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Lengin * Have	Ophthalmology FACTORS AFFECTING VISUAL OUTCOME IN INDIRECT TRAUMATIC OPTIC NEUROPATHY – A RETROSPECTIVE NON-RANDOMIZED STUDY			
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ABSTRACT Purpose To study the demographic profile and factors associated with visual outcome in patients with indirect traumatic				

optic neuropathy. **Methods** A retrospective study of patients admitted with indirect traumatic optic neuropathy, in a tertiary care centre in South India, from February 2016 to February 2018 was conducted. Patients with bony impingement on the optic nerve were treated with endoscopic surgical decompression and the rest were treated with low dose steroids. Visual acuity was assessed at presentation, 2 weeks and 3 months. **Results** The mean age of the patients was 31.6 years (13-75 years). 19(90.4%) patients were male and road traffic accident (95.23%) was the most common cause of injury. Mean time of presentation was 3.6 hours (1-7 hours) Vision at presentation was perception of light and above in 8(3.1%) and no perception of Light in 13(61.9%) patients. Visual acuity at presentation was significantly associated with final visual outcome (P=0.047). **Conclusion** Our study demonstrated that visual acuity at presentation was the only factor associated with final vision, irrespective of associated injuries and treatment modalities.

KEYWORDS : Traumatic optic neuropathy, visual outcome, low dose corticosteroids

INTRODUCTION

Traumatic optic neuropathy (TON) is a rare cause of permanent visual disability following trauma. In recent years the incidence of TON has increased ranging from 2% to 5%. ^[1] Injury to the optic nerve can be direct or indirect due to the transmitted forces from head injury or orbital injury. The proposed mechanisms of indirect injury include traction on the optic nerve [2-4], optic nerve compression by edema [2 and impingement of the optic nerve by bony spicules from the fractured optic canal causing vascular compromise. [3] But the exact pathogenesis still remains unclear. The treatment options include observation, low dose steroids or high dose steroids and surgical decompression, although none of the modalities were proven superior. ^[6] The visual outcome in TON patients is unpredictable and decision to treat or not is yet a question to be answered. The purpose of our study was to obtain the demographic profile of TON and to find whether low dose steroids and surgical treatment showed any beneficial effect thereby to analyze the possible factors that can affect the visual outcome in patients with indirect TON.

MATERIALS AND METHODS

A retrospective review of medical records of patients admitted with the diagnosis of indirect TON, in a tertiary care centre in South India, from February 2016 to February 2018 was conducted. All patients who presented within 8 hours of injury, who had a minimum follow up of one month were included in this study. Whereas, those with direct TON, altered sensorium, associated ocular injuries contributing to visual loss were excluded from the study. Diagnosis of TON was based on acute drop in vision following trauma, with Relative Afferent Pupillary Defect (RAPD) or loss of color vision in Ischihara's pseudoisochromatic chart or visual field defect. Computed Tomography (CT) scan of orbit was done to look for bony impingement of the optic nerve. Patients without bony impingement of optic nerve were treated with low dose intravenous Methyl Prednisolone 250 mg every sixth hourly for 3 days, followed by oral Prednisolone 1mg/kg/day for 11 days. Those who had bony impingement of optic nerve from medial wall of optic canal were treated with nasal endoscopic surgical decompression. Visual acuity, color vision, RAPD and optic disc evaluation was done on first three days and at the end of 2 weeks and one month. Visual recovery was defined as improvement in 2 Snellen lines, 2 weeks post injury. Statistical analysis was done using SPSS for Windows, version 20.0 (SPSS Inc., IBM, Armonk, NY, USA). The categorical variables were expressed in percentage and their association with visual outcome was analyzed using Chi square test. P value of less than 0.05 was considered to be statistically significant.

RESULTS

During the study period, 53 consecutive patients were diagnosed with indirect TON, of them 6 had record inadequacy and 26 had altered sensorium with severe brain injury, they were excluded from the study. Hence, the records of remaining 21 patients were analyzed. There were 19 males (90.4%) and 2 females (9.5%). Age group of the patients ranged from 13-75 years (Mean-31.6 years). TON occurred in right eye in 11 patients (52.3%) and in left eye in 10 (47.6%). None of the patients had bilateral injuries. Road Traffic Accident was the most common cause of TON, identified in 17 patients (95.23%). Other causes included self-fall injury in 9.5% (n=2) and trauma due to physical assault in 9.5 % (n=2). Time of presentation varied from 1-7 hours (mean-3.6 hours). Out of 21 patients, 7 (33.33%) had associated orbital wall fractures, 4 (19.04%) had lid laceration, 5 (23.8%) had lid edema and 1 (4.76%) had vitreous hemorrhage and 12 (57.14%) patients had polytrauma. The demographic profile of TON patients is summarized in Table-1.

