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Clinical Profile of Childhood Optic Neuritis in a Tertiary Care Hospital of Bangladesh

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Abstract:

Background: *Childhood optic neuritis is rare and distinct from that which occurs in adults. Visual prognosis is better in children despite severe vision loss at the initial phase. Proper understanding the clinical profile of optic neuritis in children may make an opening to find out a better management plan.*

Materials and Methods: *This cross-sectional study was conducted at the Department of Pediatric Neurology, National Institute of Neurosciences and Hospital. Total 24 children of 5- 15 years old with acute or subacute loss of vision were enrolled from January 2020 to December 2020. Then thorough evaluation was done by taking history, physical, neurological, and ophthalmological examinations. Cerebrospinal fluid (CSF) study, neuroimaging of orbit, brain, and spine, and anti- NMO Ab were done subsequently.*

Result: *Mean age was 9.57±2.70 years with female (66.67%) predominance. Bilateral ocular involvement 19(79.17%) and ocular pain 18(75%) were the main presenting feature and isolated optic neuritis (79%) were the most common cause followed by 13% of optic neuritis- neuromyelitis optica (ON-NMO), 4% of optic neuritis-clinically isolated syndrome (ON-CIS) and Optic neuritis- acute disseminated encephalomyelitis (4%). Optic nerve hyperintensity 8(33.33%) were common orbital MRI findings in isolated optic neuritis where 2(8.3%) ADEM had abnormal brain MRI and 3(12.5%) ON-NMO had abnormal MRI of spine*

Conclusion: *Most childhood optic neuritis cases were isolated in nature with bilateral involvement. Optic disc oedema was frequent.*

Key Words: *Optic neuritis; Childhood; Clinical profile.*

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Introduction:

Optic neuritis (ON), a rare inflammatory condition that affects one or both optic nerves in children, impairs vision.[1] Visual impairment is usually occurred due to a swollen and damaged myelin sheath of optic nerves that carry visual information from the retina to the brain.[2] In one population-based study, the incidence of ON was estimated to be 5.1/100000 in adults and 0.5/100000 in children.[3] The hallmark of ON is acute and subacute onset vision loss. Decreased visual acuity, abnormal color perception (especially Red Color Desaturation), central scotoma or reduced Visual Fields are most common characteristics of ON. The onset of visual impairment typically begins within a few hours to a few days, followed by gradual improvement over a few days to a maximum of two weeks.[4] Compared to adults, children with ON are more likely to have severe visual impairment at presentation, with the majority of children having 20 / 200 VA or worse.[5 6] Children are also more likely to report bilateral vision loss.

Optic neuritis is a clinical diagnosis based upon the history and examination findings. Children with ON

need MRI of brain and orbits with fat suppression with contrast to confirm the presence of optic nerve enhancement and to evaluate for other white matter lesions such as ADEM, multiple sclerosis and NMO.[3] MRI of the orbit may be normal. Some patient requires neuroimaging of the spinal cord if it is suspected NMO.[3] Lumbar puncture is not essential diagnostic test in ON but should be considered excluding other causes of visual loss.[7] Even though vision loss is very severe in the early stages, the visual prognosis in childhood ON is generally good to excellent. Early diagnosis and appropriate treatment can help prevent long-term complications.

