Original Article

Visual Outcome of Traumatic Optic Neuropathy in Patients Treated with Intravenous Methypredisolone

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Abstract

Background: Optic nerve injuries occur in the setting of head injury which is often a consequence of road traffic accidents or falls. Traumatic optic neuropathy (TON) is an important cause of functional impairment of vision. Different treatment approaches like different dosages of steroids, surgical decompression and observation alone have been suggested but there has been no conclusive evidence to establish a standard approach to this devastating cause of visual loss.

Aim: To determine the effectiveness of intravenous (IV) methylprednisolone in the treatment of patients with traumatic optic neuropathy.

Materials and Methods: An observational clinical study. Nine patients, all male with a mean age of 39.1 (14 to 55 years) were enrolled. All patients received 1 g of IV methylprednisolone for 3 days followed by 1 mg/kg oral prednisolone in tapering dose over 2 weeks. Paired proportion test has been used to find out the significance of patients with >=2 line improvement of visual acuity from base line visual acuity after treatment.

Results: The data of 9 patients (12 eyes) were analysed.Ten out of twelve eyes had poor visual acuity (<=6/60). Visual acuity was ranging from 6/36 to 6/6 in 8 patients 1 month post treatment, of which those between 6/6-6/9 was seen to be statistically significant (p=0.061). Patients with initial visual acuity (pre-treatment) of counting fingers or better had > 2 line improvement in Snellen's chart 1 month post treatment which was statistically significant (p=0.045). Though 6 out of 7 patients with very poor vision (NLP, PL, HM) had >=2 line improvement, it was not statistically significant.

Conclusion: Patients with traumatic optic neuropathy who had vision better than counting fingers showed significant improvement after treatment with methylprednisolone but those with very poor vision did not show statistically significant improvement.

Keywords: Extra ocular muscle palsy, Methylprednisolone, Traumatic optic neuropathy, Vehicular accidents

INTRODUCTION

Traumatic loss of vision, along with deficits in visual field, colour perception and an afferent pupillary defect is called traumatic optic neuropathy (TON). TON which occurs mostly after blunt trauma is an important cause of visual loss.[1]

Indirect damage to the optic nerve is the most common form of TON occurring in about 0.5-5% of all cases of closed head trauma.[2] It is divided into direct injuries caused by sharp penetrating objects that enter the orbit and indirect injuries caused by concussive forces that are transmitted to the optic nerve as a result of orbital-facial or cranial trauma (1). This impact may create a shock wave which can lead to optic nerve avulsion or posterior indirect traumatic optic neuropathy.[3] While diagnosis of indirect TON is made through a careful history and clinical examination, its optimum management is yet to be elucidated. Different approaches includes different dosages of steroids (methylprednisolone and dexamethasone) in 60 mg to 7 g/day, surgical decompression of optic canal (via intracranial trans ethmoidal, endonasal, sub labial or other techniques)[4-8] and observation alone.[9] Comparison of these different approaches did not conclude either one being superior to other.[10] We report 9 cases of TON who

received intravenous methylprednisolone at Kempegowda Institute of Medical Sciences, Bangalore, Karnataka to find out the results of such treatment in these patients.

MATERIALS AND METHODS

The study design was prospective. We included patients with indirect optic injuries in otherwise healthy individuals. Cases with pre-existing ocular abnormalities that might affect assessment of visual function were excluded. All enrolled cases had a complete ocular examination including best corrected visual acuity (BCVA), IOP measurement, pupils assessed for relative afferent pupillary defect, ocular motility and fundus examination on admission, immediately post treatment and 1 month later and had CT scans (axial and coronal) of orbit and brain accordingly.

Visual acuity was the main outcome measure of the study, which was measured by Snellen chart on admission, immediately after treatment and 1 month later. Patients were examined within 3 hours to 3 days. A written informed consent was taken prior to starting of treatment. Intravenous Methylprednisolone 1 g was given (diluted in 100 ml Normal saline over 45 minutes) for 3 days. Base-line ECG and blood sugar level were done. Pulse and B.P recorded prior to infusion and monitored using pulse-oximetry. Then oral prednisolone 1 mg/kg in tapering dose was administered for 2 weeks. Patients were examined every day during hospitalisation and later at 1st week, 2nd week and 1 month. One patient had sphenoid fracture segment impinging optic nerve for which methylprednisolone was not administered.

Results on continuous measurements are presented as Mean +/- SD (Mi-Max) and results on categorical measurements are presented in Number (%). Significance was assessed from patients who had >=2 line improvement in visual acuity after treatment with intravenous methylprednisolone from baseline visual acuity. Paired proportion test has been used to find the significance.

RESULTS

The data of 9 patients (12 eyes) were analysed. Mean age of the patients were 39.1 (14 to 55 years) and all were male. Road traffic accidents were the main cause of trauma (77.8%). Ten out of twelve eyes had poor visual acuity (<=6/60) (Table 1). Associated extra ocular palsies and orbital fractures are shown in Tables 2 and 3 which did not have significant effect on visual outcome in the affected patients. Visual acuity was ranging from 6/36 to 6/6 in 8 patients 1 month post treatment, of which those between 6/6-6/9 was seen to be statistically significant (p=0.061) (Tables 4 and 5). Five patients had one to multiple orbital fractures, of which only one patient had displaced orbital wall fracture impinging the optic nerve. Patients with initial

Table 1: Demographic and clinical characteristics were noted (2)

