

Clinical outcomes of optic neuritis: A retrospective study at a tertiary medical center in Saudi Arabia

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ABSTRACT

الأهداف: للتحقق من النتائج السريرية لمرضى التهاب العصب البصري في منشأة طبية ثالثة في مكة المكرمة، المملكة العربية السعودية.

المنهجية: تم فحص بيانات المرضى الذين تم تقييمهم للعصب البصري في مركز الملك عبدالله الطبي بمكة المكرمة، المملكة العربية السعودية، بشكل رجعي.

النتائج: لقد حددنا 15 مريضاً يعانون من التهاب العصب البصري. كان سبب التهاب العصب البصري في 73.3% من المرضى هو التصلب اللويحي. واضطراب طيف التهاب العصب البصري في 26.7% من المرضى. كان المرض ثنائياً في 60% من المرضى وأحادي الجانب في 40% من المرضى. بالإضافة إلى ذلك، كان لدى 60% من المرضى نوبتين أو أكثر من التهاب العصب البصري، بينما كان لدى 40% نوبة واحدة. كان لدى المرضى الذين يعانون من التهاب العصب البصري والذين يعانون من حركات العين المؤلمة مدة مرض أطول بشكل ملحوظ ($p=0.032$). علاوة على ذلك، لم يحقق المرضى الذين كانت مدة مرضهم 11–15 يوماً حلاً كاملاً لأعراضهم وعانوا من بعض فقدان البصر المتبقي مقارنة بـ 30.8% ممن عانوا من تغييرات بصرية مستمرة ($p=0.049$).

الخلاصة: في المجموعة السكانية التي تمت دراستها، كان التصلب اللويحي هو السبب الأكثر شيوعاً ل التهاب العصب البصري. وكانت النساء أكثر عرضة للإصابة بالتهاب العصب البصري. كان تشخيص البصر مرتبطاً بشكل كبير بطول التهاب العصب البصري.

Objectives: To investigate the clinical results of optic neuritis (ON) patients in a tertiary medical facility in Makkah, Kingdom of Saudi Arabia.

Methods: The data of patients assessed for ON at Makkah, Saudi Arabia's King Abdullah Medical Center (KAMC), was examined retrospectively.

Results: We identified 15 patients with ON. The ON was caused by multiple sclerosis (MS) in 73.3% of

patients and neuromyelitis optica spectrum disorder (NMOSD) in 26.7% of patients. The disease was bilateral in 60% of patients and unilateral in 40% of patients. Additionally, 60% of patients had 2 or more episodes of ON, whereas 40% had a single episode. Patients with ON who presented with painful eye movements had a significantly longer disease duration ($p=0.032$). Moreover, patients whose disease duration was 11–15 days did not achieve a complete resolution of their symptoms and experienced some residual vision loss compared to 30.8% who had continued visual changes ($p=0.049$).

Conclusion: In the studied population, multiple sclerosis was the most prevalent cause of ON. Women were more likely to have ON. The prognosis for eyesight was substantially connected with the length of ON.

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The optic nerve becomes inflamed and swollen when an optic neuritis (ON) occurs.¹ It is a common neuro-ophthalmological condition that affects 1-4 people per 100,000 people annually globally, with a higher prevalence in young female Caucasian individuals.² Numerous etiologies, including infections and autoimmune illnesses, have been linked by researchers to ON. Nonetheless, the most frequent causes are idiopathic and multiple sclerosis (MS).^{1,2,3} Concerns about prognosis in ON patients include the possibility of MS, ON recurrence, and visual recovery. Usually, ON is characterized by unilateral discomfort when moving the eyes, which is followed by a deterioration of vision. Patients report seeing things that are fainter and duller, with low contrast and darker hues. In nearly all of the patients, the precise moment the symptoms started was determined. Upon examination, visual acuity loss, visual field loss, color vision impairment, afferent pupillary defect, and a normal-appearing fundus in the affected eye are all common findings in patients with ON. Unless the patient has a bilateral condition or a history of optic neuropathy in the other eye, the absence of an afferent pupillary defect should raise diagnostic concerns, because an afferent pupillary defect always occurs in ON if the other eye is uninvolved and otherwise healthy. Additionally, a study in Saudi Arabia showed that acuity and color vision were affected in over 50% of cases. The most useful method for detecting ON is magnetic resonance imaging (MRI), which can directly reveal optic nerve inflammation. Autoimmune serology and CSF analysis offer important insights that help narrow down the differential diagnosis or identify the underlying etiology. ON is a common manifestation of central nervous system (CNS) inflammation. An effective and precise diagnosis of ON may be essential to averting visual loss and subsequent neurological dysfunction, depending on the underlying etiology. Within 15 years following the start of ON, 50% of patients will have MS.⁴ The quality of life of ON and MS sufferers is greatly impacted. Patients who retire early range from 33% to 45%, which puts a financial strain on their family and healthcare facilities.⁵ According to research conducted in Thailand, neuromyelitis optica spectrum disorder (NMOSD) is the second most prevalent cause of ON after idiopathic causes.¹ Prior research in the Al-Qassim area of Saudi Arabia found that 55% of ON patients also had MS.⁶ According to a randomized controlled experiment, there is a relationship between contrast sensitivity, visual acuity effects, and race or ethnicity.⁷ This study aimed to investigate the clinical outcomes of patients with ON, focusing on both treatment and natural progression..