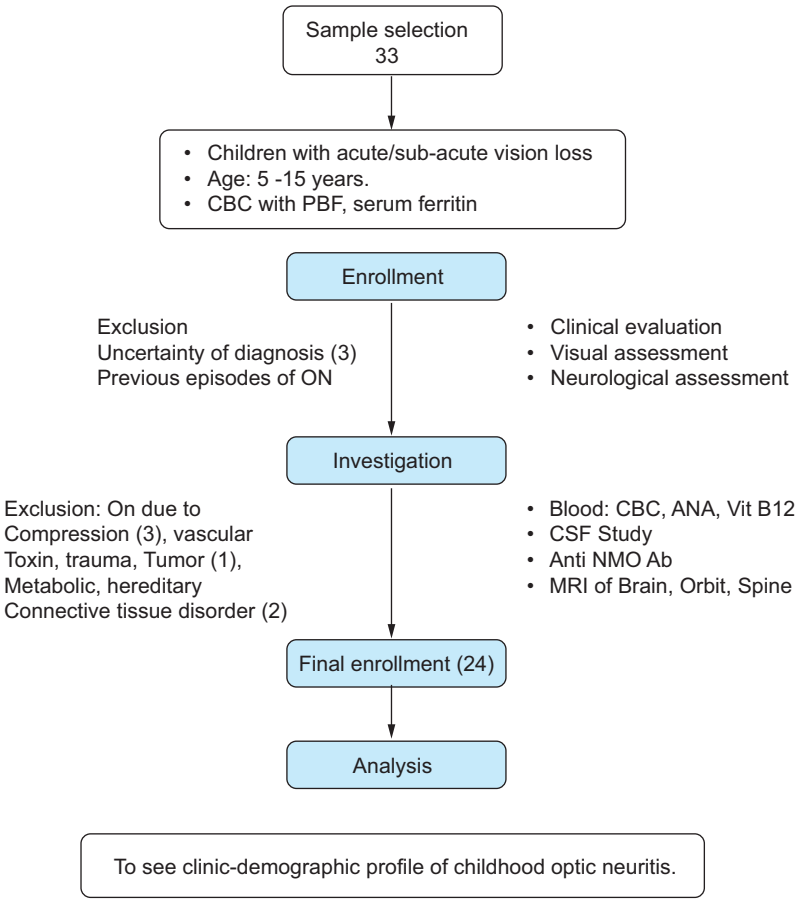
There are limited prospective data on ON in children. Our understanding of the clinical characteristics and natural history of childhood ON primarily based on case reports and retrospective case series. Specific studies on optic neuritis in children are scarce in Bangladesh. This prospective study will help better understanding the clinical profile of optic neuritis in children and may make an opening to find out a better management plan.

Materials & Methods:

This cross-sectional study was conducted at the Department of Pediatric Neurology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh. Total 24 children of 5- 15 years old with the first episode of optic neuritis were enrolled from January 2020 to December 2020. Informed written consent was taken from parents. The clinical diagnosis of optic neuritis was made based on acute or subacute visual loss and one or more of the following: pain with eye movement, a relative afferent pupillary defect, impaired color vision or optic disc swelling. Patients with previous central nervous system (CNS) inflammatory demyelinating episodes, and vision loss due to other causes like compressive, vascular, toxic, traumatic, metabolic, hereditary, and connective tissue disorders were excluded from the study. The thorough evaluation was done by taking history, physical, neurological and ophthalmological examinations. All visual assessments are primarily done at the Department of Pediatric Neurology and confirmed by a Neuro-ophthalmologist. Best corrected visual acuity in all patients was evaluated using Snellen's chart, color vision by Ishihara pseudoisochromatic plates, and relative afferent pupillary defect (RAPD) by swinging flashlight test. Visual acuity of 20/20 was considered as normal vision, 20/30 to 20/40 as mild, 20/50 to 20/160 as moderate, 20/200 as severe, <20/200 (Hand movement, counting finger) as profound visual impairment and no perception of light as total vision loss in this study. Cerebrospinal fluid (CSF) study and immunological study (anti- NMO Ab) were done subsequently. CSF was drawn with aseptic precaution by lumber puncture and sent for cytological (cell count), biochemical examination (glucose and protein), and gram staining. MRI of the brain, and spine with contrast and MRI of orbit in both axial and coronal view (fat suppression with contrast) was done in all cases at the neuroradiology department of NINS&H. MRI of brain and spine included T1, T2, fluid-attenuated inversion recovery(FLAIR) and diffusion-weighted (DWI) images. MRI images were reviewed by Neuroradiologist.

