Myelin Oligodendrocyte Glycoprotein Antibody-Associated Disease Presenting as Intracranial Hypertension

A Case Report

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Abstract

The production of autoantibodies against myelin oligodendrocyte glycoprotein (MOG) can cause a spectrum of autoimmune disorders, including optic neuritis, transverse myelitis, brainstem encephalitis, and acute disseminated encephalomyelitis. In this study, we present the case of a 19-year-old woman with an unusual clinical presentation of intracranial hypertension (IH) and bilateral papilledema. The patient presented with symptoms of increased intracranial pressure, which followed a relapsing, remitting course over several months. Serial CSF studies showed an increased opening pressure during clinical relapses. The CSF and serum tested positive for MOG immunoglobulin G antibodies. Contrast-enhanced MRI of the brain showed mild meningeal enhancement in the left parietal region with subtle underlying cortical hyperintensities, indicating possible fluid-attenuated inversion recovery variable unilateral enhancement of the leptomeninges. The patient responded well to immunosuppressive therapy using rituximab. The presentation of MOG antibody-associated disease (MOGAD) as IH without optic neuritis is rare. This report presents the first description of a relapsing remitting course presenting each time with only symptoms of raised intracranial pressure, without developing any typical clinical manifestations of MOGAD.
Myelin oligodendrocyte glycoprotein (MOG) is a glycoprotein found in the myelin sheaths of neurons in the CNS. MOG is an important target for a spectrum of autoimmune disorders, particularly optic neuritis and transverse myelitis. In this study, we report an unusual manifestation of MOG antibody-associated disease (MOGAD) in a young woman who presented with isolated intracranial hypertension (IH).

**Case History**

A 19-year-old woman developed a severe headache with acute-onset and occasional transient visual obscurations persisting for 1 week. She was evaluated at a local hospital and found to have bilateral papilledema on fundoscopy. The patient had no other neurologic symptoms. MRI of the brain with contrast venogram showed normal results. The results of CSF analysis were normal, but the opening pressure was elevated to 25 cm H₂O (normal range: 6–20 cm H₂O). The patient was subsequently diagnosed with IH. The patient responded to oral acetazolamide at 750 mg daily for 1 month. After 3 months, the symptoms recurred, with acute-onset severe headache, vomiting, and intermittent blurring of vision, which was greater in the left eye than in the right. The patient was then referred to a tertiary specialist. A detailed history was obtained, and she did not have fever, seizures, or altered sensorium. Fundoscopy revealed persistent bilateral disc edema. Focal neurologic deficits were not observed.

The visual field test results and acuity were normal. Visual evoked potentials (VEPs) were normal. Another brain MRI revealed mild meningeal enhancement in the left parietal region on contrast sequences. Minimal hyperintensity without any diffusion restriction or white matter lesions was further observed in the underlying cortex on fluid-attenuated inversion recovery (FLAIR). Figure 1A shows a postcontrast T1-weighted axial image indicating abnormal unilateral leptomeningeal enhancement along the left temporoparietal cortical sulci, and Figure 1B shows the minimal hyperintensity of the adjoining cortex on an axial FLAIR image. A repeat CSF tap showed lymphocytic pleocytosis (20 cells) and normal glucose and protein levels. The opening pressure was 35 cm H₂O.

Owing to the presence of minimal cortical FLAIR hyperintensity and leptomeningeal enhancement in the brain MRI associated with CSF pleocytosis, further evaluation was performed. Serum and CSF MOG immunoglobulin (Ig) G antibodies were tested with a cell-based immunoassay using transfected cell lines for qualitative or semiquantitative in vitro determination of human IgG antibodies to the aquaporin-4 receptor and anti-MOG positive in serum and CSF (1:10 dilutions). Other workup results for vasculitis and infective and autoimmune encephalitis were negative (including antinuclear antibodies, antineutrophil cytoplasmic antibodies, anticytotoxic granule antibodies, and antibodies to aquaporin-4).