Methods. This descriptive observational study aimed to investigate the association and clinical outcomes of patients with ON. The analysis was conducted from October to March 2023. This study was conducted at the King Abdullah Medical Center (KAMC) in Makkah, Saudi Arabia. It is a nonprofit tertiary and quaternary healthcare organization in the western region of Saudi Arabia. This study was approved by the National BioMedical Ethics Committee of King Abdullah City for Science and Technology 14-07-1433 (Registration no. H-02-K-001) and GCP-ICH regulations (OHRP Registration no. IORG0011096). After King Abdullah Medical City Institutional Review Board (IRB) approval, we retrospectively reviewed the patients' charts in the ophthalmology and neurology outpatient clinics in KAMC and performed ophthalmological evaluations for ON. The inclusion criteria were adults aged >18 years; all patients with confirmed ON diagnosed with KAMC in Makkah, Saudi Arabia; patients with unilateral or bilateral ON with no previous history of central retinal artery occlusion (CRAO), central retinal vein occlusion (CRVO), uveitis, glaucoma, or retinal or corneal pathology. We included all available records for the cases whose medical record information fulfilled the inclusion criteria. The data collection sheet encompassed information on demographic data, ophthalmological examination findings, brain MRI findings, vision and treatment outcomes, and atypical presentations of ON. All data were independently checked and typed into the "EXCEL" sheet. The data were extracted, revised, coded, and then analyzed using the statistical software IBM SPSS version 22 (SPSS, Inc., Chicago, IL). All the statistical analyses were performed using two-tailed tests. We considered $p < 0.05$ to be statistically significant. Descriptive analyses based on frequency and percentage distribution were performed on all variables, including patients' private data, medical history, and ON clinical data, including cause, laterality, and duration. Clinical signs, symptoms, clinical management, and outcomes were tabulated. Cross-tabulation analysis was used to assess the distribution of the patients' ON clinical data by age and disease duration. Relationships were tested using Pearson's chi-square test, and the exact probability test was used for small frequency distributions. Additionally, logistic regression analysis was performed to identify potential predictors of clinical outcomes in ON patients. The results were presented with odds ratios (OR) and 95% confidence intervals (CI).

Results. Overall, 15 patients with complete data who fulfilled the inclusion criteria were enrolled in the study. Ten (66.7%) patients were aged 30 years or

older, 2 (13.3%) were aged 10–20 years, and 3 (20%) were aged 20–30 years. Thirteen (86.7%) patients were women. The vast majority (93.3%) of the patients were Saudis, 14 (93.3%) were nonsmokers, and only one (6.7%) was an ex-smoker. Fourteen (93.3%) patients with ON had chronic health problems (Table 1).

Table 2 shows clinical data on ON among study patients in Saudi Arabia: ON was caused by MS in 11 (73.3%) patients and neuromyelitis optica spectrum disorder (NMOSD) in 4 (26.7%) patients. The disease duration was 11–15 days in 2 (13.3%) patients and more than 25 days in 13 (86.7%) patients. The disease was bilateral in 9 (60%) patients and unilateral in 6 patients. Regarding the number of attacks, 9 (60%) patients had two or more attacks of ON, while 6 (40%) had only one episode.

Table 3 presents the signs and symptoms of ON in the affected patients: Upon acute presentation, 7 (46.7%) patients had relative afferent pupillary defects, 5 (33.3%) had painful eye movements, and 60% had decreased color vision. The optic disc was pale in 6 (40%) patients and blurred in 5 (33.3%) patients. Visual acuity of less than 20/200 was observed in 1 patient (6.7%), visual acuity of 20/200 was seen in 7 (46.7%), and visual acuity of more than 20/200 was seen in 7 (46.7%) patients.