Isolated ON was considered who had single and isolated episode of optic neuritis with normal brain and spinal cord imaging. ON- Acute disseminated encephalomyelitis(ON-ADEM) was defined as who had ON and features of ADEM clinically and radiologically. ON-Neuromyelitis Optica (ON-NMO) was considered who had ON with 2 or more of the following: i)acute myelitis ii) Spinal MRI lesion extends over three or more segment iii) Brain MRI does not meet criteria for MS iv) Anti-NMO Ab positivity. ON-Clinically isolated syndrome(ON-CIS) was considered who had first attack of ON with monofocal or multifocal CNS symptoms without encephalopathy and MRI showed area of white matter demyelination in brain or spine.

Data was collected by predesigned questionnaire and analyzed by SPSS (version 22.0) and double checked before analysis. Means and proportions of the demographic parameters were calculated. Categorical data was compared with chi-square test. This study was approved by the ethical committee of National Institute of Neurosciences and Hospital.



Result:

Mean age was 9.57±2.70 years and the age at disease onset was >10 years in 54.2% of cases. The majority of them were female (66.67%). Mean duration of symptom at presentation was 8.91± 2.39. All study cases had visual impairment (100%), ocular pain (75%), and bilateral ocular involvement (79.17%) at presentation. 66.67% had history of viral prodrome. At presentation, all patients had reduced vision with majority of the eyes (30) had severe to worse vision loss (20/200 or less). Most of the cases had impaired color vision (89.2%). About 14% of affected eyes, color vision was not able to record due to poor vision. Positive RAPD was found in 70.83% of patient. Optic disc edema was seen in most of the eyes (86.05%). Headache, limb weakness, irritability and bowel bladder involvement were other non-ocular presentations. Among the study cases, 33.33% had hyper-intensity in the optic nerve on MRI of orbit, 8.3% had abnormal brain MRI and 12.5% had abnormal spine MRI. Bilateral, multifocal and subcortical lesions were common findings on brain MRI, Corpus callosal hyper-intensity was found in 50% cases of abnormal brain MRI. Most of the study cases had normal CSF study, 12.5% had CSF pleocytosis, and serum anti-NMO Ab was found in 1 case. Among the study cases isolated ON (79%) were the most common demyelinating disease followed by ON- NMO (13%), ON-CIS (4%) and ON-ADEM (4%). All cases of ON-CIS and ON-NMO were presented after 10 years. The majority of the cases of isolated ON and ON-ADEM were presented below 10 years. There was statistically insignificant. On neuroimaging, optic nerve hyperintensity commonly found in isolated ON. ON-ADEM group had bilateral subcortical demyelinating lesions whereas corpus callosal involvement were found in ON-CIS (P=0.000). LETM was prominently found in ON-NMO group (p=0.001). CSF pleocytosis were commonly found in ON-NMO, ON-CIS and ON-ADEM groups (p=0.000). Anti NMO Ab prominently found in ON-NMO groups (p=0.002).

Table-I

Clinico- demographic profile of study cases (n=24)

Variable	Frequency
Age (Years)	
Mean Age	9.57 ± 2.70
Age of onset	
<10 yearse	11 (45.8%)
≥10 yeas	13 (54.2%)
Gender	
Female	16 (66.67%)
Male	8 (33.33%)
F:M	2:1
Duration of symptoms at presentation (days)	8.91 ± 2.39

Table-II

Clinical Profile of the study cases at presentation (n=24)

Clinical profile	Frequency (%)
Visual impairment Laterality	24 (100%)
Unilateral	5 (20.83%)
Bilateral	19 (79.17%)
Ocular Pain	18 (75%)
Visual acuity	
20/20 (Normal vision)	0%
20/30-20/40 (Mild impairment)	8 (18.50%)
20/50-20/160 (Moderate impairment)	5 (11.60%)
20/200(severe impairment)	14 932.30%)
<20/200 (Profound impairment)	10 (23.30%)
NPL (Total vision loss-No perception of light)	6 (14%)
*Color vision	
Normal	4/37 (10.80%)
Impaired	33/37 (89.20%)
Not Possible	6/43 (13.95%)
Positive RAPD	
Unilateral	8/8 (100%)
Bilateral	9/16 (56.25%)
*Fundus	
Normal	6/43 (13.95%)
Optic disc oedema	37/43 (86.05%)
Headache	13 (54.2%)
Limb weakness	3 (12.5%)
Irritability	1 (4.2%)
Bladder involvement	1 (4.2%)