TABLE 1. Demographic profile of the study group

Demographic data	Classification	Number (n)	%
Age	<25	8	38
-	>25	13	62
Gender	Male	19	90
	Female	2	10
Etiology	RTA	17	81
	Fall	2	9.5
	Assault	2	9.5
Time of	<= 4 hrs	15	71
presentation (hrs)	>4 hrs	6	29
Radiological	Orbital wall fractures	6	28.5
findings	Facial fractures other than	3	14.2
	orbit	8	38.09
	Intracranial pathology Nil pathology	4	19.04

Vision at presentation was PL+ (Perception of light) and above in 8 (37.1%) and PL- (No perception of Light) in 13 (61.9%) patients. On radiological imaging, 6 patients (28.5%) had associated orbital wall fractures, 3 (14.2%) had facial fractures without orbital involvement, 8 patients (38.09%) had associated intracranial pathology, and 4(19.04%) patients had no other pathology except vision loss. 18 patients (85.7%) without bony impingement of optic nerve were treated with low dose steroids and 3 patients (14.2%) with medial bony impingement were treated with endoscopic surgical decompression.

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Visual improvement was noted in 4(22.2%) patients who had steroid treatment and 1(33.3%) patient who underwent surgical decompression (Fig-1).



Fig.1. Bar diagram showing the two treatment groups and numbers improved in each

On studying the factors which can affect visual outcome at 2 weeks, it was found that initial visual acuity at presentation was the only strong factor which had an influence on visual outcome (P=0.047). Other factors like time of presentation and associated orbital fractures had no influence on the visual outcome. It is also important to note that the two different modes of treatment did not affect the visual outcome significantly (P= 0.675). Table-2 shows the variable and their significance of association with visual outcome at 2 weeks.

Variable		Visual improvement	P value
		(n, %) at 2 weeks	
Age	<25	1(12.5%)	0.606
	>25	4(31%)	
Gender	Male	3(16%)	0.047
	Female	2(100%)	
Etiology	RTA	3(18%)	0.058
	Fall	2(100%)	
	Assault	0 (0%)	
Time of presentation	$\leq 4 \text{ hrs}$	2(13%)	0.114
_	>4 hrs	3(50%)	
Associated orbital	Present	2(33.3%)	0.597
wall fractures	Absent	3(20%)	
Associated facial	Present	1(33.3%)	0.516
fractures	Absent	4(22.2%)	
Intracranial pathology	Present	1(12.5%)	0.339
	Absent	4(30.7%)	
Nil radiological	Present	1(25%)	0.950
finding	Absent	4(23.5%)	
Vision at presentation	PL-	1(77%)	0.047
_	PL+ and	4(50%)	
	above		
Treatment modality	Low dose	4(22.2%)	0.675
	steroids	1(33.3%)	
	Surgical		
	decompre		
	ssion		

TABLE 2. Effect of variables on visual outcome

DISCUSSION

In the present study, traumatic optic neuropathy (TON) occurred in young, economically active males and road traffic accident was the commonest cause with history of driving two-wheeler in all these cases. None of the patients used helmet during their ride and nearly half of the patients had associated head injury (n=10). This concurs with several other studies, ^[7-9] and emphasizes the role of accelerationdeceleration injury to the optic nerve in such accidents. The pathophysiology of TON is multi-factorial and the current hypothesis is that the primary injury is irreparable causing direct axonal damage, and secondary injury from ischemia and activation of apoptotic cascades in the retinal ganglion cells is possibly reversible. Most research into neuroprotection strategies is currently based on limiting damage from secondary injury.¹⁷

The visual loss in TON is usually immediate and severe but rarely it may be delayed, associated with impaired color vision and variable visual field defects. The initial ocular examination is typically normal except in anterior nerve injuries with associated optic disc swelling and retinal hemorrhage. Classically, optic atrophy develops in the weeks following the injury.

The treatment options for TON are conservative management, systemic steroids and surgeries like decompression of the optic canal, optic nerve sheath fenestration, evacuation of compressive orbital hematoma and a combined steroid therapy and surgical modality. To reduce the risk of serious adverse effects with mega-dose steroid, we used low-dose corticosteroid on the rationale that the antiinflammatory effect reduces the inflammation-induced tissue damage associated with traumatic optic neuropathy. To our knowledge, low dose steroids were used to treat TON in only one other study done in Singapore by Yip CC et al ^[11] which proved no difference in visual recovery between steroid treated group and conservative group. Several case series showed benefit from optic canal decompression surgery ^[12,13] particularly in the presence of optic canal fracture with an impinging bony fragment. But, our study did not find any significant difference in final visual acuity in patients treated with low-dose corticosteroid or those treated surgically.

The only significant factor determining final visual acuity, in this study was found to be the visual acuity at presentation. This result is in concordance with IONTS [14] and Lee et al study. [15] None of the other factors like orbital fracture, etiology and time of presentation were associated with the visual outcome. Gender had a significant association to visual outcome in this study probably because majority of the study patients were male. Limitations of the study include small study population and retrospective design.

In conclusion, the initial vision at presentation determines the final visual outcome in patients with TON, irrespective of the etiology and treatment modalities. This study highlights the importance of protective helmet wear to avoid such an irreversible visual morbidity which is preventable.

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