Table 4 shows clinical outcome of ON among study patients: Regarding the outcomes of patients with ON, after two years of regular follow-up, 46.7% of participants had a visual acuity of 20/20, 33.3% of participants had

Table 2 - Clinical data of optic neuritis among study patients in Saudi Arabia

ON clinical data	No	(%)
<i>Cause of the disease</i>		
Multiple Sclerosis	11	(73.3)
Neuromyelitis optica spectrum disorders (NMOSD)	4	(26.7)
<i>Disease duration</i>		
>25 days	13	(86.7)
11-15 days	2	(13.3)
<i>Affected side</i>		
Right	2	(13.3)
Left	4	(26.7)
Bilateral	9	(60.0)
<i>Number of attacks</i>		
One attack of optic neuritis	6	(40.0)
Two or more attacks of optic neuritis	9	(60.0)

Table 3 - Clinical signs and symptoms of optic neuritis among study patients, Saudi Arabia.

Clinical signs/symptoms	No	(%)
<i>Pupillary reaction</i>		
Defective	7	(46.7)
Normal	8	(53.3)
<i>Painful eye movement</i>		
Absent	10	(66.7)
Present	5	(33.3)
<i>Color vision</i>		
Decreased	9	(60.0)
Normal	6	(40.0)
<i>Visual Acuity</i>		
<20/200	1	(6.7)
>20/200	7	(46.7)
20/200	7	(46.7)
<i>Optic disc</i>		
Blurred	5	(33.3)
Normal	4	(26.7)
Pale	6	(40.0)
<i>Brain MRI findings</i>		
Multiple lesions	6	(40.0)
Normal	6	(40.0)
Not done	3	(20.0)

Table 1 - Demographics of the optic neuritis patients, Saudi Arabia.

Personal data	No	(%)
<i>Age in years</i>		
10-20	2	(13.3)
20-30	3	(20.0)
30-40	6	(40.0)
> 40	4	(26.7)
<i>Gender</i>		
Male	2	(13.3)
Female	13	(86.7)
<i>Nationality</i>		
Non-Saudi	1	(6.7)
Saudi Arabian	14	(93.3)
<i>Smoking</i>		
Ex-Smoker	1	(6.7)
No	14	(93.3)
<i>Do you have a history of chronic diseases :</i>		
No	1	(6.7)
Yes	14	(93.3)

improved better than 20/200, and 13.3% complained of a loss of field of vision. Within 2 months of the initial presentation, 26.7% of patients had complete resolution of their symptoms without residual vision loss, 26.7% had continued visual changes (residual loss of vision or reduced color vision), and 20% had reduced color vision. Regarding the treatment received, 53.3% of patients received immunomodulatory drugs, 26.7% were on oral steroids, and 20% had IV steroids.

Table 4 - Clinical outcome of optic neuritis among study patients, Saudi Arabia.

Outcome	No	(%)
Vision outcome in optic neuritis patients		
<20/200, loss of field of vision	1	(6.7)
20/200	7	(46.7)
Improved better than 20/200	5	(33.3)
loss of field of vision	2	(13.3)
Vision prognosis for optic neuritis		
Complete resolution of their symptoms with some residual vision loss	1	(6.7)
Complete resolution of their symptoms without some residual vision loss	4	(26.7)
Continued visual change	4	(26.7)
Reduced color vision	3	(20.0)
Missing	3	(20.0)
Treatment		
Immunomodulating drugs	8	(53.3)
IV steroid	3	(20.0)
Oral steroid	4	(26.7)

This study also found no significant association between age and visual outcomes (Table 5).

Table 6 shows the distribution of patients' ON clinical data, highlighting the varying characteristics and outcomes observed across different disease durations: Precisely 23.1% of patients with ON for more than 25 days had painful eye movement compared to all cases with the disease for 11–15 days with recorded statistical significance ($p=0.032$). The duration of ON had a statistically significant association with the prognosis of the vision, with a recorded p -value of 0.049.

Discussion. The incidence of ON was higher in women in this research. Our results are consistent with those of a prior national population survey, which found that young women had an increased risk of ON and a female-to-male ratio ranging from 1.5:1 to 2.5:1.⁸ According to Braithwaite et al,⁸ there is no direct link between smoking and ON.⁸ It has been demonstrated by several studies and meta-analyses that smoking has a major impact on the development and course of MS. Smoking has been linked to a greater chance of getting MS, a higher likelihood of relapse, and a more severe course of the illness in those who already have MS.⁹ Merely 6.8% of the participants in our research who had verified ON linked to MS had previously smoked. Approximately 93.3% of our patients with ON had chronic health problems, suggesting a possible association with eye health effects.

