Original Article

Sequential Nonarteritic Anterior Ischaemic Optic Neuropathy (NAION): A Study on Clinical presentations and Outcome of Patients Attending in Neuro-ophthalmology Department of a Tertiary Eye-care Hospital in Bangladesh

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ABSTRACT

Purpose: To draw an overview of clinical presentation, the pattern of vision loss in fellow eye and management of sequential Nonarteritic Anterior Ischaemic Optic Neuropathy (NAION)

Methods: This is a cross sectional study among the patients with sequential NAION, attended at Neuro-Ophthalmology Department of a tertiary eye-care hospital in Bangladesh from June 2019 to February 2020.

Results: Of the total 57 cases, 35 (61.40%) were males. The mean age of the patients was 51.85 ± 8.69 years. Mean duration between attacks in two eyes: 10.9 months. 10 patients (17.54%) had secondary optic atrophy in both eyes, 30 patients (52.63%) had come with NAION in one eye. On examination other eye disc was found pale. 16 patients (28%) had come with NAION in one eye. Subsequently they developed NAION in other eye. Around twenty four (42.15%) patients in first eye and twenty eight patients (49.12%) in 2nd eye had presented with 6/6-6/18 visual acuity. Twelve patients (21.05%) in first eye and nine patients in 2nd eye presented with 6/24-6/60 visual acuity. Twelve (21.05%) patients presented with less than 1/60 in first eyes and 8 patients in 2nd eyes. The difference in log MAR acuity between two eyes was not statistically significant. 7 patients (12.28%) had same visual acuity in both eyes. 25 patients (43.85%) had difference of visual acuity with in 2 lines of snellen acuity chart. Difference of visual acuity by more than 4 lines in between 1st and 2nd eyes was found in 22 (38.59%) patients. One third of the patients showed two line improvements of visual acuity after treatment. Control of risk factors, vitamin supplements, low dose aspirin were given all patients, systemic methylprednisolone was given one third of patients and intravenous erythropoietin was given six number of patients.

Conclusion: NAION is a common cause of vision loss in adults and elderly population. Fellow eye involvement also not uncommon. It is therefore worthwhile to report its clinical presentation, the pattern of vision loss, effectiveness of management which provides some useful information for counseling patients.

Introduction

Nonarteritic anterior Ischemic optic neuropathy (NAION) is the 2nd most common acute optic neuropathy in patients older than 50 years after glaucoma[1]. This condition typically presents with sudden painless monocular variable visual loss, accompanied by disc edema and disc related visual field loss. A further attack of NAION in an already affected eye is unusual[2], but occurrence in the fellow eye is common. The frequency of such a contra lateral event has been investigated in a number of studies, ranging from 10.5% to 73% of patients[3]. To the best of our knowledge, sequential NAION and its clinical outcomes have been reported on Western populations[4]. There is limited documentation of this particular ophthalmic diseases in Asian populations. Therefore, the objective of this study was to perform a cross sectional study of sequential NAION to determine the risk factors, clinical features, comparison of visual acuity between two eyes and treatment efficacy of NAION in an Asian population like Bangladesh.

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Methodology

This was a cross sectional study in which a total of 57 patients were enrolled. Inclusion criteria were :

the patients who were diagnosed sequential bilateral NAION attended at Neuro-Ophthalmology Department of Chittagong Eye Infirmary & Training Complex (CEITC), Bangladesh from June 2019 to February 2020. All patients were followed up with in this period. Detailed clinical information; clinical course, management and outcome were recorded using a semi-structured questionnaire after informed consent of the patients. Diagnosis of NAION based on following 5 criteria (these criteria were approved by Ischemic Optic Neuropathy Decompression Trial Research Group)

a) Sudden/sequential loss of vision of one or both eyes.

b) Fundus examination suggestive of disc edema/pallor.

c) Visual fields with specific field defects.

d) FFA – minimal or no filling defect or delay in filling in the optic disc and/or peripapillary choroid or choroidal watershed zone.

e) Exclusion of other causes of vision loss.

