdominal sonography showed a 131 mm spleen and a 150 mm liver without any lymphadenopathy. Computed tomography revealed widespread lytic bone lesions in the iliac, femur, vertebral bodies, and sternum. Additionally, a 67x35 mm destructive lytic lesion was found in the sacrum (Figure 1).

Serum viscosity was reported at 10.2 cP. Plasma exchange with normal saline was initiated, and after three sessions, serum viscosity dropped to 1.78 cP. During this treatment, her hearing status improved (Figure 2), and her headaches resolved. Serum cryoglobulin was not detected, and viral markers were negative. Insulin therapy was initiated to manage the patient's high blood sugar levels.

Serum protein electrophoresis showed an M-protein spike (9.45 g/dL). Bone marrow aspiration indicated a hypercellular marrow with a significantly elevated proportion of plasma cells, comprising about 90% of the total marrow cells and displacing normal hematopoietic elements. The plasma cells displayed abnormal characteristics, such as eccentric nuclei, prominent nucleoli, and a heightened nuclear-to-cytoplasmic ratio, with some cells appearing binucleate or multinucleated. There was a noticeable reduction in the number of megakaryocytes.

The bone marrow biopsy showed extensive infiltration by sheets of abnormal plasma cells, which replaced the normal hematopoietic components. Immunohistochemistry (IHC) for CD138 (Syndecan-1) demonstrated strong and diffuse membranous

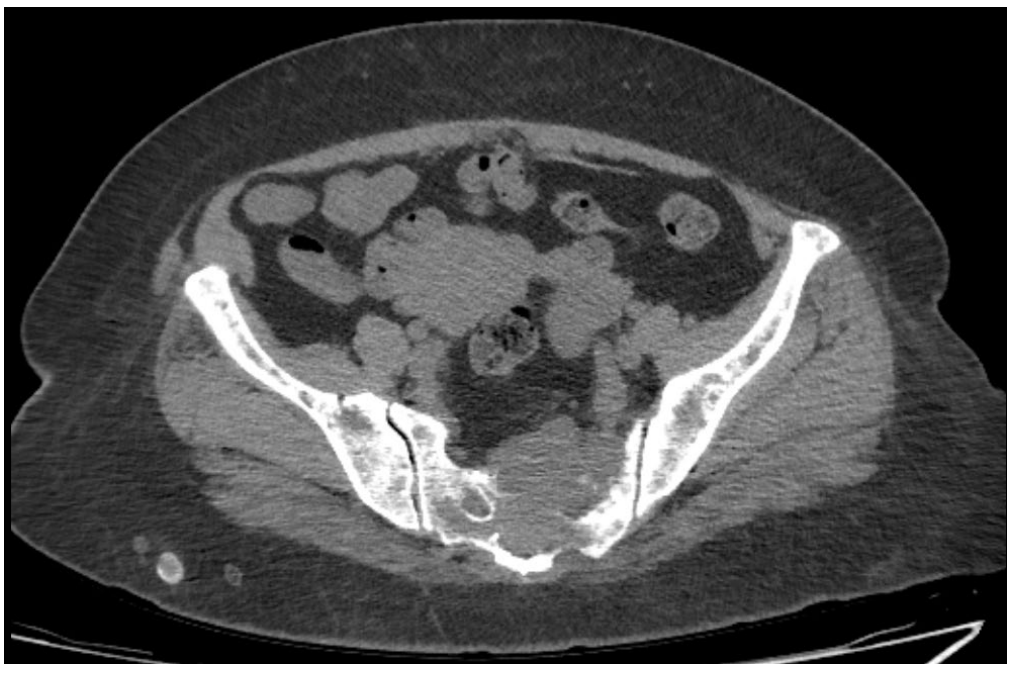


**Fig. 1.** Computed tomography showed a destructive lytic lesion in the sacral bone with extraosseous soft tissue extension.