*No of eyes =43

Table-III

Investigation profile of the study cases (n=24)

Variable	Frequency (%)
Neuroimaging	
MRI of Orbit	
Normal	16 (66.67%)
Hyperintensity in optic nerve	8 (33.33%)
MRI of Bain	
Normal	22 (91.7%)
Abnormal: pattern of lesion (demyelination)	2 (8.3%)
Bilateral and multifocal (Subcortical and cortical)	1 (4.15%)
Corpus callosal involvement	1 (4.155)
MRI of Spine	
Normal	21 (87.5%)
Abnormal (LETM)	3 (12.5%)
CSF study	
Normal	21 (87.5%)
Abnormal	3 (12.5%)
Serum anti NMO Ab (12)	
Seropositive	1/12 (8.3%)
Seronegative	11/12 (91.7%)

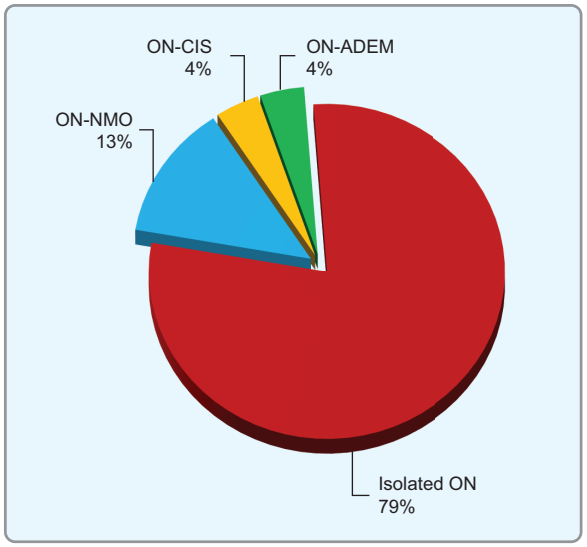
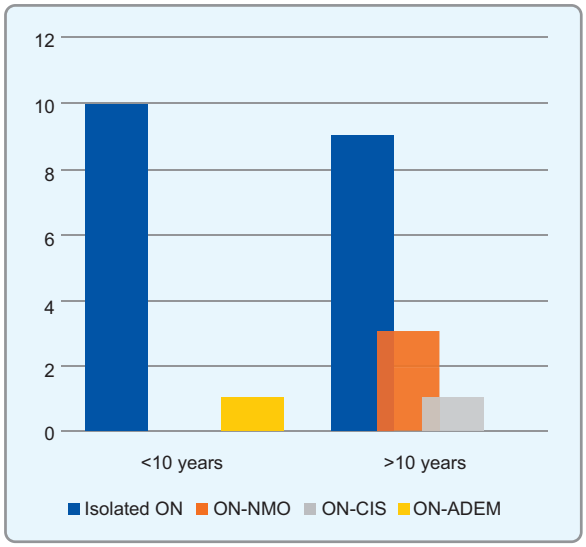


Figure 1: *Pattern of optic neuritis in children (N=24)*



**Chi-square test p= 0.078*

Figure 2: *Pattern of ON according to age groups among the study cases (N=24)*

Table-IV

Comparison of neuroimaging and other lab findings of ON groups(n=24)

Variable	Isolated ON (19)	ON-NM0 (3)	ON-CIS(1)	ON-ADEM(1)	P value*
MRI Orbit: Optic nerves					
Normal (16)	14(87.5%)	2(12.5%)	0 (0%)	0 (0%)	0.219
Hyperintensity(8)	5 (62.5%)	1(12.5%)	1(12.5%)	1(12.5%)	
MRI of Brain lesions					
Bilateral & Multifocal (2)	0(0%)	1(50%)[a]	1(50%)[b]	0(0%)	0.000
MRI of Spine					
Normal(21)	19(90.47%)	0(0%)	1(4.76%)	1(4.76%)	0.001
LETM(3)	0(0%)	3 (100%)	0(0%)	0(0%)	
CSF study					
Normal (21)	19(90.47%)	2(67%)	0(0%)	0(0%)	
Pleocytosis (3)	0(0%)	1(33%)	1(33%)	1(33%)	0.000
Anti-NMO Ab (1)	0(0%)	1(100%)	0(0%)	0(0%)	0.002

