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Detection of Aquaporin 4 Antibody and Myelin Oligodendrocyte Glycoprotein Antibody in Clinically Suspected Neuromyelitis Optica Spectrum Disorders Patients in a Tertiary Eye Hospital

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Abstract **Original Research Article**

Background: Neuromyelitis optica spectrum disorders (NMOSD) and myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) are distinct autoimmune demyelinating conditions that affect the optic nerves and spinal cord. Regional data from Bangladesh are limited. This study aimed to detect AQP4 and MOG antibodies in patients with clinically suspected NMOSD and compare the demographic, clinical, and neuroimaging features between seropositive groups. ***Methods:*** This prospective observational study was conducted at the Neuro-ophthalmology Department of Ispahani Islamia Eye Institute and Hospital, Dhaka, from January 2020 to March 2022. Patients with atypical optic neuritis underwent clinical evaluation, visual acuity assessment, and antibody testing using an immunofluorescence assay. Neuroimaging was performed in selected patients. The data were summarized descriptively. ***Results:*** Of the 184 patients, 64 (34.8%) were MOG-positive, 16 (8.7%) were AQP4-positive, and 2 (1.1%) were double seropositive. Female predominance was observed in both groups (65.6% MOG+, 81.2% AQP4+). The median age at onset was 25 years (MOG+) and 28 years (AQP4+). Severe visual loss (<6/60) was the most common presentation in the affected eyes (74.3% MOG+, 76.9% AQP4+). Bilateral papillitis predominated in MOG+ cases, whereas AQP4+ cases showed equal unilateral and bilateral papillitis. MRI revealed spinal cord lesions in 12.5% of AQP4+ cases, but none in MOG+ cases. ***Conclusion:*** MOGAD was more frequent than AQP4-positive NMOSD in this Bangladeshi cohort, with both groups presenting severe visual impairment. Routine antibody testing is recommended for atypical optic neuritis to enable accurate diagnosis and appropriate treatment.

Keywords: NMOSD, MOGAD, Aquaporin-4 antibody.

INTRODUCTION

Neuromyelitis optica spectrum disorders (NMOSD) are a group of inflammatory demyelinating disorders of the central nervous system (CNS) characterized predominantly by optic neuritis and myelitis [1,2]. Historically considered a subtype of multiple sclerosis (MS), NMOSD is now recognized as a distinct entity with unique immunopathogenic mechanisms, clinical features, neuroimaging patterns, and treatment responses [3,4]. The identification of serum antibodies against aquaporin-4 (AQP4-IgG) has been pivotal in redefining NMOSD, establishing its nature as an autoimmune astrocytopathy [5].

In recent years, myelin oligodendrocyte glycoprotein antibodies (MOG-IgG) have been identified in patients presenting with NMOSD-like syndromes but who are AQP4-IgG negative [4,6]. MOG antibody-associated disease (MOGAD) is now considered a separate clinical and pathological entity, primarily representing an oligodendropathy [5,6]. Both AQP4-IgG-positive NMOSD and MOGAD can present with recurrent optic neuritis, longitudinally extensive

transverse myelitis, or brainstem syndromes, but their demographic patterns, clinical presentations, MRI features, and prognosis differ [6,7].

Epidemiological studies have demonstrated a female predominance in AQP4-IgG-positive NMOSD, often affecting adults in their 30s–40s, whereas MOGAD tends to have a younger onset and a more balanced sex distribution [8]. The severity and recovery patterns of optic neuritis also differ between the two disorders, with MOGAD generally showing better visual recovery but higher recurrence rates [9,10]. MRI findings can help differentiate the two: AQP4-IgG-positive cases often have spinal cord lesions extending over three or more vertebral segments, whereas MOGAD more frequently shows optic nerve swelling and anterior segment involvement.

The epidemiology of NMOSD and MOGAD varies across geographic and ethnic populations [7,11]. Studies from Western countries report a higher prevalence of AQP4-IgG positivity, whereas some Asian cohorts, including pediatric populations, report higher MOG-IgG positivity [11,12]. Data from South Asia, and particularly Bangladesh, remain sparse. Understanding the antibody distribution and associated clinical patterns in this region is essential for improving diagnostic accuracy and guiding management strategies.

The present study aimed to detect AQP4 and MOG antibodies in patients with clinically suspected NMOSD presenting to a tertiary eye hospital in Bangladesh, and to compare demographic features, clinical phenotypes, visual outcomes, and neuroimaging findings between the two seropositive groups. This work provides important regional epidemiological and clinical data that may inform future diagnostic and treatment algorithms.

Methodology & Materials

This prospective observational study was conducted in the Neuro-ophthalmology Department of Ispahani Islamia Eye Institute and Hospital, Dhaka, Bangladesh, over a 26-month period from January 2020 to March 2022. A total of 184 patients meeting the inclusion and exclusion criteria were enrolled. The study population comprised patients presenting with unilateral or bilateral optic neuritis of various clinical phenotypes. Among these, patients testing positive for myelin oligodendrocyte glycoprotein (MOG) antibodies or aquaporin-4 (AQP4) antibodies were analyzed.

