

ABSTRACT

Aims: To determine the frequency of defective visual functions in patients with dengue fever and to determine the association of age and duration of dengue fever with changes in visual functions.

Study Design: Cross-sectional study.

Duration and Setting of Study: Six months (from September 2017 to February 2018) at department of medicine, Hayatabad Medical Complex, Peshawar.

Methods: Using non-probability sampling technique, two hundred and eighteen eyes of 109 patients, admitted in hospital due to dengue fever, were included in this study. Visual functions of the patients with dengue fever were recorded. LogMAR chart for visual acuity, confrontation test for visual fields, Amsler Grid for central field, Pelli-Robson Chart for contrast sensitivity and Farnsworth D-15 Test for color vision were used. Descriptive statistics were calculated and association among the variables were analyzed through chi-square test.

Results: Out of total 109 patients, 69 (63.3%) were male. The mean age was 31.27 ± 12.18 years. Mean visual acuity of the study participants was 0.23 ± 0.25 LogMAR units. Visual field defects were found in 25 (11.47%) and Amsler Grid central field defects were detected in 36 (16.51%) eyes, while 101 (46.33%) had contrast sensitivity of 1.05-1.65 log units. Regarding color vision, 40 (18.34%) eyes had Tritan defects while 24 (11.01%) had no pattern. There was a significant association found between age and impaired visual acuity ($p < 0.001$).

Conclusion: Majority had impaired contrast sensitivity and almost half of the subjects had impaired visual acuity, visual fields and color vision.

Keywords: Dengue Fever, Visual Disorders, Visual Acuity, Visual Fields, Contrast Sensitivity, Color Vision.

INTRODUCTION

Dengue fever is caused by a Flavivirus called dengue virus (DENV) and has been a serious public health concern in recent decades.¹ Furthermore, it has been recognized as a "neglected tropical disease".² Recently, the incidence has climbed by 30 times with 400 million people affected worldwide and 22,000 deaths each year.^{1,3} Dengue infection is often undetectable in humans. DENV is a positive stranded RNA-containing flavivirus of the species Dengue virus. It belongs to genus Flavivirus and family Flaviviridae. The mosquitoes *Aedes aegypti* and *Aedes albopictus* are the major vectors. DENV has four antigenically different serotypes (1, 2, 3, and 4) that have been found all over the world. In 2007, a newly found fifth serotype (DENV-5) was discovered in the blood of a patient in Malaysia.⁴ Dengue fever (DF) is a systemic and progressive disease with a wide range of clinical symptoms ranging from mild to severe. The disease can be categorized into three phases after an incubation

period: febrile, critical, and recovery. Patients experience a rapid high-grade fever that lasts 2–7 days, along with facial flushing, skin erythema, headache, body pains, muscles pain, arthralgia, acute retro-orbital discomfort, and other symptoms include nausea, vomiting, anorexia, sore throat, injected pharynx, and conjunctivitis. In fever phase, it is hard to distinguish between dengue symptoms and those of other non-dengue febrile illnesses and it is hard to differentiate between severe and non-severe dengue cases.⁵ Currently, dengue fever has no specific treatment or drugs that are approved by the US Food and Drug Administration (FDA). The current treatment choices are supportive, with the goal of limiting complications and symptom severity. Fluid therapy is one of the most important treatments for dengue fever. For DF, oral fluid replacement is sufficient; however, for shock protection, intravenous fluid replacement is recommended.⁶

Apart from systemic infections, these pathogens have been associated with numerous ocular problems. Dengue eye disease can be unilateral or bilateral, and the commencement of ocular symptoms can occur somewhere between 2 to 5 days following the onset of fever. Majority of ocular symptoms occurring within one day of the peak thrombocytopenia. The main ocular symptoms include eye pain, retro-orbital pain, blurring of