The patient’s serum angiotensin-converting enzyme level was normal at 26 nmol/mL/min (normal value, ≤40 nmol/mL/min). PET imaging of the entire body, including the brain, revealed normal results. The patient was diagnosed with MOGAD. Her headache subsided, and the papilledema was partially resolved with IV methylprednisolone at 1 g/d for 3 days, followed by oral steroids. However, after initial improvement, her symptoms reappeared while steroids were being tapered.

Mycophenolate mofetil (MMF) was added to the treatment, but despite this, she experienced 4 relapses in 6 months. All relapses presented with headache and signs of increased intracranial pressure (ICP) with papilledema when steroids were tapered, except at the fourth follow-up. Each episode improved after a CSF tap. The serial CSF reports are presented in Table.

In view of the relapses with headache despite treatment with MMF and steroids, IV rituximab was initiated, with positive results. Her symptoms, such as headache and papilledema, subsided, and steroids and MMF were tapered. Papilledema resolved over a period of 2 months. The patient remained asymptomatic even after 1 year (Figure 2).

**Discussion**

Antibodies against MOGs (MOG-IgG) cause a wide spectrum of inflammatory demyelinating CNS conditions. Optic neuritis (45.8%), transverse myelitis (22.8%), and brainstem encephalitis (17.1%) are more common presentations in adults, whereas acute disseminated encephalomyelitis is common in children. A few patients with unusual presentations have been reported to have MOG-IgG positivity, including encephalitis, leukodystrophy, posterior reversible encephalopathy syndrome, multiple sclerosis, meningoencephalitis, and aseptic meningitis.

In this study, we report a case of a MOG-IgG-positive patient who presented with IH. Although a few such patients with
IH have been reported, they ultimately developed other presentations of MOGAD, which aided in the diagnosis.4–6 The patient had several relapses of IH but did not develop any of the typical clinical features, which is unusual for MOGAD. Our patient had elevated ICP and bilateral papilledema. Although bilateral optic neuritis affecting the anterior optic nerve may be confused with papilledema,8 visual complaints and investigations, including VEP, were not consistent with optic neuritis and favored papilledema because of raised ICP. The CSF opening pressure was elevated in multiple taps, and clinical symptoms resolved after CSF drainage. A few cases have been reported with increased CSF pressure in MOGAD, but this is usually accompanied by acute disseminated encephalomyelitis or meningoencephalitis.5–7

Lymphocytic pleocytosis was identified in a few subsequent CSF studies, which is consistent with the findings of other studies (50%–66%).9 To the best of our knowledge, raised ICP without other features as a presentation of MOGAD has not been reported. A possible mechanism in our patient could involve low-grade meningeal inflammation producing excessive CSF.

Neuroimaging revealed meningeal enhancement with minimal hyperintensity in the underlying cortex. Most MRI studies on patients with MOGAD have shown meningeal bystander inflammation overlying a cord lesion or accompanying brain lesions.10 The MRI results of this patient likely indicate FLAIR-variable unilateral enhancement of the leptomeninges, which is a rare, newly recognized finding in MOGAD.11

A small study performed on 34 diagnosed patients with IH to determine the presence of MOG-IgG antibodies did not identify a single patient who was positive for the antibody.12 Conversely, our patient consistently had positive results for MOG-IgG antibody in CSF and serum, even with subsequent relapses. Strongly positive test results and the presence of neutrophils in CSF coincided with the onset of a new relapse. The patient also had an ill-sustained response to steroids and MMF, as has been noted in the literature.13 Her response to rituximab was good, as evidenced by clinical improvement, resolved papilledema, and negative CSF MOG results.

In conclusion, our results widen the spectrum of MOGAD. Along with common presentations such as optic neuritis and transverse myelitis, our case broadens the clinical spectrum to include unusual presentations such as idiopathic IH, especially in cases of relapse, and without a response to usual therapy. A high degree of suspicion of MOGAD as a cause of isolated IH can help provide specific treatment and improve outcomes.