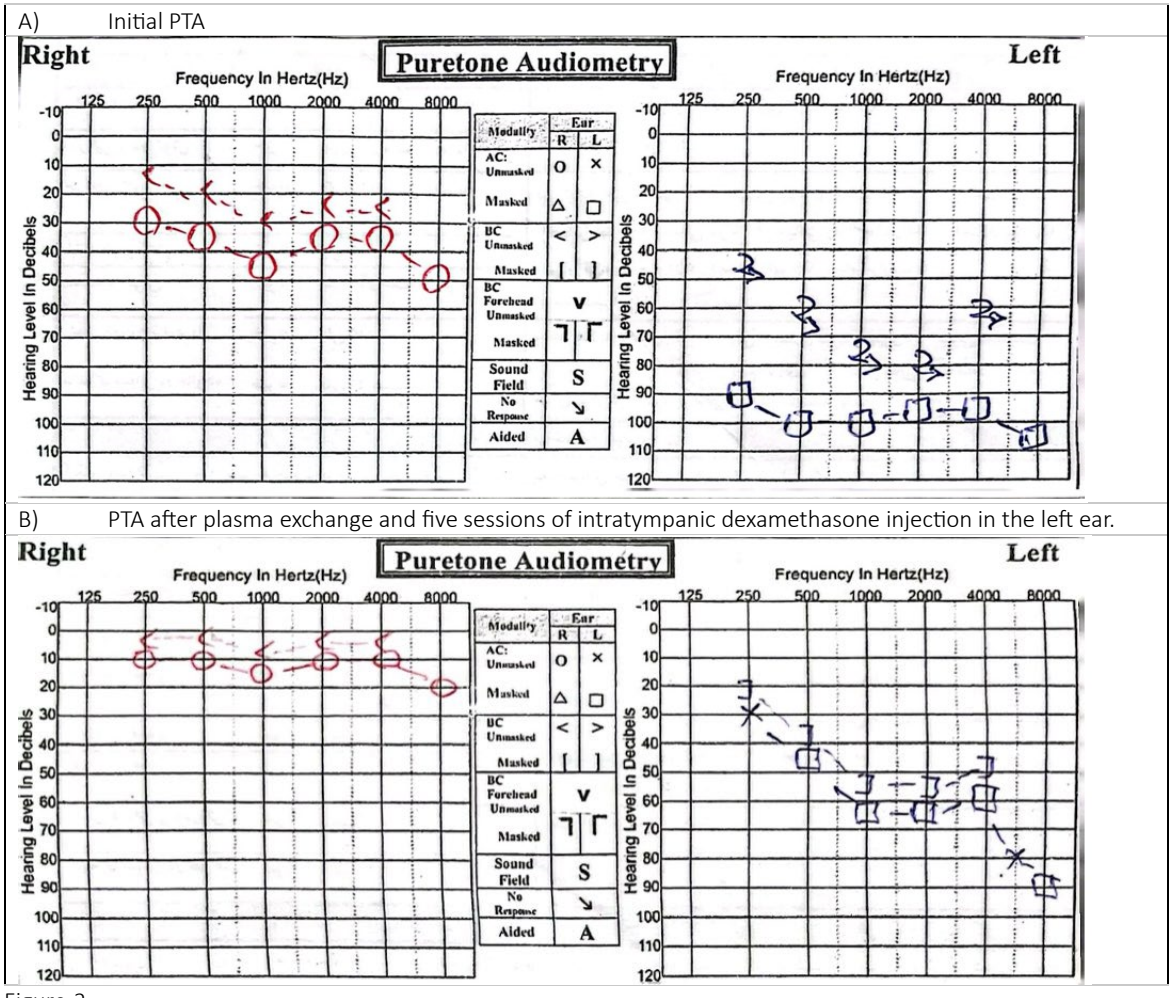



**Fig. 2.** Pure tone audiometry (PTA). (A) The audiogram reveals severe to profound sensorineural hearing loss in the left ear an d mild hearing loss in the right ear(B) its improvement following treatment.

staining in the abnormal plasma cells, confirming their plasma cell origin. Furthermore, negative staining for CD20 excluded the possibility of B-cell lymphoproliferative disorders. Light chain restriction was noted, with a predominant expression of lambda light chains (Figure 3A-F). The sacral mass core needle biopsy also revealed plasma cell infiltration. The patient was prescribed a standard chemotherapy regimen

## Discussion

Multiple myeloma (MM) is a hematologic malignancy involving plasma cells, accounting for nearly 10% of all hematologic malignancies. The diagnosis of MM necessitates either clonal bone marrow plasma cells of ≥10% or a biopsy-confirmed plasmacytoma in bony or soft tissue, along with organ impairment indicated by CRAB (hypercalcemia, renal insufficiency, anemia, bone lesions) or a biomarker associated with likely progression to end-organ damage indicated by SLiM (sixty, light chain ratio, MRI) [2]. The occurrence of SSNHL as the first manifestation of hematologic disease is extremely rare and could be caused by hyperviscosity and ensuing cochlear ischemia. Although the response to plasma exchange therapy has been reported to be rare [3, 4], our case demonstrated an acceptable response in the affected ear and also improvement of hearing level in the contralateral side.

