

Optic Neuritis Associated With Chikungunya Virus Infection in South India

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Objective: To define optic neuritis associated with chikungunya virus (CHIKV) infection in a clinical setting.

Methods: This observational case series includes 14 patients with clinical features of CHIKV infection and associated optic neuritis. Complete ophthalmic evaluations were performed, as well as other examinations, including Mantoux test, Widal test, blood profile, color vision, neuroimaging, visual fields, visual evoked potentials, VDRL test, and enzyme-linked immunosorbent assay for CHIKV-specific immunoglobulin. Relevant clinical findings of optic neuritis associated with seropositive CHIKV infection were recorded.

Results: Nineteen eyes (in 14 patients) had optic nerve involvement. The mean \pm SD patient age was 45.8 ± 15.6 years. Eight eyes (42%) had papillitis, 4 eyes (21%) had

retrobulbar neuritis, 4 eyes (21%) had retrochiasmal (optic tract) neuritis, and 3 eyes (16%) had neuroretinitis. Parenteral corticosteroids were administered in all patients. Color vision, visual fields, and best-corrected visual acuity of 6/12 (or 20/40 Snellen visual acuity) or better improved statistically significantly by the end of 3 weeks ($P < .001$). Partial to complete recovery of visual function was seen in 10 patients (71%). Four patients had a poor visual outcome; 3 of them were initially seen 1 month after onset of ocular symptoms.

Conclusions: Acute-onset visual loss due to optic neuritis may be associated with CHIKV infection. Visual recovery is good. Corticosteroids accelerated recovery when initiated at an early stage of the disease.

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CHIKUNGUNYA VIRUS (CHIKV), an arbovirus, is an important human pathogen responsible for disease characterized by acute febrile illness and crippling joint pain. It is spread by the bite of an infected mosquito. Its name is derived from the Swahili word meaning "that which bends up" in reference to the stooped posture that develops as a result of the arthritic symptoms of the disease, first detected in a febrile human resident of Tanzania in 1953.¹ Since then, the virus has been associated with many epidemics in tropical regions of Africa, South Asia, and South America.² In Africa, the virus is maintained through a sylvatic transmission cycle between wild primates and mosquitoes such as *Aedes luteocephalus*, *Aedes furcifer*, and *Aedes taylori*. In Asia, CHIKV is transmitted among humans primarily by *Aedes aegypti* and to a lesser extent by *Aedes albopictus* through an ur-

ban transmission cycle.^{2,3} Large-scale outbreaks of fever caused by CHIKV in Indian Ocean territories during 2005 and 2006 confirmed the reemergence of the virus.^{3,4} Isolated cases of infection are also seen among individual residents of non-endemic countries who travel to affected regions.^{5,6}

Chikungunya virus infection is characterized by acute-onset fever, headache, rash, low backache, nausea, vomiting, myalgia, and arthralgia (with or without swelling, usually of smaller joints).³ Rarely, neurological complications such as meningoencephalitis have been reported (eg, during the first Indian outbreak in 1972 and in the 2005-2006 French Réunion island outbreak⁴). To our knowledge, optic nerve inflammation (termed *optic neuritis* hereafter) associated with CHIKV illness is not mentioned in the literature (via a MEDLINE search). We identified cases of papillitis, neuroretinitis, retrobulbar neuritis, and optic

Table 1. Ocular and Systemic Features Among 14 Patients With Chikungunya Virus Infection–Associated Optic Neuritis at the Initial Visit^a