The diagnosis of NAION requires that 3 out of first 4 criteria are met while the 5th (e) criterion must essentially be fulfilled. Arteritic anterior ischaemic optic neuropathy was excluded based on clinical presentation with normal erythrocyte sedimentation rate (ESR), normal C-reactive protein level. Neuro imaging of brain and orbit with contrast was done most of the cases because good number of patients presented with one disc pale and other disc edematous. To exclude any space occupying lesion as in true foster Kennedy syndrome we have done neuroimaging. Serological investigation such as blood for Antibody to Aquaporin 4, CSF study etc to exclude other diagnosis such as recurrent optic neuritis, etc. Details of the history including biographical details (age gender, address of patient), any relevant history, sign and symptoms, time course history of vasculopathic risk factors other than older age (i.e. diabetes mellitus, hypertension, hypercholesterolemia, stroke, smokers, myocardial infarction, Chronic renal failure) were recorded. All NAION patients underwent thorough ophthalmic examinations, including a slit - lamp examination, pupillary reaction to see relative afferent pupillary Defect, (RAPD), color vision test by Ishihara colour plate, fundus examination by +78D volk lens with slit lamp and indirect ophthalmoscopy. Best-corrected visual acuity was done by the Snellen visual acuity chart under the same testing condition which was also converted to log MAR units for statistical purposes. Average Snellen visual acuity measurement was done by the summation of the total number of the denominator of the Snellen visual acuity records divided by the total number of the patient's eyes. Counting fingers was assigned a value of 2 ; hand movement 3[6]. Visual field test have done using automated static threshold perimetry (Humphrey 30-2 SITA [Swedish Interactive Testing Algorithm]. Fundus photography with fluorescence angiography was done. Patients who were active cigarette smokers at the time of diagnosis or had used tobacco in the previous 5 years were classified as smokers[7].

All patients treated with vitamin B1,B2, B12 supplements with folic acid and antiplatelets supplement except those have creatinine level more than normal. Some patients treated with systemic steroid who had developed repeated attack of NAION within 3 weeks , visual acuity less than 1/60 and progressive loss of vision, huge disc edema. The patient who treated with steroid has no history of DM or controlled DM. Patients typically attended within 3 weeks of onset. Six patients treated with injectable erythopoetin (10,000 IU intravenously, two times daily) for 3 days who had uncontrolled DM, poor visual acuity. Paired t test was done and 'p' value was quoted for the test. P value of less than 0.05 was considered as statistically significant.

Result

Of the 57 patients in the study group, 35 (61.40%) were males and 23 (40.35 %) were females. The mean age was 51.85 ± 8.69 years. A total of 39 (68.42%) affected right eyes were the first eye side, where as 17 (29.82%) affected left eyes were the first and 1 patient developed in (1.75 %) in B/E. Mean duration between attack 329.13 days or 10.9 months. Mean duration between attacks were found out from 46 numbers of patients as because 13 patients couldn't remember about their first attack.

Demographics of 57 patients

- **Mean age was 51.85 ± 8.69**
- **Gender:**

Male : 35 (61.40%)
Female : 23 (40.35 %)

- **First eye to develop NAION**

Right eyes: 39 (68.42%)
Left eyes: 17 (29.82%)