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vision, foreign body sensation, diplopia, floaters, photopsia, and metamorphopsia.⁷⁻¹⁰ The most common of which are conjunctivitis, subconjunctival hemorrhages, uveitis, and disorders of the posterior segment of the eye (e.g. choroiditis, retinitis, chorioretinal atrophy, macular mottling).¹¹ In patients with maculopathies, macular edema and macular hemorrhage are prevalent findings.¹² Retinal vasculopathy and macular edema, poses a major threat to vision.¹³ Dengue-associated maculopathy (DAM) has an uncertain prognosis. The visual restoration is usually excellent and DAM has previously been documented to recover spontaneously.¹⁴ Visual recovery process may take longer in some cases, and scotomata may persist for up to two years.¹⁵

The dengue virus, which has a high mortality rate, can also cause blindness and ample evidence exist about the ability of this virus to impair the vision.¹⁶ Therefore, it has been hypothesized that dengue may affect visual functions of the patients. Visual functions may also be affected by age, platelets count and duration of dengue occurrence. Therefore, this study was designed to determine the effect of dengue fever on visual functions.

METHODS

A descriptive cross-sectional study design was adopted to conduct this study. Non-probability sampling technique was used and the patients were recruited from the department of medicine at Hayatabad Medical Complex Peshawar over 6 months. Patients diagnosed with dengue, age 15 years and above, and of either sex were included. Patients having ocular or systemic diseases that affect visual functions like cataract, glaucoma, macular degeneration, optic neuropathy, retinal detachment, diabetes mellitus, hypertension, AIDS, Grave's disease, sarcoidosis, systemic lupus erythematosus, rheumatoid arthritis, atherosclerosis, sickle cell disease and multiple sclerosis were excluded from the study. An informed consent was

taken from each participant fulfilling the inclusion criteria before recruitment. The participants were informed about the aims and objectives and salient features of the protocol. A semi-structured proforma was used to collect the data. Assessment of visual functions such as visual acuity, visual fields, contrast sensitivity and color vision were conducted. Visual acuity (VA) was taken through LogMAR visual acuity chart at a standard distance. After VA assessment, visual field was done through confrontation method and Amsler Grid chart. Pelli_Robson contrast sensitivity chart was used for assessing contrast sensitivity and color vision was evaluated via Farnsworth D-15 Test. Before starting the test, patients were guided about the procedure of the test.

Data was analyzed using IBM- SPSS (Statistical Package for Social Sciences) version 20.0. Statistical tests applied were descriptive percentages and frequencies for categorical variables and P-values were generated using chi-square test for comparison of categorical variables.

RESULTS

Out of total 109 patients recruited, 69 (63.3%) were male and 76 (69.72%) belonged to 15-35 years age group. When analyzed for visual acuity, 99 out of 218 (45.41%) eyes had some degree of visual impairment and among them 73 (33.5%) eyes had mild visual impairment. Most of the eyes, 199 (91.3%), had some degree of contrast sensitivity loss and among them 19 (8.7%) had severe loss. Amsler Grid examination revealed that 36 (16.5%) eyes had central visual field defects. Similarly, color vision defects were found in 71 (32.5%) eyes with tritan defect the most common abnormality that was found in 40 (18.3%) eyes. Confrontation visual fields examination showed that 13 (12%) had visual field defects. Table 1 shows the association between visual functions and different age groups and table 2 shows the association between visual functions and duration of dengue fever.

Table 1: Association between age groups and visual functions (n=218)