Variable	Value
Age, y	45.8 ± 15.6 (22-68)
Sex	
Male	9 (64.3)
Female	5 (35.7)
Systemic illness	
Diabetes mellitus	3 (21.4)
Hypertension	3 (21.4)
Cardiac disease	1 (7.1)
Alcoholism and smoking	1 (7.1)
Systemic features of primary infection among patients (n = 14)	
Fever	14 (100.0)
Joint pain	14 (100.0)
Body ache	4 (28.6)
Headache	4 (28.6)
Loss of consciousness	1 (7.1)
Vomiting	1 (7.1)
Hematuria	1 (7.1)
Period of systemic illness, d	10.5 ± 15.5 (2-60)
Symptom-free period, d	11.0 ± 14.0 (0-49)
Duration of ocular symptoms, d	13.0 ± 16.3 (1-60)
Ocular symptoms	3 (21.4)
Bilateral	5 (35.7)
Unilateral	9 (64.3)
Among eyes (n = 19)	
Blurred vision	19 (100.0)
Diplopia	1 (5.3)
Redness	1 (5.3)
Pain	3 (15.8)
Inability to close eyes	2 (10.5)
Best-corrected visual acuity (n = 19) ^b	
6/6-6/12	3 (15.8)
6/18-6/60	5 (26.3)
<6/60	11 (57.9)
Clinical features of ocular disease (n = 19)	
Abnormal pupillary reactions	14 (73.7)
Papillitis	8 (42.1)
Retrobulbar neuritis	4 (21.1)
Retrochiasmal neuritis	4 (21.1)
Neuroretinitis	3 (15.8)
Bilateral external ophthalmoplegia	1 (5.3)
Facial weakness	2 (10.5)
Exposure keratopathy	1 (5.3)
Hemiparesis	1 (5.3)
Color vision defect	17 (89.5)
Field defects (n = 19)	
Central	6 (31.6)
Peripheral	4 (21.1)
Central and peripheral	9 (47.4)
Lymphocytosis	6 (42.8)
Visual evoked potentials, mean P100 latency, ms	
Affected eyes	114.5 ± 14.4 (95.2-140)
Normal eyes	95.6 ± 2.0 (92.8-99)

^aData are given as mean ± SD (range) or as number (percentage).

^bThe equivalent Snellen visual acuities are as follows: 6/6 to 6/12 (20/20 to 20/40), 6/18 to 6/60 (20/60 to 20/200), and less than 6/60 (<20/200).

tract inflammation (termed *retrochiasmal neuritis*) in serologically CHIKV-positive patients during the 2006 outbreak of the disease in South India. In this article, the clinical characteristics of eyes with optic neuritis secondary to CHIKV infection are presented.

This observational case series includes 14 patients with a history of acute-onset fever and joint pain of varying severity initially seen with clinical features suggestive of optic neuritis in the months of September and October during the 2006 outbreak of CHIKV infection among the South Indian population. After obtaining informed consent, a complete ophthalmic examination (including best-corrected visual acuity at j6 m) was performed, as well as intraocular pressure by applanation tonometry, indirect ophthalmoscopy of the dilated fundus, slitlamp biomicroscopy of the anterior and posterior segments, and color vision and visual field examination (Humphrey visual field analysis if possible or Bjerrum field test). Visual evoked potentials and neuroimaging tests were performed at the initial visit to assist in diagnosis. Complete blood profiles, platelet counts (for dengue), Widal test (for typhoid fever), peripheral blood smear for malaria, tuberculin syringe test (Mantoux test for tuberculosis), and VDRL test (for syphilis) were also performed.

For confirmation of the clinical diagnosis of CHIKV infection, blood samples of all patients were investigated for CHIKV-specific serum IgM antibodies using IgM antibody capture enzyme-linked immunosorbent assay at the National Institute of Virology, Pune, Maharashtra, India. Chikungunya virus infection was diagnosed if the patient had acute-onset fever with joint pain of varying severity, positive anti-CHIKV IgM antibodies in serum, and negative test results for dengue, typhoid, malaria, and tuberculosis. All patients having confirmed diagnoses of CHIKV infection and optic neuritis were included in the study.

All patients were advised to undergo treatment with 1000 mg/d of intravenous methylprednisolone in divided doses for 3 days, followed by 1 mg/kg of body weight daily of oral prednisolone for 14 days, with tapering of the corticosteroid dose over 4 weeks. Visual function (color vision, visual fields, and best-corrected visual acuity) was recorded at the initial visit, at the end of 3 days of therapy, and 3 weeks after the initiation of therapy.