- **Mean duration between attack: 10.9 months**

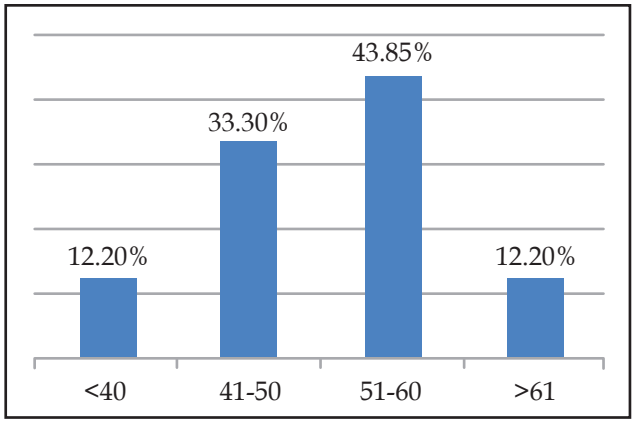
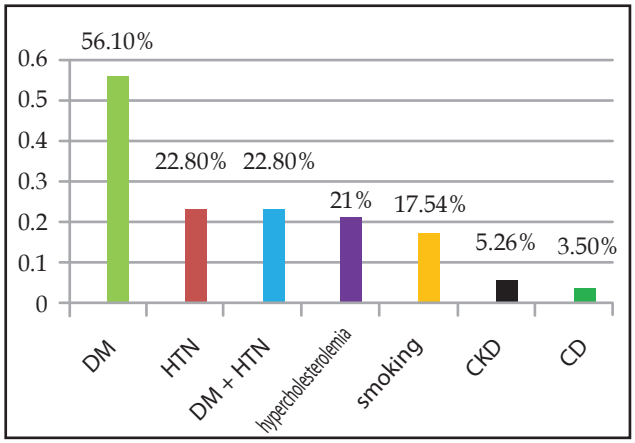


Figure-01: Age distribution in study group

The most 25 (n=43.85%) of the patients were aged 50 above. 19 patients (33.30%) were in between 41-50 age group. 7 patients aged (12.20%) more than 61 years. 12.20% of patients were in less than 40 years group. The age distribution of studied patients was shown in figure 1.



Note: DM - Diabetes Mellitus, HTN - Hypertension, CKD - Chronic Kidney Diseases, CD - Cardiac Diseases.

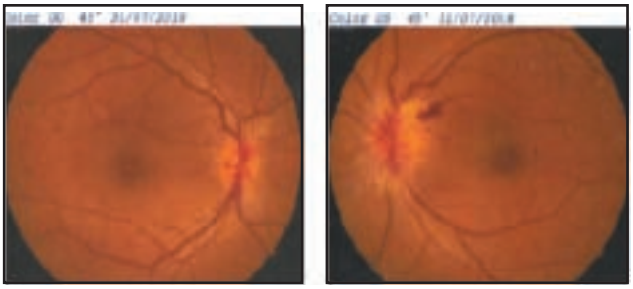
Figure-2: Common micro vascular risk factors found in sequential NAION

Diabetes Mellitus (DM) was found as the most commonly associated systemic disease (n=32, 56.10%) followed by systemic hypertension (n=13, 22.80%). 9 Patients had DM for more than 10 years, 9 patients had more than 5 years and 6 patients were newly diagnosed DM. 6 patients had diabetic retinopathy. 3 patients had mild NPDR 2 had found moderate NPDR. 1 patients had severe NPDR. 3 patients had CSME. 1 patients treated with focal laser. DM and HTN both were found in 13 patients (22.80%), H/O smoking was found in 17.54% of cases. Hypercholesterolemia associated with 12 patients (21%) H/O cardiac diseases, chronic kidney diseases (CKD) were found in 2 (3.5%), 3 (5.26%) respectively.

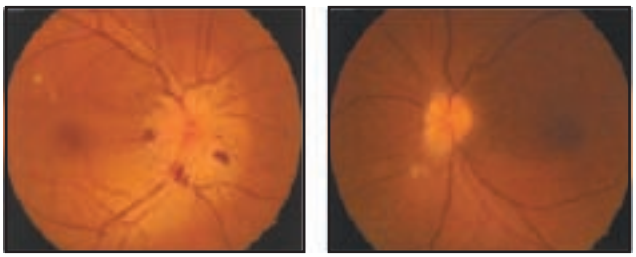
Table-01: Duration of attack in between two eyes:

Duration in between attack	Patients (%)
5 days	1 (1.75%)
Within 1 month	12 (21.05%)
Within 3 months	8 (14.03%)
Within 6 months	6 (10.52%
Within 1 year	1221.05%)
More than a year	5(8.77%)
Couldn't remember	13(22.80%)
Total	57(100%)

Out of 57 patients 12 (21.05%) numbers of patients experienced a symptoms of attack in 2 eyes within 1 month.8 patients (14.03%) developed NAION in both eyes within 3 months. 12 patients (21.05%) had symptomatic within a year. 13 (22.8%) patients couldn't remember their first attack. Only one patient came with bilateral NAION developed within 5 days.