Hyperviscosity is a rare complication of hyperproteinemia due to multiple myeloma. Serum hyperviscosity can be caused by hypergammaglobulinemia (particularly in Waldenström's macroglobulinemia and multiple myeloma) or hyperfibrinogenemia. Severe polycythemia, hyperleukocytosis, or profound thrombocytosis may lead to whole blood hyperviscosity. Hyperviscosity typically presents with neurologic symptoms, visual or auditory disturbances, or bleeding diathesis. Treatment

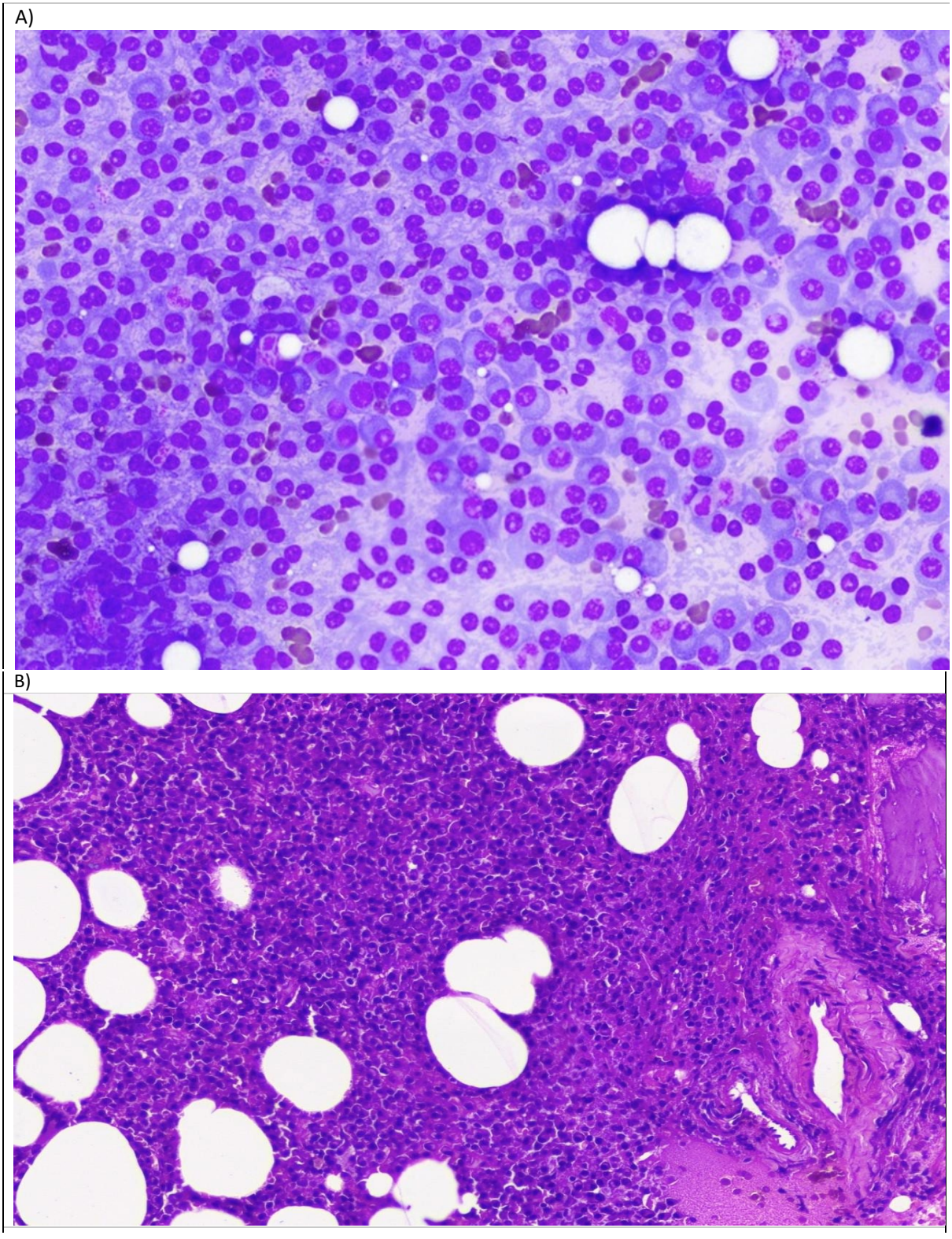
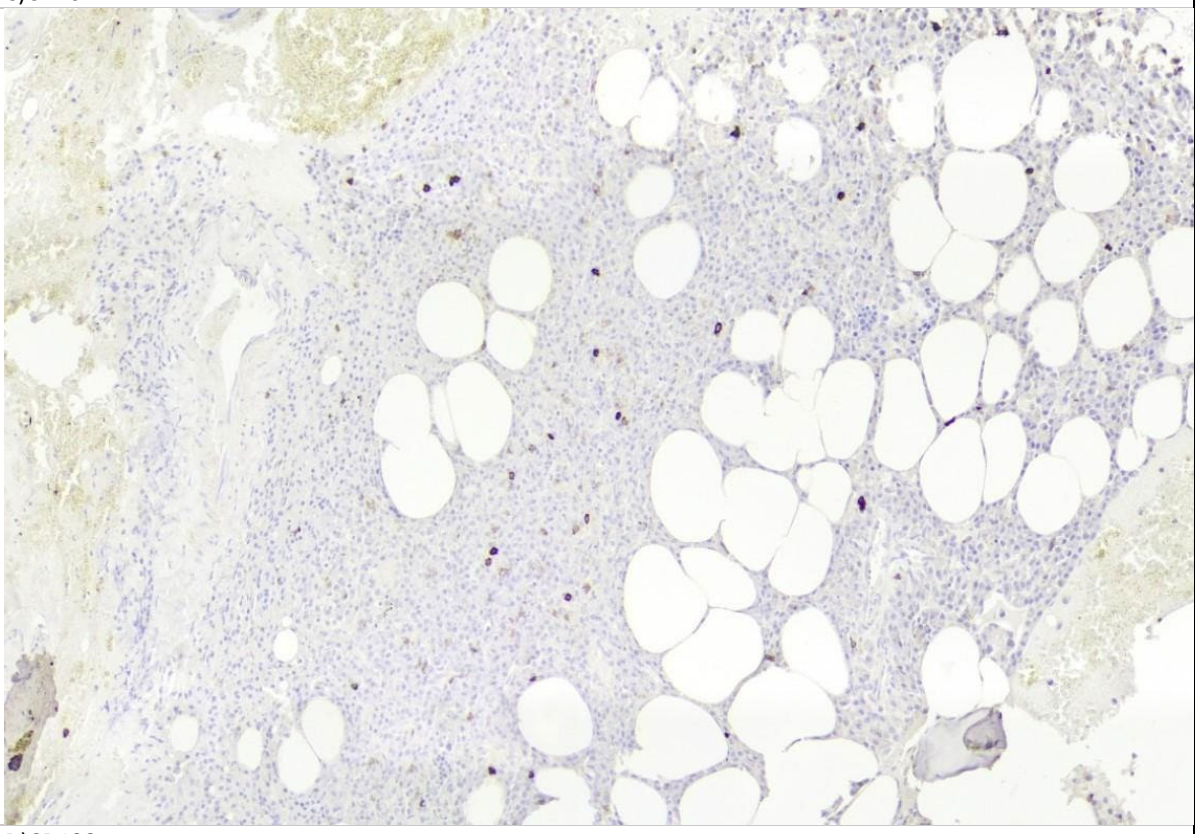
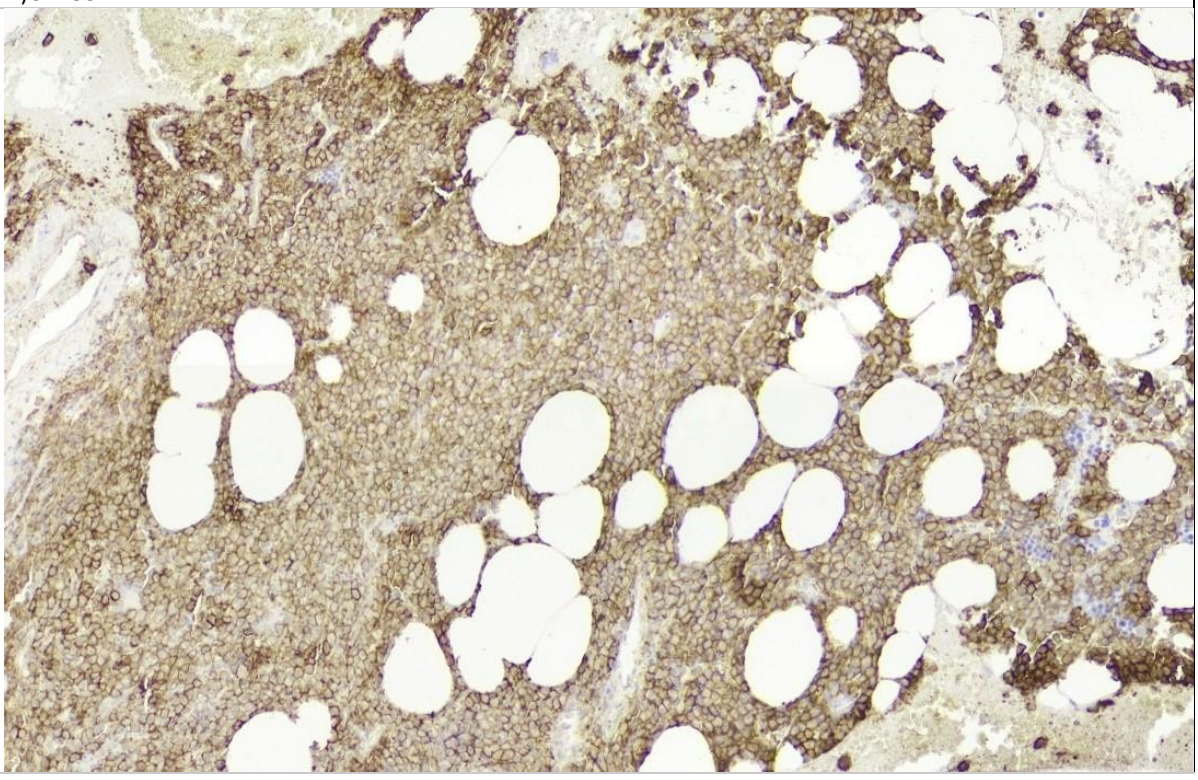