S. No.	Visual Functions		Age Groups			Total n(%)	p-value
			15-35 years, n(%)	36-55 years, n(%)	>55 years, n(%)		
1.	Visual Acuity	Normal	100 (84.03)	19 (15.9)	0 (0)	119 (100)	<0.001
		Mild	41 (56.16)	28 (38.36)	4 (5.48)	73 (100)	
		Moderate	9 (37.5)	9 (37.5)	6 (25)	24 (100)	
		Severe	2 (100)	0 (0)	0 (0)	2 (100)	
		Total	152 (69.72)	56 (25.69)	10 (4.59)	218 (100)	
2.	Confrontation Test (Visual Field)	Normal	143 (74.1)	41 (21.24)	9 (4.66)	193 (100)	0.006
		ST Defect	1 (20)	4 (80)	0 (0)	5 (100)	
		SN Defect	3 (37.5)	5 (62.5)	0 (0)	8 (100)	
		IT Defect	1 (25)	2 (50)	1 (25)	4 (100)	
		IN Defect	3 (75)	1 (25)	0 (0)	4 (100)	
		IT & IN Defect	1 (100)	0 (0)	0 (0)	1 (100)	
		SN & IN Defect	0 (0)	2 (100)	0 (0)	2 (100)	
		ST & IN Defect	0 (0)	1 (100)	0 (0)	1 (100)	
		Total	152 (69.72)	56 (25.69)	10 (4.59)	218 (100)	
3.	Amsler Grid (Visual Field)	Normal	130 (72.53)	45 (24.73)	7 (3.85)	182 (100)	0.33
		Abnormal	22 (61.11)	11 (30.55)	3 (8.33)	36 (100)	
		Total	152 (69.72)	56 (25.69)	10 (4.59)	218 (100)	
4.	Contrast Sensitivity	0.00-0.45	6 (31.58)	5 (26.32)	8 (42.1)	19 (100)	<0.001
		>0.45-1.05	46 (58.23)	31 (39.24)	2 (2.53)	79 (100)	
		>1.05-1.65	83 (82.18)	18 (17.82)	0 (0)	101 (100)	
		>1.65-2.25	17 (89.47)	2 (10.53)	0 (0)	19 (100)	
		Total	152 (69.72)	56 (25.69)	10 (4.59)	218 (100)	
5.	Color Vision	Normal	112 (75.68)	32 (21.62)	4 (2.7)	148 (100)	<0.001
		Protan Defect	0 (0)	2 (100)	0 (0)	2 (100)	
		Deutran Defect	4 (100)	0 (0)	0 (0)	4 (100)	
		Tritan Defect	16 (40)	18 (45)	6 (15)	40 (100)	
		No Matching	20 (83.33)	4 (16.67)	0 (0)	24 (100)	
		Total	152 (69.72)	56 (25.69)	10 (4.59)	218 (100)	

n = frequency, % = percentage, ST = superotemporal, SN = superonasal, IT = inferotemporal, IN = inferonasal

Table 2: Association between visual functions and duration of dengue fever (n=218)

S. No.		Visual Functions	Duration of Dengue Fever in Days			Total n (%)	P- Value	
			1-3 years n (%)	4-7 years n (%)	8-15 years n (%)			
1.	Visual Acuity	Normal	10 (8.4)	79 (66.39)	30 (25.21)	119 (100)	0.076	
		Mild	11 (15.07)	55 (75.34)	7 (9.59)	73 (100)		
		Moderate	5 (20.83)	16 (66.67)	3 (12.5)	24 (100)		
		Severe	0 (0)	2 (100)	0 (0)	2 (100)		
		Total	26 (11.93)	152 (69.72)	40 (1.83)	218 (100)		
2.	Confrontation Test (Visual Field)	Normal	25 (12.95)	129 (66.84)	39 (20.21)	193 (100)	0.793	
		ST Defect	1 (20)	4 (80)	0 (0)	5 (100)		
		SN Defect	0 (0)	8 (100)	0 (0)	8 (100)		
		IT Defect	0 (0)	3 (75)	1 (25)	4 (100)		
		IN Defect	0 (0)	4 (100)	0 (0)	4 (100)		
		IT & IN Defect	0 (0)	1 (100)	0 (0)	1 (100)		
		SN & IN Defect	0 (0)	2 (100)	0 (0)	2 (100)		
		ST & IN Defect	0 (0)	1 (100)	0 (0)	1 (100)		
		Total	26 (11.93)	152 (69.72)	40 (1.83)	218 (100)		
3.	Amsler Grid (Visual Field)	Normal	20 (10.99)	129 (70.88)	33 (18.13)	182 (100)	0.591	
		Abnormal	6 (16.67)	23 (63.89)	7 (19.44)	36 (100)		
		Total	26 (11.93)	152 (69.72)	40 (1.83)	218 (100)		
4.	Contrast Sensitivity	0.00-0.45	1 (5.26)	16 (84.21)	2 (10.53)	19 (100)	0.028	
		>0.45-1.05	13 (16.46)	58 (73.42)	8 (10.13)	79 (100)		
		>1.05-1.65	11 (10.89)	62 (61.39)	28 (27.72)	101 (100)		
		>1.65-2.25	1 (5.26)	16 (84.21)	2 (10.53)	19 (100)		
		Total	26 (11.93)	152 (69.72)	40 (1.83)	218 (100)		
5.	Color Vision	Normal	16 (10.81)	104 (70.27)	28 (18.92)	148 (100)	0.042	
		Protan Defect	0 (0)	2 (100)	0 (0)	2 (100)		
		Deutran Defect	2 (50)	2 (50)	0 (0)	4 (100)		
		Tritan Defect	4 (10)	24 (60)	12(30)	40 (100)		
		No Matching	4 (16.67)	20 (83.33)	0 (0)	24 (100)		
		Total	26 (11.93)	152 (69.72)	40 (1.83)	218 (100)		
n = frequency, % = percentage, ST = superotemporal, SN = superonasal, IT = inferotemporal, IN = inferonasal								