Completed data forms were prepared to describe the characteristics of optic neuritis at the initial visit and during follow-up. Data were analyzed using commercially available software (Excel 2002; Microsoft Corp, Redmond, Washington), and results are given as percentages, means, and standard deviations. Pretreatment and posttreatment visual function was assessed using the χ^2 test. This study was conducted at a site that has no institutional review board or ethics committee, but prior consent from the hospital advisory board and informed consent from all study patients were obtained.

RESULTS

Fifteen patients with a history of fever and joint pain (probable CHIKV infection) and optic neuritis were investigated for CHIKV serology. Fourteen of these patients were positive for CHIKV-specific immunoglobulin; the cause of the remaining case remains unknown. Clinical features of these 14 patients are detailed herein.

DEMOGRAPHICS

The study included 9 male and 5 female patients (**Table 1**). All patients were of Indian origin. The ages ranged from 22 to 68 years (mean ± SD age, 45.8 ± 15.6 years), with no age differences between male and female patients ($P = .73$).

CHARACTERISTICS OF SYSTEMIC ILLNESS (CHIKV)

All 14 patients had acute-onset fever and joint pain at a mean±SD of 32.4±17.2 days (range, 12-60 days) before their initial visit at our institution (**Table 2**). Other symptoms included headache, body ache, vomiting, bladder disturbance, and loss of consciousness. The primary illness lasted a mean±SD of 10.5±15.5 days (range, 2-60 days).

OCULAR SYMPTOMS

Patients were initially seen with reports of blurred vision after a mean±SD of 11.0±14.0 days (range, 0-49 days) of a symptom-free period (Table 1). Nineteen eyes of 14 patients were affected. Five patients (36%) described visual symptoms in both eyes. The mean±SD duration of ocular complaints at the initial visit was 13.0±16.3 days (range, 1-60 days). Five patients had ocular symptoms overlapping with the course of initial systemic illness.

OCULAR FEATURES

Best-corrected visual acuity varied from 6/6 (or 20/20 Snellen visual acuity) to counting fingers (median, 5/60 [or 20/240 Snellen]) (**Figure** and Tables 1 and 2). Eleven eyes (58%) of the 19 eyes had vision less than 6/60 (or 20/200 Snellen) at the initial visit. Fourteen eyes had abnormal pupillary reactions. Relative afferent pupillary defect was seen in all unilateral cases. Disc edema was seen in 11 eyes (58%) of 9 patients (2 cases were bilateral); 3 of them had incomplete macular star appearance on ophthalmoscopy, suggesting a diagnosis of neuroretinitis, and the remaining ones were diagnosed as papillitis. Patient 3 (Table 2) with papillitis also had ipsilateral facial palsy with exposure keratitis, and patient 4 had sensory neural deafness. Retrobulbar neuritis was suspected in 4 eyes (21%) of 3 patients (1 patient had bilateral involvement). Patient 13 with retrobulbar neuritis also had bilateral external ophthalmoplegia, left-sided hemiparesis, and upper motor neuron type of facial palsy, suggesting generalized involvement. Two patients at the initial visit had bilateral visual field defect suggestive of retrochiasmal involvement. One of these patients (patient 2) had left incongruous homonymous hemianopia with macular sparing (right optic tract lesion), and the other one (patient 10) had right incongruous homonymous hemianopia with macular involvement (suggestive of left optic tract lesion).

Color vision on Ishihara charts was defective in all patients except patient 2 (in Table 2). Central field testing revealed central or centrocecal scotoma in 6 eyes (32%) and peripheral field defect in 4 eyes (21%); 4 eyes (21%) had visual field defect involving both peripheral and central areas, and the remaining 5 eyes (26%) had poor fixation to the visual target. Visual evoked potentials at the initial visit showed a statistically significant delay in latency in eyes with defective vision (mean±SD P100 latency, 114.5±14.4 milliseconds; $P<.001$). Latency was also statistically significantly delayed in affected eyes with

unilateral disease compared with the contralateral normal eye ($P=.02$). Results of computed tomography and magnetic resonance imaging of the brain at the initial visit were normal for all patients.