**Fig. 3.** Morphology and immunohistochemistry (IHC) findings in bone marrow aspiration and biopsy: (A) Bone marrow aspirate smear (Wright-Giemsa stain, 100x): Hypercellular marrow with increased plasma cells. (B) Bone marrow biopsy (H&E stain, 100x): Diffuse sheets of plasma cells infiltrating marrow spaces. (C) Immunohistochemistry (CD20, 40x): Rare scattered B lymphocytes. (D) Immunohistochemistry (CD138, 40x): Diffuse and strong membranous staining of plasma cells. (E-F) Immunohistochemistry (kappa/lambda, 40x): Light chain restriction observed, with a predominance of lambda.

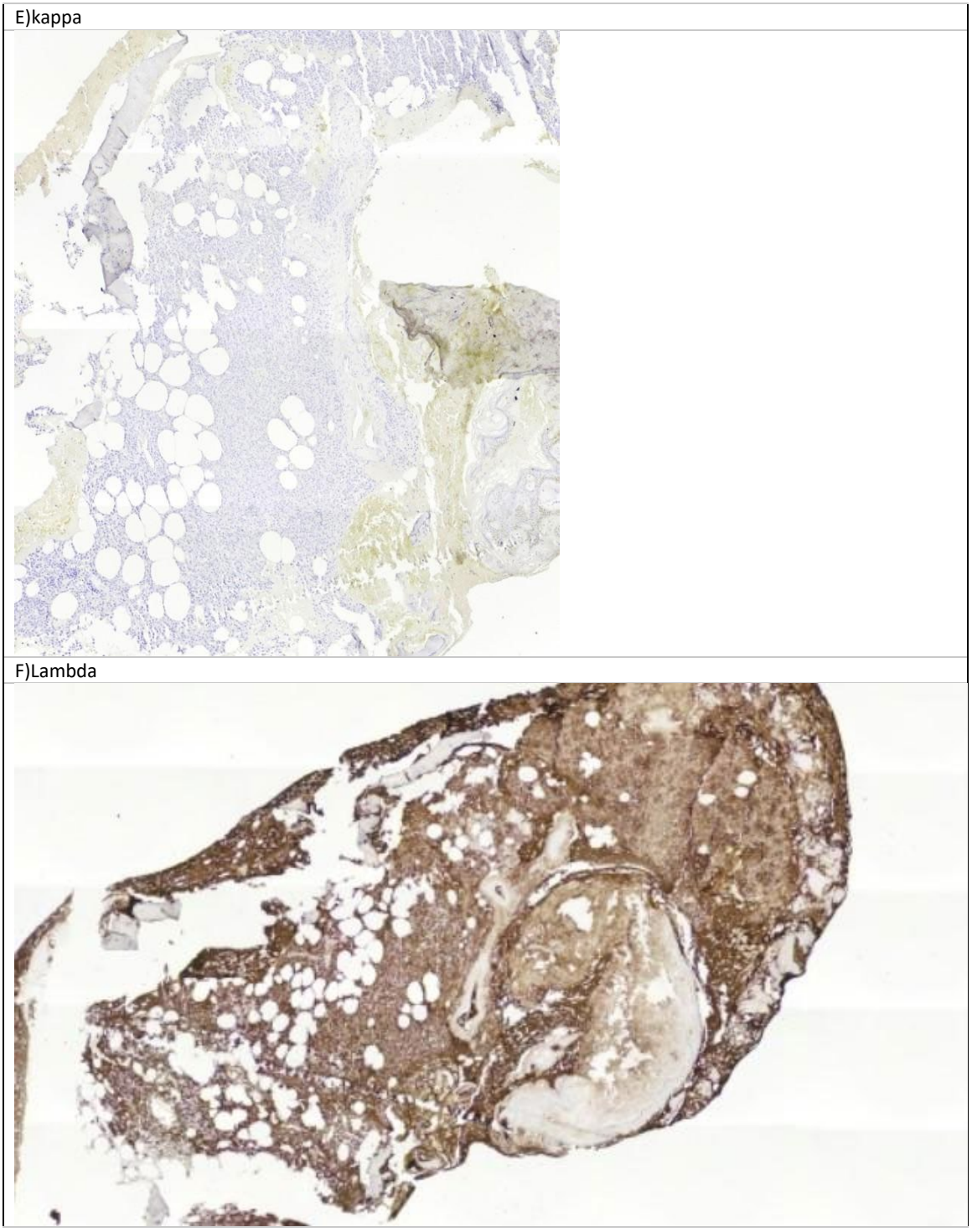
C)CD20



D)CD138



**Continued Fig. 3.** Morphology and immunohistochemistry (IHC) findings in bone marrow aspiration and biopsy: (A) Bone marrow Aaspirate smear (Wright-Giemsa stain, 100x): Hypercellular marrow with increased plasma cells. (B) Bone marrow biopsy (H&E stain, 100x): Diffuse sheets of plasma cells infiltrating marrow spaces. (C) Immunohistochemistry (CD20, 40x): Rare scattered B lympho- cytes. (D) Immunohistochemistry (CD138, 40x): Diffuse and strong membranous staining of plasma cells. (E-F) Immunohistochemistry (kappa/lambda, 40x): Light chain restriction observed, with a predominance of lambda.

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consists of addressing the underlying etiology and performing plasma exchange in symptomatic cases. In a compatible clinical setting, a high index of suspicion is sufficient to initiate plasma exchange and therapy should not be delayed while awaiting serum viscosity results, as prompt treatment is essential [5]. We used normal saline for plasma exchange, and based on the diagnosis of MM, the first chemotherapy session was administered a few days later.