Inclusion Criteria

- Recurrent unilateral retrobulbar optic neuritis (RBN).
- Recurrent unilateral papillitis.
- Bilateral retrobulbar optic neuritis.
- Bilateral papillitis.
- Unilateral RBN or papillitis unresponsive to intravenous methylprednisolone.

Exclusion Criteria

- Optic neuritis secondary to infectious or para-infectious diseases.
- Clinically suspected multiple sclerosis (MS).
- Confirmed MS cases.

Data Collection and Study Procedure:

Ethical approval was obtained from the Institutional Review Board. Written informed consent was obtained from all participants or their guardians. Clinical evaluation included detailed history, visual acuity testing with the Snellen chart, and fundus examination. Serological testing for MOG and AQP4 antibodies was performed using an immunofluorescence assay. MRI brain and/or spine was conducted in selected cases. Data were recorded in a predesigned form.

Results

A total of 184 patients with clinically suspected NMOSD were included. Of these, 64 (34.8%) were MOG antibody-positive, 16 (8.7%) were AQP4 antibody-positive, and 2 (1.1%) were double seropositive. Female predominance was noted in both groups, with 65.6% of MOG-positive and 81.2% of AQP4-positive patients being female. The youngest MOG-positive patient was 3 years old, and the youngest AQP4-positive patient was 16 years old.

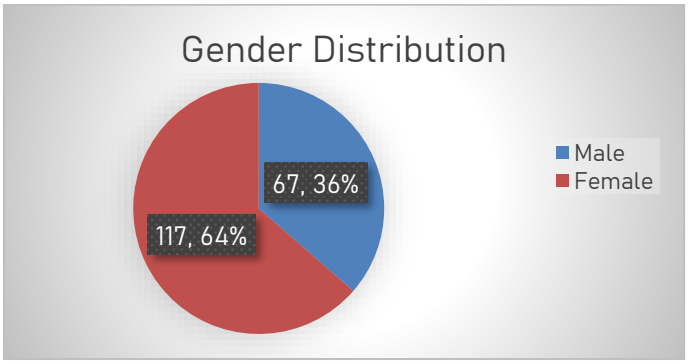

Figure 1: Gender Distribution of the Study Participants (n=184)

Figure 1. Gender distribution among the study cohort (n = 184). The pie chart shows that females constituted the majority of participants (117; 64%), while males accounted for 67 cases (36%). This reflects a notable female predominance in the study population.

Table 1: Demographic Profile of Seropositive NMOSD Patients

Characteristic		MOG+ (n=64)	AQP4+ (n=16)
Age Groups (Years)	≤10	1 (1.6)	0
	11–30	32 (50.0)	7 (43.8)
	31–50	16 (25.0)	8 (50.0)
	>50	15 (23.4)	1 (6.2)
Sex	Male	22 (34.4)	3 (18.8)
	Female	42 (65.6)	13 (81.2)

Table 1 shows that MOG-positive patients tended to be younger, with half of the cases occurring between 11–30 years, whereas AQP4-positive patients were most commonly in the 21–50-year range. Female predominance was evident in both groups, particularly in AQP4-positive patients.

Table 2: Visual Acuity at Presentation in Affected Eyes

Visual Acuity (Snellen)	MOG+ (n=105 Eyes) n (%)	AQP4+ (n=26 Eyes) n (%)
6/6 – 6/18 (Normal–Mild)	19 (18.1)	6 (23.1)
6/24 – 6/60 (Moderate)	8 (7.6)	0 (0)
<6/60 (Severe)	78 (74.3)	20 (76.9)

Table 2 shows that severe visual loss (<6/60) at presentation was common in both groups, affecting nearly three-quarters of affected eyes. A smaller proportion retained normal to mildly reduced vision, and moderate impairment was observed only among MOG-positive cases.

Table 3: Clinical Phenotypes and Neuroimaging Findings

Feature		MOG+, n=64 (%)	AQP4+, n=16 (%)
Ocular Presentation	Papillitis	43 (67.2)	10 (62.5)
	-Bilateral	27 (42.2)	5 (31.2)
	-Unilateral	16 (25.0)	5 (31.2)
	Retrobulbar Neuritis (RBN)	15 (23.4)	4 (25.0)
	-Bilateral	7 (10.9)	1 (6.2)
	-Unilateral	6 (9.4)	3 (18.8)
	Recurrent Optic Neuritis	5 (7.8)	2 (12.5)
Systemic Involvement	Transverse Myelitis	1 (1.6)	0 (0)
MRI Abnormalities	Spinal Cord Lesions	0 (0)	2 (12.5)
	Brain Lesions	1 (1.6)	1 (6.2)

Table 3 summarizes the distribution of clinical phenotypes and MRI findings. Papillitis was the most frequent ocular presentation in both groups, with bilateral papillitis being more common among MOG-positive patients. Retrobulbar neuritis was seen in about one-quarter of patients in each group. MRI abnormalities were rare in MOG-positive cases but more notable in AQP4-positive patients, especially spinal cord lesions.