Patient had come with attack in the left eye, on examination right disc found crowded disc.



Subsequently experienced visual loss in the right eye about 1 month later and left disc was becoming pale.

Visual acuity

Average Snellen visual acuity was 6/487 for the first eye attack and 6/464 for the second eye attack. With conversion to log MAR visual acuity, the mean (SD) log MAR visual acuity was 0.99 (± 0.90) for the first eye attack and 0.87 (± 0.76) (0.64) for the second eye. The difference in log MAR acuity between fellow eyes was not statistically significant (P=0.41, students T test)

Visual acuity:	In first eye	2nd eye	P value
In log MAR	0.99 (±0.90)	0.87 (±0.76)	0.410

Table-02 : Visual acuity in first and 2nd eye

Visual acuity	In first eye (n)	2nd eye(n)
6/6-6/18	24 (42.15%)	28 (49.12%)
6/24-6/60	12 (21.05%)	10 (1.75%)
<6/60 -1/60	9 (15.78%)	12 (21.05%)
<1/60	12 (21.05%)	8 (14.03%)
Total	57 (100%)	57 (100%)

Around twenty four (42.15%) patients in first eye and twenty eight patients in Second eye had presented with 6/6-6/18 (49.12%) visual acuity. Twelve patients (21.05%) in first eye and nine patients in Second eye presented with 6/24-6/60 visual acuity. Nine patients with less than 6/60-1/60 in first eye and 12 patients in Second eye. Twelve (21.05%) patients presented with less than 1/60 in first eye and 8 patients in Second eyes.

Table-03: Difference of visual acuity in first and Second eye

Difference of Visual Acuity	Visual Acuity	Number of Patients	
		n	%
Within 2 line of Snellen chart	6/6-6/18	11	
	6/24-6/60	5	
	<3/60	9	
Total		**25**	43.85
Within 3 line of Snellen chart	6/6-6/36	**3**	
Within 4 line of Snellen chart	6/6-6/60	**22**	
Same visual acuity	6/6-3/60	**7**	
Total		57	100.0

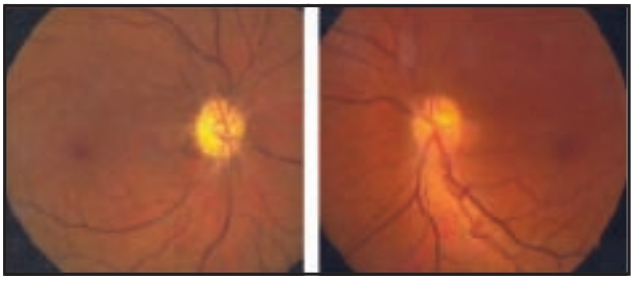
25 patients (43.85%) had difference of visual acuity with in 2 line of snellen acuity chart. Out of 25 patients 11 patients had visual acuity within 6/6-6/18 in both eyes. 5 patients had visual acuity with in 6/24-6/60 and 9 patients had less than 3/60 in both eyes. 1 patient had visual acuity 6/18 in one eye and 6/24 in other eye. He was included in 6/24 -6/60 group.

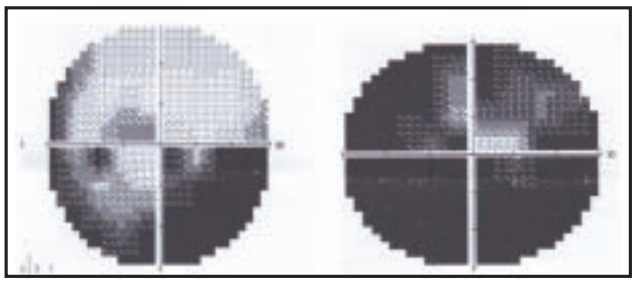
Difference of visual acuity by 3 lines was found 5.26% cases. Difference of visual acuity by > 4 lines in between 1st and 2nd eyes was found 22 (38.59%) patients. 7 patients (12.28%) had same visual acuity in both eyes. 4 patients had visual acuity within 6/9 in both eye. 1 had 6/36 and other 2 patients had 3/60 and hand movement in both eye.