Another noteworthy aspect of this case is the impact of the underlying disease on laboratory tests, including electrolytes, coagulation parameters, and anemia. For instance, hyperviscosity can lead to plasma volume expansion, potentially causing pseudoanemia due to a dilutional effect [5]. Paraproteins can spuriously prolong thrombin time [6], and marked hypergammaglobulinemia may result in pseudohyponatremia and pseudohyperphosphatemia [7]. Additionally, hyperglycemia can also contribute to pseudohyponatremia [8], adding another layer of complexity in interpreting laboratory results in patients with multiple underlying conditions.

Abnormal coagulation tests, such as increased PT and/or PTT, are common in patients with plasma cell dyscrasias, but they are usually asymptomatic and do not correlate with significant bleeding. These observations can be explained by various mechanisms, such as factor deficiency caused by the inhibitory effects of paraproteins on coagulation factors, particularly factor X or von Willebrand factors. Some paraproteins may also exhibit heparin-like activity [9-11].

## Conclusion

We present a case of multiple myeloma with hyperviscosity syndrome-induced SSNHL that responded favorably to plasma exchange therapy. This case highlights the importance of considering hyperviscosity as a potential cause of sudden sensorineural hearing loss and the efficacy of plasma exchange therapy in managing this rare complication.

## Ethical Considerations

### Compliance with ethical guidelines

There were no ethical considerations to be considered in this article.

### Funding

No funding was received to assist with the preparation of this manuscript.

### Conflict of Interests

The authors have no conflict of interest to declare.

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