DISCUSSION

This prospective study conducted in a tertiary eye hospital in Bangladesh found that myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) occurred more frequently than aquaporin-4 antibody-positive neuromyelitis optica spectrum disorder (AQP4-NMOSD) among patients presenting with atypical optic neuritis. This pattern differs notably from most Western and Caucasian series, where AQP4 seropositivity predominates, often exceeding 70% of NMOSD cases, as reported by Asgari *et al.,* and Petzold *et al.,* [13,14]. These differences may reflect regional and ethnic variations in autoimmune demyelinating disorders, as well as differences in referral patterns and diagnostic practices. Dauby et al. and Collongues *et al.,* have highlighted that certain Asian and pediatric cohorts show a higher prevalence of MOG antibodies, a finding that resonates with the distribution observed in our cohort [7,11]. In this study, the predominance of MOGAD may be influenced by the ophthalmology-focused nature of the hospital, which may preferentially capture patients with optic nerve–

dominant presentations rather than those with primary spinal or brainstem symptoms.

In terms of sex distribution, both groups demonstrated a female predominance, which was more marked among AQP4-positive patients. This observation is consistent with the findings of Kitley et al., who documented that AQP4-NMOSD, as an autoimmune astrocytopathy, disproportionately affects women, often at ratios exceeding 3:1 [15]. In contrast, MOGAD has been reported to have a more balanced sex distribution in many Western studies, yet our cohort still showed a female majority among MOG-positive patients. The reasons for this difference could be multifactorial, including genetic, hormonal, and environmental influences, as well as possible referral bias.

The median age at onset in our study was lower for MOG-positive patients than for AQP4-positive patients, which aligns with international data. Kitley et al. and Kang *et al.,* have noted that MOGAD typically presents in the second and third decades of life, whereas AQP4-NMOSD more often manifests later [6,9]. This age distribution pattern has important clinical implications, as younger patients with optic neuritis are more likely to undergo extensive work-up to exclude inflammatory etiologies, potentially increasing detection rates of MOGAD.

Severe visual loss at presentation was common in both groups, affecting more than 74% of affected eyes in each. This finding aligns with the descriptions of Messias *et al.,* and Chen *et al.,* who reported that both MOGAD and AQP4-NMOSD can cause profound vision loss during acute episodes [8,10]. In our cohort, bilateral papillitis emerged as the most common presentation among MOG-positive patients, whereas AQP4-positive patients exhibited equal proportions of unilateral and bilateral papillitis. These results support the observations of Chen *et al.,* who found that optic disc swelling and simultaneous bilateral optic neuritis are more typical of MOGAD, while AQP4-NMOSD often presents with retrobulbar optic neuritis or isolated unilateral attacks [10].

Neuroimaging findings in this study followed patterns described in the literature. Spinal cord lesions were observed more frequently in AQP4-positive patients, which is consistent with the established association between AQP4-NMOSD and longitudinally extensive transverse myelitis, as noted by Petzold *et al.,* and Kitley *et al.,* [14,15]. Brain lesions were relatively uncommon in both groups; however, the single MOG-positive patient with cortical and deep grey matter involvement reflects the atypical presentations of MOGAD reported by Dauby *et al.,* [7]. The lower rate of neuroimaging abnormalities in our MOGAD group may be partly due to selective MRI use, as only patients with neurological symptoms beyond optic neuritis underwent imaging.

The clinical implications of these findings are significant. The distinct pathophysiological mechanisms of these two antibody-mediated disorders — astrocytopathy in AQP4-NMOSD and oligodendropathy in MOGAD — result in different relapse patterns, prognoses, and therapeutic responses. Banerjee and Butcher emphasized that B-cell-depleting agents, such as rituximab, are highly effective in AQP4-NMOSD but show variable efficacy in MOGAD, where relapse prevention may require alternative immunomodulatory strategies [2]. This reinforces the need for routine testing of both antibodies in patients with atypical optic neuritis, particularly in resource-limited settings where delayed or inaccurate diagnosis could lead to irreversible disability.

LIMITATIONS OF THE STUDY

This single-center study was conducted in an ophthalmology-focused setting, which may have underrepresented patients with predominant neurological presentations. Neuroimaging was performed selectively, and the longitudinal outcomes were not assessed.

CONCLUSION

MOG antibody-associated disease was more common than AQP4-positive NMOSD in this Bangladeshi cohort of patients with atypical optic neuritis. Both conditions showed a female predominance and severe vision loss at presentation. Bilateral papillitis was more frequent in MOGAD, whereas AQP4-positive cases showed greater spinal cord involvement. Routine antibody testing is recommended for accurate diagnosis and individualized treatment planning in patients with ITP.

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Conflicts of interest

There are no conflicts of interest.

Ethical approval

The study was approved by the Institutional Ethics Committee.

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