INVESTIGATIONS

Complete blood profile results were normal in all patients except for 6 patients (43%) who had mild lymphocytosis. Mantoux test, Widal test, and VDRL test results were negative, and all patients had positive anti-CHIKV IgM antibodies in serum samples.

OUTCOMES AND PROGNOSIS

All except patients 3, 8, 13, and 14 had improvement in visual function following administration of methylprednisolone (Table 2 and **Table 3**). Patient 2 with retrochiasmal neuritis refused intravenous medication; he was given oral corticosteroids (1 mg/kg of prednisolone daily for 14 days initially and then in tapering doses). Patient 13 defaulted follow-up after receiving parenteral methylprednisolone. At the end of 3 weeks, 12 eyes had visual acuity of at least 6/12 (or 20/40 Snellen) ($P<.001$); 3 eyes had no improvement in their initial visual acuity. Color vision returned to normal in 13 eyes and visual fields improved in 9 eyes ($P<.001$ for both). Disc pallor (secondary to optic atrophy) developed in 10 eyes, of which 1 eye had disc edema in a stage of resolution.

COMMENT

Chikungunya virus is a member of the *Alphavirus* genus of the family *Togaviridae*. The genus *Alphavirus* represents a group of enveloped viruses with a single-stranded plus-sense RNA genome. This genus has more than 40 known members that share a minimum amino acid sequence identity of about 45% in the more divergent structural proteins and about 60% in the nonstructural proteins. Eastern equine encephalomyelitis, western equine encephalomyelitis, Venezuelan equine encephalomyelitis, and Ross River viruses are other members of this genus. They are classified as arboviruses because they are maintained in nature by a biological transmission cycle between susceptible vertebrate hosts and hematophagous arthropods, usually ticks and mosquitoes.⁷

Chikungunya virus is geographically distributed in Africa, India, and Southeast Asia. Chikungunya virus was recognized as producing a self-limiting disease characterized by fever and arthralgia but, during the 2005-2006 epidemic, severe infection associated with multiorgan failure, acute hepatic failure, central neurological involvement, neonatal infection (transplacental or mosquito borne), and death was observed.⁷ This change in disease characteristics is probably due to the evolution in viral structural and nonstructural proteins reported in the East African CHIKV responsible for this epidemic.⁸⁻¹⁰

The pattern of visual sensory system involvement in our CHIKV-infected patients was variable. Twelve patients had optic nerve involvement in the form of papillitis, retrobulbar neuritis, or neuroretinitis. Features suggestive of

Table 2. Demographics and Ocular and Systemic Features Among 14 Patients With CHIKV Infection–Associated Optic Neuritis^a