Lim et al^{10,11} and Tan showed that ON has been linked to MS in 25.5% of patients.^{10,11} The incidence of MS-related ON is reported to be highest among populations in Western Europe and North America, located at higher latitudes, and lowest closer to the equator.¹² Compared to Western cohorts, studies have shown that individuals of Asian descent with ON may have a reduced risk of developing MS.^{11,13} These findings suggest that there may be variations in the risk of developing MS. However, it is essential to note that these findings are based on studies and should not be considered definitive. Further research is warranted to better understand the relationship between ON, ethnicity, and the risk of MS. According to a recent study by Alamgir et al⁶ in Al Qassim, Saudi Arabia, 55% of patients with ON exhibited demyelinating lesions in the brain on MRI; the majority of them acquired MS over time, and the high MS risk and connection are remarkably identical to those of Western Europe and North America.⁶ This demonstrates an increased risk of MS and its association with ON.

In the current study, during 2 years of regular follow-up, we discovered that MS was the underlying cause of ON in 11 (73.3%) patients, while neuromyelitis optica spectrum disorder (NMOSD) was the cause in 4 (26.7%). We discovered that in the MS group, 40% of patients with multiple demyelinating lesions on brain MRI had 2 or more attacks of ON. The MRI revealed abnormalities consistent with brain demyelination in 48.7% of patients in the ON treatment trial group.¹⁴ Compared to the Western cohort, Asians with ON had a lower risk of MS.

In terms of visual results, among ON patients, 46.7% reported having a visual acuity of 20/200, 33.3% reported an improvement to more than 20/200, and 13.3% reported experiencing a loss in field of vision. In contrast to the Alamgir et al. research, the image stayed at 20/200 or worse in 15% of instances, whereas in 85% of cases, vision improved to greater than 20/200. Little is known regarding the severity and recovery from acute ON attacks, despite the large body of data on acute ON gathered from observational research^{15,16} and clinical trials.¹⁷ According to a 2014 study by Malik et al,¹⁸ male sex and the intensity of the attack were independently linked to recovery, but no clinical or demographic component was linked to severity. Recoveries from MS in juvenile patients are noticeably quicker than in adult MS patients. Moreover, there is a correlation between the intensity of an attack and the vitamin D levels measured subsequent to it.¹⁸ Younger patients had a substantially larger proportion of optic disc enlargement than older patients, according to research

Table 5 - Distribution of patients' optic neuritis clinical data by their age, Kingdom of Saudi Arabia.

Clinical data	Age in years				P-value
	< 30 years		> 30 years		
	No	(%)	No	(%)	
<i>Pupillary reaction</i>					
Defective	3	(60.0)	4	40.0)	.464 [§]
Normal	2	(40.0)	6	60.0)	
<i>Painful eye movement</i>					
Absent	3	(60.0)	7	70.0)	.699 [§]
Present	2	(40.0)	3	30.0)	
<i>Color vision</i>					
Decreased	3	(60.0)	6	(60.0)	1.0
Normal	2	(40.0)	4	(40.0)	
<i>Visual Acuity</i>					
<20/200	0	(0.0)	1	(10.0)	.651 [§]
>20/200	3	(60.0)	4	(40.0)	
20/200	2	(40.0)	5	(50.0)	
<i>Optic disc</i>					
Blurred	2	(40.0)	3	(30.0)	.509
Normal	2	(40.0)	2	(20.0)	
Pale	1	(20.0)	5	(50.0)	
<i>Brain MRI findings</i>					
Multiple lesions	2	(40.0)	4	(40.0)	.325 [§]
Normal	3	(60.0)	3	(30.0)	
Not done	0	(0.0)	3	(30.0)	
<i>Number of attacks</i>					
One attack of optic neuritis	1	(20.0)	5	(50.0)	.264
Two or more attacks of optic neuritis	4	(80.0)	5	(50.0)	
<i>Vision consequences in optic neuritis patients</i>					
<20/200, Presence of loss of field of vision	0	(0.0)	1	(10.0)	.596 [§]
20/200	3	(60.0)	4	(40.0)	
Improved better than 20/200	2	(40.0)	3	(30.0)	
Presence of loss of field of vision	0	(0.0)	2	(20.0)	
<i>Vision prognosis for optic neuritis (3 missing cases)</i>					
Complete resolution of their symptoms with some residual vision loss	0	(0.0)	1	(10.0)	.558 [§]
Complete resolution of their symptoms without some residual vision loss	2	(40.0)	2	(20.0)	
Continued visual change	2	(40.0)	2	(20.0)	
Reduced color visio	0	(0.0)	3	(30.0)	
Missing	1	(20.0)	2	(20.0)	