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### Table Results of Serial CSF and Laboratory Studies

| Date             | May 11, 2019 | August 2, 2019 | October 17, 2019 | November 6, 2019 | January 13, 2020 |
|------------------|--------------|---------------|------------------|------------------|-----------------|
| **CSF cell count** | 2            | 20            | 80               | 2                | 3               |
| **CSF differential count** | 100% lymphocyte | 100% lymphocyte | 90% lymphocyte, 10% polymorph | 100% lymphocyte | 100% lymphocyte |
| **CSF protein, mg/dL** | 20           | 29            | 83               | 31               | 20              |
| **CSF glucose, mg/dL** | 80           | 61            | 48               | 55               | 54              |
| **CSF opening pressure** | 25 cm of H2O | 35 cm of H2O  | 35 cm of H2O     | 23 cm of H2O     | 38 cm of H2O    |
| **CSF MOG antibodies** | Negative     | Negative      | Positive         | Negative         | Negative        |
| **Oligoclonal bands** | Negative     | Negative      | —                | —                | —               |
| **Gene X TB**     | Negative     | Negative      | —                | —                | —               |
| **CSF culture**   | Negative     | Negative      | —                | —                | —               |
| **Papilledema**   | Positive     | Positive      | Positive         | Negative         | Negative        |
| **Serum NMO antibodies** | Negative | Negative | — | — | — |
| **Serum MOG antibodies** | — | Positive | Strongly positive | Positive | Positive |
| **OCT**           | Normal retina | — | — | — | — |
| **MRI brain (plain and contrast)** | Normal | Mild leptomeningeal enhancement | — | Normal | — |

**Abbreviations:** MOG = myelin oligodendrocyte glycoprotein; NMO = neuromyelitis optica; OCT = optical coherence tomography; TB = tuberculosis.
Figure 2 Flowchart of the Clinical Course of Patient Treatment

May 2019

19-year-old female patient presents with acute severe headache, papilledema.

Brain MRI with normal contrast venogram, normal CSF, and pressure of 25 cm of water.

Good response to acetazolamide 750 mg daily for one month.

August 2019 (Relapse 1)

Headache, papilledema. Normal visual acuity and VEP, contrast MRI of the brain-mild meningeal enhancement in left parietal region, CSF pressure of 35 cm of water. 20 cells lymphocytes MOG-positive.

Good response to acetazolamide, IV methylprednisolone 1 g for 3 days, and oral steroids at 60 mg daily.

October 2019 (Relapse 2)

Occurrence of headaches when steroids were tapered. Papilledema present, CSF pressure 35 cm of water. 80 cells MOG-positive. Responded to steroids 60 mg, MMF 2 g.

November 2019 (Relapse 3)

Recurrence of headache when steroids were minimally tapered, papilledema absent. MRI brain-normal. CSF pressure of 23 cm of water, which was lower than the previous CSF study, 2 cells MOG-negative. Responded to steroids (60 mg), 1st-cycle rituximab (1 g), and MMF (2 g).

January 2020 (Relapse 4)

Headache worsened over 1 week when steroids were tapered. No papilledema, CSF pressure 38 cm of water, which is higher than the previous follow-up visit, 3 cells MOG-negative, 2nd-cycle rituximab and MMF received, symptoms resolved.

March 2020 (Follow-up)

Mild intermittent headache. Papilledema resolved. MMF-tapered, 3rd-cycle rituximab received (1 g) every 15 days.

Follow-up 1 year (February 2021)

The patient reported minor headache and no papilledema and received MMF (1 g) daily.

MMF = mycophenolate mofetil; MOG = myelin oligodendrocyte glycoprotein.

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| Name                      | Location                   | Contribution                                                                 |
|---------------------------|----------------------------|------------------------------------------------------------------------------|
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| Jui Jade Bagul, MD, DM    | Bombay Hospital Institute of Medical Science, India | Drafting/revision of the manuscript for content, including medical writing for content; major role in the acquisition of data; study concept or design; analysis or interpretation of data |
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