Characteristic	Total (n=9 patients)
Age	39.1
Sex	
Male	9 (100%)
Eye	
Right	6 (66.7%)
Left	3 (33.3%)
Injury type	
Vehicle accident	7 (77.8%)
Fall	1 (11.1%)
Assault	1 (11.1%)
Base line visual acuity (n=12 eyes)	
NLP	1 (8.3%)
LP	4 (33.3%)
HM	2 (16.7%)
<20/200 to CF	3 (25.0%)
<20/40 to>=20/200	1 (8.3%)
>=20/40	1 (8.3%)

Abbreviations: NLP, no light perception; LP, light perception; HM, hand motion; CF, counting fingers

Table 2: Frequency of different paresis

Paresis	Number of eyes affected
Ptosis	5
Pupil palsy	3
3rd nerve palsy	4
6th nerve palsy	2
Total ophthalmoplegia	3

Table 3: Frequency of different orbital fractures

Type of fracture	Number of eyes affected
Orbit fx (total)	6
No fx	5
Optic canal fx	1
Ethmoidfx	2
Maxillary fx	3
Frontal fx	3
Zygomatic fx	4
Sphenoid fx	2
Temporal fx	2
Occipital fx	1

Abbreviations: fx, fracture

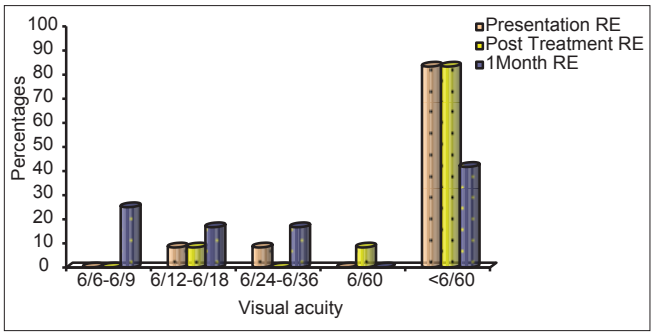
Table 4: Frequency of different visual acuities in assessment times

Visual acuity	Presentaion both eyes (n=12)	Post treatment both eyes (n=12)	1 month both eyes (n=12)	P value
6/6-6/9	0 (0%)	0 (0%)	3 (25%)	0.061+
6/12-6/18	1 (8.3%)	1 (8.3%)	2 (16.7%)	0.311
6/24-6/36	1 (8.3%)	0 (0%)	2 (16.7%)	0.311
6/60	0 (0%)	1 (8.3%)	0 (0%)	-
<6/60	10 (83.3%)	10 (83.3%)	5 (41.7%)	0.132

Table 5: % of patients with 2 line improvement in visual acuity according to baseline visual acuity

Baseline visual acuity	Immediately post-treatment (n=12)	After 1 month (n=12)	% change	P value
NPL, PL, HM	7 (58.3%)	7 (58.3%)	0.0	1.000
>=2 line improvement	4 (33.3%)	6 (50.0%)	+16.7%	0.266
CF or better	5 (41.7%)	5 (41.7%)	0.0	1.000
>=2 line improvement	1 (8.3%)	5 (41.7%)	+33.4%	0.045*

P values are obtained by using paired proportion test



Graph 1: Frequency of patients with visual acuities pre-treatment and post treatment

visual acuity (pre-treatment) of counting fingers or better had > 2 line improvement in Snellen's chart 1 month post treatment which was statistically significant (p=0.045). Though 6 out of 7 patients with very poor vision (NLP, PL, HM) had >=2 line improvement, it was not statistically significant (Table 4) (Graph 1).

DISCUSSION & CONCLUSION

The management of traumatic optic neuropathy should be guided by the Hippocratic adage to do no harm.[11] While there is little controversy on the macroscopic mechanism of trauma to the optic nerve, including the deceleration theory,[1] multiple hypotheses have been proposed at microscopic level of damage to the optic nerve, including contusion necrosis, nerve fibre tears and nerve infarction secondary to closed space edema, haemorrhage within the optic nerve sheath, thrombosis, vasospasm, impingement by bone spicules and shearing of dural vessels in the optic canal.[10]

Treatment of TON has been a topic of controversy. Even after 2 years, The International Optic Nerve Trauma Study (TIONTS) failed to recruit enough eligible patients to conduct a clinical trial to compare the results of steroid only arm with surgery plus megadose steroid arm.[10] Therefore it was transformed into an observational study and ultimately found no clear benefits for either corticosteroid or optic canal decompression approach. The idea of use of megadose steroid is extrapolated from traumatic spinal cord injury studies introduced by Anderson et al. Although the exact mechanism of its action is not clear yet, it seems that the main mechanism by which corticosteroids are thought to block neuronal death in the setting of trauma is inhibition of free radicals, decrease intra-neuronal or extra-neuronal oedema, reduce vasospasm limiting contusion necrosis of the nerve.[12-15]

Road traffic accident were the main cause of TON in our study, a finding similar to a report from Iran.[11] Similar to most reports,[10,16,17] our study indicated that patients with poor visual acuities have poorer visual prognosis. Although our study has limited number of patients, but 54.6% of them had atleast one orbital fracture (Table 3) with different degrees of extraocular nerve palsies (Table 2) but in contrast to the conclusion of some reports,[18] we failed to show significances of these findings and their effect on final visual results (Table 5).

Our study showed intravenous methylprednisolone as proposed by Optic Neuritis Treatment Trial (ONTT) for optic neuritis to be effective for treatment of traumatic optic neuropathy provided the visual acuity pre-treatment is not less than counting fingers. This thus reduces steroid induced side effects caused by megadose regimen.

One limitation in our study is small sample size, though it correlates with the incidence of TON in closed head trauma in our institution.

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