Patient No./ Sex/ Age, y	Features of CHIKV Infection	Duration of Initial Illness/ Symptom-Free Period/Duration of Ocular Symptoms, d	Ocular Symptoms	Eye	Visual Acuity (Snellen)	Clinical Features	Fundus Features	Visual Field Defect	Visual Evoked Potentials, Mean P100 Latency, ms	Diagnosis	Features at Day 21 of Treatment
1/M/32	Fever, joint pain	2/14/4	Defective vision	OD	6/36 (20/120)	RAPD	Disc edema	Central scotoma	115	Papillitis	OD 6/6 (20/20 Snellen), CV normal, VF normal, disc pallor
2/M/46	Fever, joint pain, headache, body ache	3/5/4	Defective left side vision	OD, OS	6/6, 6/6 (20/20 for both)	Normal	Normal	Left incongruous homonymous hemianopia with macular sparing	...	Right optic tract demyelination	OU 6/6 (20/20 Snellen), CV normal, VF normal, disc normal
3/M/68	Fever, joint pain, body ache	10/10/30	Defective vision, inability to close eyes	OD	Perception of light	Exposure keratitis, RAPD, Bell palsy	Disc edema, disc pallor	Poor fixation to test fields	140	Papillitis with seventh cranial nerve palsy	OD FC, CV defective, VF no fixation, disc atrophy
4/F/50	Fever, joint pain, headache, vomiting	10/10/10	Defective vision	OD, OS	2/60, 2/60 (20/600, 20/600)	RAPD, APD, sensory neural deafness	Disc edema, disc hemorrhage	Poor fixation to test fields	118, 134	Papillitis	OD 6/9 (20/30 Snellen), OS 6/12 (20/40 Snellen), CV normal, VF constriction of fields, disc pallor
5/F/25	Fever, joint pain, headache	3/7/7	Defective vision, pain	OS	5/60 (20/240)	RAPD	Normal	Centrocecal scotoma	100.8	RBN	OD 6/6 (20/20 Snellen), CV normal, VF normal, disc normal
6/F/50	Fever, joint pain	2/21/7	Defective vision	OD	2/60 (20/600)	RAPD	Disc edema, disc hemorrhage, macular star	Constriction of fields	134.4	Neuroretinitis	OD 6/24 (20/80 Snellen), CV normal, VF inferior altitudinal defect, disc pallor
7/F/27	Fever, joint pain	7/20/3	Defective vision	OD	5/60 (20/240)	RAPD	Disc edema, disc hemorrhage, ILM folds	Centrocecal scotoma	104	Papillitis	OD 6/6 (20/20 Snellen), CV normal, VF normal, disc normal
8/M/66	Fever, joint pain	4/49/7	Defective vision	OS	1/60 (20/1200)	RAPD	Disc edema, disc hemorrhage, macular star	Nasal sectoral defect involving macula	110.8	Neuroretinitis	OS 1/60 (20/1200 Snellen), CV defective, VF nasal sectoral defect involving macula, disc pallor
9/M/56	Fever, joint pain, body ache	60/0/5	Defective vision	OD	6/12 (20/40)	RAPD	Disc edema, macular star	Inferior altitudinal defect	127.2	Neuroretinitis	OD 6/6 (20/20 Snellen), CV normal, VF inferior defect, disc resolving edema and pallor
10/M/37	Fever, joint pain, headache	14/0/1	Defective right side vision, floaters	OD, OS	6/24, 6/24 (20/80 for both)	Normal	Normal	Right incongruous homonymous hemianopia with macular loss	...	Left optic tract demyelination	OU 6/6 (20/20 Snellen), CV normal, VF normal, disc normal
11/M/22	Fever, joint pain, hematuria	2/6/7	Defective vision	OD, OS	FC	Dilated, not reacting	Disc edema	Poor fixation to record vision	95.2, 95.6	Papillitis	OD 6/6 (20/20 Snellen), OS 6/9 (20/30), CV normal, VF normal, disc normal
12/F/66	Fever, joint pain	5/18/7	Defective vision	OS	5/60 (20/240)	Posterior chamber intraocular lens, RAPD	Disc edema, disc hemorrhage	Centrocecal scotoma	110.4	Papillitis	OD 6/36 (20/120 Snellen), CV defective, VF central scotoma, disc pallor
13/M/55	Fever, joint pain, headache, loss of consciousness	3/0/30	Defective vision, diplopia	OD	3/60 (20/400)	External ophthalmoplegia, RAPD, left hemiparesis, Bell palsy	Normal	Constriction of fields	118.2	RBN with seventh nerve palsy and bilateral external ophthalmoplegia	OD 4/60 (20/300 Snellen) on day 3, no follow-up thereafter
14/M/41	Fever, joint pain, headache, body ache	15/0/60	Defective vision	OD, OS	6/36, 6/36 (20/120 for both)	RAPD, APD	Normal	Central scotoma	100.0, 113.6	RBN	OU 6/36 (20/120 Snellen), CV defective, VF central scotoma, disc pallor

Abbreviations: APD, afferent papillary defect; CHIKV, chikungunya virus; CV, color vision; DM, diabetes mellitus; FC, finger counting close to face; HT, hypertension; ILM, internal limiting membrane; RAPD, relative afferent papillary defect; RBN, retrobulbar neuritis; VF, visual field.

^aAll patients, except patient 2, had a color vision defect.