Relative afferent pupillary defect (RAPD):

28 (49.12%) patients had RAPD when difference of visual acuity between two eye was more. 10 patients had sluggish reaction when visual acuity was poor in both eyes. 19 (33.33%) patients had no RAPD when difference of visual acuity is found minimal.

Visual field: We found reliable field defect in 38 patients in both eyes. 32 patients showed altitudinal field defect mostly inferior. Other showed arcuate field defect, peripheral constriction.





Sequential NAION: Right disc shows optic atrophy left disc shows sectoral disc edema right eye shows diffuse field defect and left eye shows arcute loss.

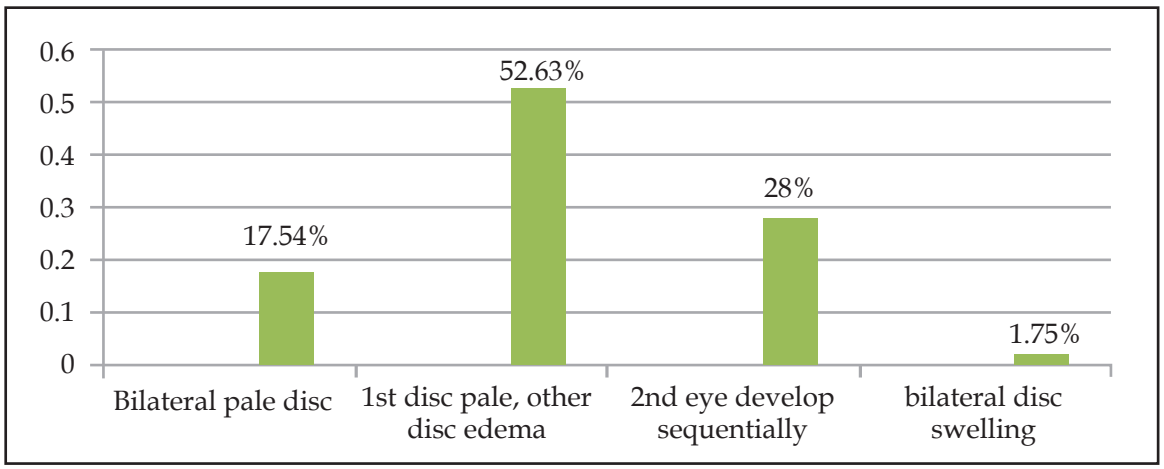
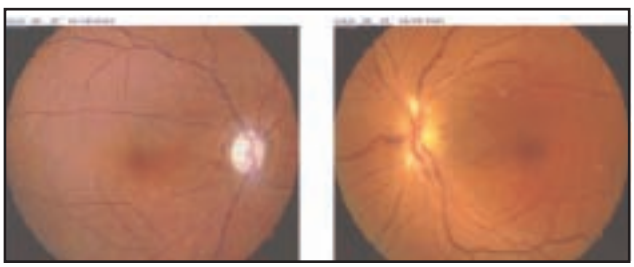


Figure-03: Findings of optic disc

10 patients (17.54%) have secondary optic atrophy in both eyes at presentation. 4 patients had visual acuity <6/60 in both eyes. 4 patients visual acuity >6/36 at least one eye. 2 patients had good visual acuity (>6/12) in both eyes. 30 patients (52.63%) had come with attack of NAION in one eye. On examination other eye disc was found pale. Out of 30 patients, 7 patients had visual acuity < 6/60 in both eye, 8 patients had visual acuity more than or equal to 6/24 in one eye, 15 patients had more than 6/24 vision in both eyes. 16 numbers of patients (28%) had come with attack in one eye. Sub sequentially they developed NAION in other eye. 1 patient developed 2nd eye attack within a month. 4 patients developed within a 6 months. Other patients (11 numbers of patients) developed within a year. All patients were developed 2nd attack in between study period. 7 patients had visual acuity more than 6/24 in one eye other eye had less than 3/60. 8 patients had visual acuity more than 6/24 in both eye. Only a patient had less than 3/60 visual acuity in both eye.