DISCUSSION

The visual functions are influenced by dengue fever. To the best of author's knowledge, no data is available in Khyber Pakhtunkhwa province about visual functions in dengue patients. In current study more than half of participants had normal visual acuity, however, different results were observed in another study in which most of respondents had impairment of visual acuity.⁸ This study shows that majority had visual acuity in the normal range, while 73 eyes (33.5%) were in mild, 24 (11%) in moderate and 2 eyes (0.9%) having severe visual acuity loss. In present study majority of the participants had normal confrontation test, but very few proportion of participants had some type of visual field defects, which was similar in comparison to other study performed by Lim WK et al.¹⁷ Results show that 193 eyes (88.5%) were normal, 8 eyes (3.7%) having superior nasal defects, 5 eyes (2.3%) having superiotemporal defects, 4 eyes (1.8%) with inferior nasal defects, 4 eyes (1.8%) inferiotemporal defects, 2 eyes (0.9%) SN and IN defects, one eye (0.5%) with ST and IN defect and one eye (0.5%) having IT and IN defect. In present study population, the respondents had normal central fields through Amsler grid, other studies revealed central field defects regarded as a sign of dengue.⁷ Amsler Grid test for visual field results shows that 182 eyes (83.5%) gave normal results while 36 eyes (16.5%) were abnormal.

In present study more than half of the respondents had abnormal contrast sensitivity. The previous study also showed abnormal contrast sensitivity of the participants. Results show that 19 (8.7%) eyes were in range from 0.00-0.45 log units, 79 (36.2%) in range from >0.45-1.05 log units, 101 (46.3%) in range from >1.05-1.65 log units and 19 (8.7%) in range from >1.65-2.25 log units. In this study most of respondents had no color vision defect, in defective respondents tritan defect was more obvious, which is similar to previous study that color vision defect was present.¹⁸ Results showed that 74 persons (67.9%) were having normal color vision, while 1 person (0.9%) was having protan defect, 2 persons (1.8%) having deutan defect and 20 persons (18.3%) having tritan defect. 12 persons (11%) were having no-matching pattern.

Majority of the participants had association between visual functions and age. The higher proportion of the participants that had visual

acuity manifestations were from the age group 15-35 years. In confrontation test most defects were in age group 36-55 years. In Amsler Grid results most abnormalities were in age group 15-35 years with p-value (0.337). In both contrast sensitivity and color vision results most manifestations were in age group of 15-35 years. Contrast sensitivity and color vision have some association with dengue duration with p-value (0.028) and (0.042) respectively. Most of the manifestations were in participants of duration of 3-7 days in all visual functions.

The limitations of current study are single-center and observational study design. A multi-centered study will further strengthen the data and will help the authorities to design the preventive strategies.

CONCLUSIONS

Majority had impaired contrast sensitivity and almost half of the subjects had impaired visual acuity, visual fields and color vision.

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