P: Pearson X² test, §: Exact probability test

by Luo et al.¹⁹ On the other hand, older individuals had a much greater incidence of brain plaques than younger ones. The incidence of ocular discomfort, however, did not change in a way that was statistically significant.¹⁹

Regarding clinical data, there was no statistically significant correlation found in the current investigation between the 2 age groups. Furthermore, we discovered that in 61.5% of patients, color vision did not significantly worsen. According to a survey conducted in Al Qassim, Saudi Arabia, by Alamgir et al., 66.7%

of patients showed diminished color vision.⁶ In this study, 30.8% of the patients had no residual vision loss and their symptoms were entirely gone; however, 30.8% still had apparent alterations. In a similar vein, Chinese research found that after an average hospital stay of 12.5±5.3 days, vision loss improved in 85 of the patients before they were discharged.¹³ This study's main drawback was its tiny sample size, which might have an impact on how broadly the results can be applied. Additionally, the study only provides the duration of

Table 6 - Distribution of patients' optic neuritis clinical data by their disease duration, Saudi Arabia.

Clinical data	Disease duration				P-value
	>25 days		11-15 days		
	No	(%)	No	(%)	
<i>Pupillary reaction</i>					
Defective	6	(46.2)	1	(50.0)	.919
Normal	7	(53.8)	1	(50.0)	
<i>Painful eye movement</i>					
Absent	10	(76.9)	0	(0.0)	.032*
Present	3	(23.1)	2	(100.0)	
<i>Color vision</i>					
Decreased	8	(61.5)	1	(50.0)	.756
Normal	5	(38.5)	1	(50.0)	
<i>Visual Acuity</i>					
<20/200	1	(7.7)	0	(0.0)	.921
>20/200	6	(46.2)	1	(50.0)	
20/200	6	(46.2)	1	(50.0)	
<i>Optic disc</i>					
Blurred	5	(38.5)	0	(0.0)	.177
Normal	4	(30.8)	0	(0.0)	
Pale	4	(30.8)	2	(100.0)	
<i>Brain MRI findings</i>					
Multiple lesions	5	(38.5)	1	(50.0)	.364
Normal	6	(46.2)	0	(0.0)	
Not done	2	(15.4)	1	(50.0)	
<i>Number of attacks</i>					
One attack of optic neuritis	5	(38.5)	1	(50.0)	.756
Two or more attacks of optic neuritis	8	(61.5)	1	(50.0)	
<i>Vision consequences in optic neuritis patients</i>					
<20/200, Presence loss of field of vision	1	(7.7)	0	(0.0)	.883
20/200	6	(46.2)	1	(50.0)	
Improved better than 20/200	4	(30.8)	1	(50.0)	
Presence of loss of field of vision	2	(15.4)	0	(0.0)	
<i>Vision prognosis for optic neuritis</i>					
Complete resolution of their symptoms with some residual vision loss	1	(7.7)	0	(0.0)	.049*
Complete resolution of their symptoms without some residual vision loss	4	(30.8)	0	(0.0)	
Continued visual change	4	(30.8)	0	(0.0)	
Reduced color vision	3	(23.1)	0	(0.0)	
Missing	1	(7.7)	2	(100)	

P - Exact probability test, * $p < 0.05$ (significant)

disease in broad categories (11–15 days and >25 days), without any specific details on the exact duration for each case.

Also, the retrospective nature of the study may introduce bias. In our study, optic neuritis (ON) was only observed in multiple sclerosis (MS) and neuromyelitis optica (NMO). Further and more extensive community-based longitudinal studies with larger sample sizes, more specific duration data, and more detailed association requirements are needed to

determine if optic neuritis occurs in other neurological diseases to validate our findings and provide a more comprehensive understanding of ON.

Conclusions. In this study, we discovered that multiple sclerosis (MS) was the most common cause of optic neuritis (ON) in the study population. The ON was more prevalent among female patients. Patients with multiple demyelinating lesions on brain MRI were more likely to experience two or more episodes

of ON. The study concluded that visual outcomes were significantly related to the duration of ON.

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