Patient came with attack in left eye, On examination right disc was found pale.

Table-04: Treatment of NAION

Treatment	Patients (n,%)	Improvement (n,%)
Injectable methyl prednisolone	17 (29.82)	8 (47.05)
Intravenous Erytropoetin	6 (10.52)	2 (33.33)
Only vitamin supplement + anti platelets therapy	34 (59.64%)	8 (23.52)
	57 (100%)	18 (31.57%)

Injection methyl prednisolone was given seventeen patients (23.7%). Visual acuity of eight patients (47.05%) improved with 2 lines or 1 meter. Intravenous erythropoietin injection was given in six patients and VA of two patients from 6/60 to 6/18, counting finger 1 ft to 6/24 improved and maintained up to last follow up in our study period. Only vitamin supplement had given in 34 studied patients when 10 patients both disc was already found pale and other patients visual acuity in involved eye was better than 6/18. VA was improved in 8 (23.52%) patients.

Table-05: Visual acuity before and after treatment

Visual acuity	First eye	Second eye	First eye	Second eye
	Before treatment		After treatment	
6/6-6/18 (Group 1)	24 (42.15%)	28 (49.12%)	28 (51.85%)	27 (50%)
6/24-6/6/60 (Group 2)	12 (21.05%)	9 (15.87%)	10 (18.5%)	18 (33.33%)
6/60-1/60 (Group 3)	9 (15.87%)	12 (21.05%)	11 (20.3%)	6 (11.1)
< 1/60 (Group 4)	12 (21.05%)	8 (14.03%)	5 (9.25%)	3 (5.55)
Total	57	57	54*	54*

* Three patients lost for follow up.

Visual acuity (in log MAR):	Before treatment	After treatment	P value
In first eye	0.99 (±0.90)	0.76 (± 0.7)	0.41
Second eye	0.87(±0.76)	0.70 (± 0.66)	0.20

After treatment 51.85% patients had visual acuity in 6/6-6/18 group improved from 42.15% in first eye. In 2nd eye VA improved to 50% from 49.12%. In group 2 (6/24-6/6/60) after treatment 15.87% patients improved to 33.33% in second eye. After treatment 20.3 % in first eye and 11.1% patients in second eye had visual acuity in between 6/60-1/60. Only 9.25% and 5.55% had visual acuity in group 4 (<1/60) after treatment in first and second eye respectively. There was no deterioration of visual acuity after treatment in four groups.

After conversion in LogMAR visual acuity before and after treatment is not significant. (p value in 0.41 in first eye and 0.20 in second eye). 3 patients lost for follow up after treatment.

Discussion

Our study was cross sectional study conducted in a specialized tertiary eye care hospital for nine months. The studied patients were therefore presented with non arteritic anterior ischemic optic neuropathy (NAION) in both eye sequentially.

Only one patient presented with bilateral NAION. Thus, this study was interesting to investigate the mode of presentation, visual acuity of first and second eye and its difference and also risk factors, given treatment and its outcome of involvement of eye in NAION.

More than half of our total studied patients with NAION were older aged 50 years and above (n=61.45%). The average age at onset in most studies ranges from 57 to 65 years[1]. However, in our study, the onset of diseases was found in a bit younger ages. In our study patients age less than 50 years had one of the risk factors like uncontrolled or newly diagnosed diabetes mellitus with systemic hypertension or newly diagnosed hyperlipidamia and/history of smoking. Optic disc structure and systemic vascular risk factors for NAION would be the same for both eyes.