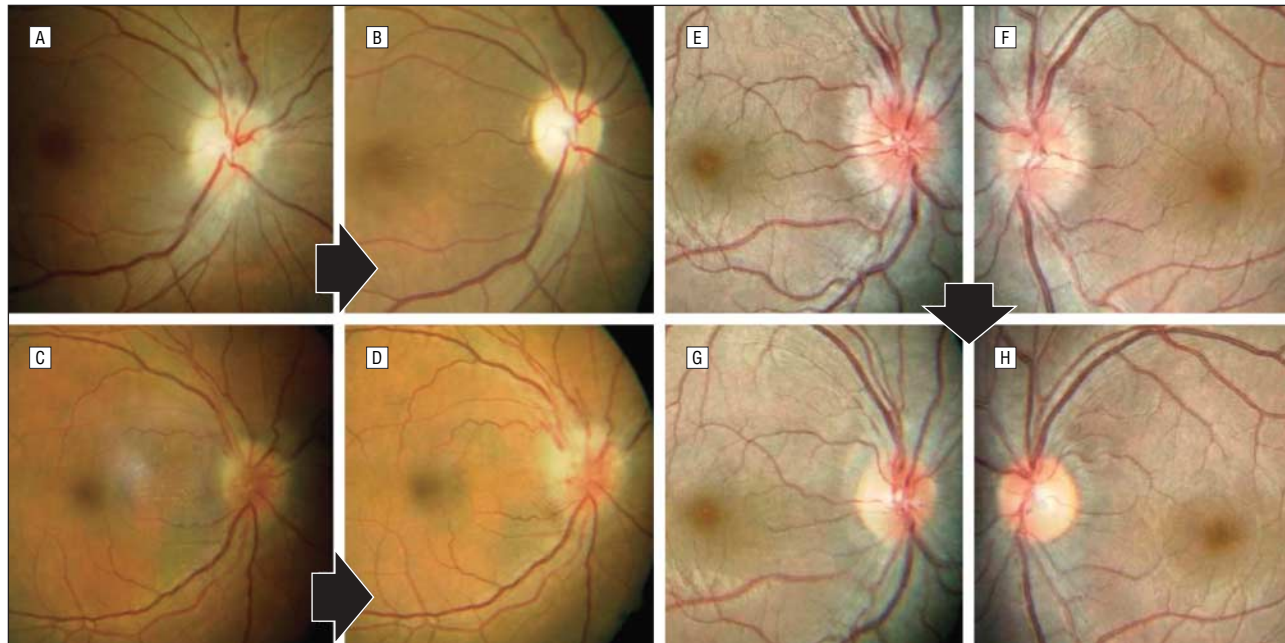


Figure. Pretreatment (bottom of arrowhead) and posttreatment (tip of arrowhead) fundus views of patients 6 (A and B) and 9 (C and D) with neuroretinitis and patient 11 (E through H) with bilateral papillitis. In the pretreatment views, disc edema (A, C, E, and F), flame-shaped hemorrhages (A), and an incomplete macular star (A and C) are evident. With administration of intravenous methylprednisolone, the disc edema, hemorrhages, and exudates decreased (B, D, G, and H) with development of disc pallor (B and D).

Table 3. Outcomes Among 19 Eyes With Chikungunya Virus Infection–Associated Optic Neuritis^a

Variable	Initial Visit (n=19)	Day 3 of Treatment (n=19)	Day 21 of Treatment (n=18)	P Value ^b
Best-corrected visual acuity ^c				
6/6-6/12	15.8	47.4	66.7	<.001
6/18-6/60	26.3	21.1	22.2	
<6/60	57.9	31.6	11.1	
Color vision				
Normal	10.5	...	72.2	<.001
Defective	89.5	...	27.8	
Central fields				
Normal	0	...	50.0	<.001
Defective	100.0	...	50.0	
Disc pathologic findings	57.9	...	55.6	.74

^aData are given as percentages.

^b χ^2 Test between initial visit and day 21 of treatment.

^cThe equivalent Snellen visual acuities are as follows: 6/6 to 6/12 (20/20 to 20/40), 6/18 to 6/60 (20/60 to 20/200), and less than 6/60 (<20/200).

optic tract involvement were also seen in 2 patients. The rare occurrence of bilateral papillitis and retrobulbar neuritis was also noted. None of the patients had clinical evidence suggesting optic chiasma involvement.