*Chi-square test

a- corpus callosum, b-subcortical,cortical

Discussion:

In this study, clinical characteristics of childhood ON in a tertiary care of hospital of Bangladesh was described. Mean age of study cases were 9.57± 2.70 years and female were predominant which is similar to other studies where age ranged from 9.2 to 9.8 years.[8 9] But this contrasts with an Indian study (mean age were 12.08 years)[10] which may be due to the variation in the inclusion criteria.

Childhood ON is considered to be bilateral in nature.[2] In this study, most of the patient presented with bilateral involvement (66.67%), which is consistent with that of other studies where bilateral involvement was reported in the range of 42%-87% of cases.[11 12 13] In this study 74.41% of cases presented with ocular pain. This finding differed from Wan et al.[14] , where they found ocular pain in 50% of children with ON. On the other hand, Marco et al.[15] showed pain associated with visual loss in only 10 (37%) which was also not consistent with present study. Visual acuity is quite variable in children with ON. An affected eye may have a VA ranging from 20/20 to NPL. In this study, VA at presentation was poor in most of the children with over 69.80% (30 of 43 eyes) having VA of 20/200 or worse which is similar to Kumar et al.[10]

Optic disc edema (ODE)is found more commonly in children with ON.[15] In the current study, ODE was present in 86.4% of affected eyes whereas Kriss et al.[16] reported 74% of ODE of children with ON. This showed that the present study is comparable with other studies. In contrast, ODE was found only in 35% cases of adult onset ON.[17] Relative afferent pupillary defect was found positive in 70.4% of children with ON cases in this study which is similar to findings of Chang et al.[18] Impaired color vision was found in 74.4% of affected eyes at presentation whereas Kriss et al.[16] found color vision defects in 98% of all cases. This dissimilarity may be due to small sample size and poor vision at presentation.

In our study, MRI of brain with orbit and spinal cord were done in all cases. Optic nerve hyperintensity was found in 8 (33.33%) cases at presentation in the current study whereas it was in 16.66% cases an Indian study[10] and Zhou et al.[17] found it in 35 (83.33%) which were not consistent with the present study. Isolated ON (79%) were the most common demyelinating disease followed by ON- NMO (13%), ON-CIS (4%) and ON-ADEM (4%) in the current study. Zhou et al.[17] found isolated ON in 76% of cases which is consistent with present study. Sun et al.[19] reported ADEM was the most common systemic cause of childhood ON which differs from the

present study. Earlier age of disease onset was found among isolated ON and ADEM than CIS and NMO. In this study optic nerve hyperintensity was mostly found in isolated ON. At presentation abnormality of brain MRI was found in 12.5% of cases that revealed ADEM (1), CIS (1) in this study. All cases of isolated ON (19) had normal MRI of brain and spine. MRI of spine revealed abnormality in 3 cases (12,5%) and all of them were LETM and these all were found in ON-NMO groups.

CSF examination in childhood optic neuritis may show slight pleocytosis and elevated protein content, but more frequently is normal.[16] In the present study, CSF pleocytosis was found in only 3 cases and all in ON-NMO, ON-CIS, and ON-CIS groups but none in the isolated ON. Jacobs et al.[20] reported nonspecific CSF abnormalities (lymphocytosis and elevated protein) in 60% to 80% of their study cases. In our study anti NMO-Ab was found in one patient (ON-NMO) whereas most previous studies of ON in children did not search for serum anit- NMO Ab status due to the unavailability of this test.

The present study was conducted to understand the clinical picture of childhood ON. To our knowledge, this is the first study of childhood ON in Bangladesh.

In conclusion, this study found that most childhood optic neuritis cases were isolated in nature with bilateral involvement. Optic disc oedema was frequent.

Conflict of interest: None

Limitation

There were a few limitations of this study. It was a single-center study with small sample. Hence the findings of this study may not apply to a larger population.

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