In our study diabetes Mellitus (DM) (n=32, 56.10%), systemic hypertension (n=13, 22.80%), hypercholesterolemia n-12, 21%) H/O smoking (n-13, 17.54%) is also found as commonly observed risk factors. In most of the previous studies with western populations, diabetes mellitus[7], hypertension[1], hypercholesterolemia[8], smoking[7] were found independent risk factors. Our study confirms the widely accepted concept. On presentation 32 patients (52.63%) had come with attack in one eye and on examination other eye disc was found pale. 13 (22.8%) patients were unnoticed about their first attack and some were anxious about their involved second eye when vision was poor. 16 patients (28%) had come with attack in one eye and diagnosed as right or left NAION. Sub sequentially they developed NAION in other eye in our study period. 10 patients came with optic atrophy in both eyes. Here patients worried when vision of both eyes were affected. NAION in both eyes has been reported in as few as 10.5% and as many as 73% of patients[3,4]. Twenty-three percent of the patients in the IONDT (Ischemic Optic Neuropathy Decompression Trial Study Group) initially had contra lateral optic disc pallor, which suggested possible previous NAION[9].

In this study we included only NAION in both eyes. Mean duration between attacks: 10.9 months. The probability of involvement of fellow eye varies among different studies. While Beri et al.[10], reported 25% risk of involvement of fellow eye over 3 years, the risk was 17% over 5 years as per Beck et al[11]. In our study 28% patients returns back with attack on NAION in fellow eye.

In our study we found 25 patients (43.85%) had difference of visual acuity with in 2 line of snellen acuity chart. Difference of visual acuity by 3 lines was found in 3 patients (5.26%). 7 patients (12.28%) had same visual acuity in both eyes. Difference of visual by > 4 lines in between 1st and 2nd eyes was found 22 (38.59%) numbers of patients. Boone et al reported their findings in 16 patients with bilateral NAION, visual acuity was within 3 lines in 81% of cases[12]. Jennifer Loh Mercado el have found in their series of 86 cases of bilateral sequential NAION, high degree of concordance between the visual outcomes in fellow eyes[13]. It would be seem that our findings more closely match those of Boone et al. and a Jennifer el study. In Jennifer et al. study findings was demonstrated in measures of visual acuity, the magnitude and pattern of visual field loss, and the magnitude of the RAPD.

But in our study we found reliable field defect in 38 patients and RAPD was found in eyes with poor visual acuity either first or 2nd eye. These two findings were not taken as parameters for comparison between 1st and fellow eye. We had taken visual acuity only for comparison.

Various treatments for NAION have been advocated from time to time, but no treatment was fully effective. In our study Injectable methyl-prednisolone was given to almost one one third of patients, and we observed improvement of VA in acute NAION half of the cases. Hayreh and Zimmerman[14] performed a nonrandomized, open-label trial of systemic corticosteroids for acute NAION. We tried with intravenous ethythropoietin, which is tried by Modarres et al[15] and we noticed 2 patients with improvement of visual acuity. There may be scope of further research in this respect. We also gave low dose aspirin to all patients' vitamin supplements and advised to control of risk factors those who already came with bilateral pale disc and visual acuity better than 6/12. Though improvement of visual acuity after treatment is not statistically significant but one third of the patients showed two line improvements of visual acuity.

We found a high degree of similarities between fellow eyes based on measurements of visual acuity. This information can be useful for counseling patients after a first episode of NAION, although it is not very helpful or comfort to counseling to those at the severe end of visual loss in this condition. More important, these data may be helpful for assessing possible efficacy of novel treatments for NAION.

Conclusion

NAION is a common cause of vision loss in adults and elderly population. Fellow eye involvement also not uncommon. So its clinical presentation, the pattern of vision loss, effectiveness of management should be well known. The pattern of vision loss was found similar in fellow eyes. Though it's consistently effective management has yet to be identified, this study may provides some useful information for counseling patients and may help allow better prediction of visual outcome for the second eye in patients with NAION.

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