The exact mechanism of optic nerve involvement following CHIKV infection is unknown. Simultaneous onset of systemic and ocular disease in 5 patients (36%) suggests direct viral involvement. The remaining 9 patients (64%) had late optic nerve involvement, suggesting a delayed immune response (postviral infection). Potential immune mechanisms may be similar to those seen in encephalitis; these include immune dysregulation, superantigen induction, hypersensitivity reaction, direct result of the infection, and molecular mimicry between stimulating virus-derived antigens and normal or altered host tis-

sue proteins.^{11,12} Several characteristics indicate the possibility of an autoimmune mechanism in the pathogenesis of the disease, including delay in onset, partial recovery of disc changes, bilateral involvement in a few patients, and good response to corticosteroid therapy. The involvement of other nerves (in patients 3, 4, and 13) suggests generalized disease secondary to CHIKV infection.

Although an infection by a virus is an important cause of optic neuritis, other organisms and metabolic disturbances are implicated in its cause and pathogenesis.¹³ Infections such as syphilis, tuberculosis, leptospirosis, and toxoplasmosis prevalent in this region are other important causes associated with optic neuritis. Viruses such as dengue, mumps, measles, varicella zoster, and West Nile are also associated with optic neuritis.¹⁴⁻¹⁷ Clues observed

in the history, examination, and investigative profile may assist in the diagnosis. Dengue infection is endemic in our region; a close resemblance of its clinical symptoms with those of CHIKV infection makes it mandatory to distinguish between the 2 conditions.¹⁷ Clinically, dengue infection is associated with abrupt onset of fever with macular or maculopapular rash and blood dyscrasias (thrombocytopenia and neutropenia). Features of dengue shock syndrome (hypotension, circulatory failure, and narrowing of pulse pressure [to < 20 mm Hg]) are not observed with CHIKV infection. The absence of dermatological signs and thrombocytopenia in our patients helped us establish the diagnosis of CHIKV infection.

Confirmation of CHIKV infection can be performed by reverse transcriptase–polymerase chain reaction or by virus isolation.¹⁸ These are rapid confirmatory tests of choice if the illness is of less than 4 days' duration. Beyond 4 days, diagnosis is possible only with detection of CHIK-specific IgM in patient serum.¹⁹ Because all patients in our study were initially seen after 4 days of initial symptoms, serum samples were investigated for CHIKV-specific IgM. The presence of acute-onset fever with joint pain, negative test results for other common organisms, travel to a CHIKV epidemic area, and positive serology tests for CHIKV helped in confirming the diagnosis.

The overall prognosis in terms of visual acuity, color vision, and visual fields was good. Three-fourths of our study patients had improved visual function. Evidence from the Optic Neuritis Treatment Trial^{20,21} suggests that administration of intravenous corticosteroids can accelerate the recovery of visual symptoms but cautions that corticosteroid therapy may not have a substantial role in the final outcome (at the end of 1 year) in terms of visual recovery in acute-onset demyelinating or idiopathic optic neuritis.^{20,21} We administered parenteral corticosteroids (intravenous followed by oral) in our patients and noted that 91% (10 of 11) of patients who were initially seen within 10 days of onset of ocular symptoms had improved visual function; this improvement was seen even at day 3 after initiation of corticosteroid therapy. Three patients in whom treatment was initiated 1 month after onset of visual symptoms had no visual improvement. This suggests that corticosteroid therapy can assist in rapid recovery of visual function if administered in patients with acute presentation of optic neuritis but possibly has no role when treatment is initiated at a late stage of the disease. Development of disc pallor in half of the eyes indicates that some amount of permanent damage occurs in most patients even if they have good visual recovery.

In conclusion, optic neuritis associated with CHIKV infection is primarily an acute-onset inflammatory reaction of the optic nerve. Corticosteroid therapy accelerates the recovery of visual function if administered at the early stage of the disease. Chikungunya virus infection should be an important component of the differential diagnosis in individuals with optic neuritis who reside in tropical regions and in travelers from nonendemic regions to the epidemic areas.

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