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Visual Outcome after Treatment with High Dose Intravenous Methylprednisolone in Indirect Traumatic Optic Neuropathy

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ABSTRACT

Background: Traumatic optic neuropathy is an acute injury of the optic nerve due to trauma. It is an ocular emergency, requiring early treatment though there is no proven standard treatment protocol for the condition. Various studies have shown improvement in vision after intravenous steroids, but not statistically significant. Studies have revealed even optical decompression surgery is not the ultimate treatment because of no significant improvement of vision. Our study aims to assess visual outcome after high dose (1 gram) of intravenous methylprednisolone in cases with indirect optic neuropathy.

Methods: This was a non-randomized interventional study carried out in Kathmandu Medical College Teaching Hospital from May 1st 2013- June 1st 2014.

Results: There were 10 cases with indirect traumatic optic neuropathy included in the study. Four cases received IV methylprednisolone and six cases were observed without steroid treatment. Traumatic optic neuropathy was observed more in males[8 (80%)]with higher number in age group 21-30 years old. The visual recovery after intravenous steroid treatment was rapid and beneficial in cases with vision better than Non Perception of Light (NPL), even in cases presented 4 days after the trauma.

Conclusions: There was rapid and beneficial improvement in visual acuity after high dose of intravenous steroid treatment in cases with indirect traumatic optic neuropathy with vision better than Non Perception of Light (NPL).

Keywords: Intravenous, methylprednisolone, traumatic optic neuropathy, visual acuity.

INTRODUCTION

Traumatic optic neuropathy (TON) is an acute injury of the optic nerve due to trauma characterized by vision loss, color vision defect, visual field loss and afferent pupillary defect.

Direct injury to the optic nerve results from disruption of the optic nerve fibres from bone fragments within the optic canal, nerve sheath hematomas or penetrating orbital injuries.[1] An indirect injury occurs from the transmission of concussive forces to the optic canal from blunt trauma of the head which damages the axons of the fibres or to the vascular supply of the nerve causing ischemic injury to the retinal ganglion cells.[2] A secondary mechanism for optic nerve injury occurs due to optic nerve swelling after the trauma which compromises the vascular blood supply, through a rise in intraluminal pressure or reactive vasospasm.[2] The incidence of TON in closed head injury in various studies ranges from 0.5-5%.[2]

Steroid therapy for TON arecategorized as moderate

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dose, high dose or mega dose.[3]

This study was carried out to assess whether high dose of intravenous methylprednisolone is effective in the treatment of indirect optic neuropathy.

METHODS

This was a hospital based non-randomized interventional study. Patients included in the study were cases with optic neuropathy admitted in Kathmandu Medical College Teaching Hospital with closed head injury and patients attending ophthalmology OPD with blunt trauma eye from 24th February 2013 to 1st June 2014.

Visual acuity was recorded with Snellen's chart. Vision was taken before intravenous (IV) steroid, 1st day after treatment, 3rd day, 7th day, 1 month and 3 months after the IV treatment. Visual acuity was assessed following WHO classification. Color vision was assessed with Ishihara chart in every visit in those cases with vision 6/60 and above. Anterior segment and posterior segment of the eyes were examined with slit lamp. Posterior segment of the eyes were examined with 90D lens to assess optic disc and fundus. All cases were assessed for relative afferent pupillary defect with torch light.

Inclusion criteria for cases were cases with blunt trauma eye with decrease vision and presence of relative afferent pupillary defect; CT scan of cases revealing normal optic canal with no fractures and no bony fragments impinging optic nerve.

Exclusion criteria for cases were cases with penetrating orbital injuries and direct optic nerve injuries; injuries involving lens, vitreous and retina; patients who did not allow consent to enroll in the study.

Head injury in cases was graded using Glasgow coma scale. Coma scale 13-15 was graded as mild head injury; 9-12 as moderate head injury and 3-8 as severe injury. In moderate and severe head injury, ocular examination was reperformed after the regain of consciousness of patient which was after 3-4 days after admission.

Patients after diagnosis, were subjected to intravenous methylprednisolone 1gm for 3 days unless contraindicated. In children less than 13 years, 500mg methylprednisolone for 3 days was administered. Methylprednisolone was given in 100ml normal saline drip in 1 hour.

Patients who presented later than 7 days in the hospital after trauma and patients with moderate or severe head injury were not subjected to steroid treatment.

Consent from the Ethical board committee of the Kathmandu Medical College Teaching Hospital was also undertaken as per the rule of Helsinki Act before conducting this study. Informed consent was taken from all patients for enrollment in the study.

Data was recorded in SPSS 17 version programme and data was analysed. The statistical significance could not be calculated due to small sample size. The variables for this study were age, sex, type of trauma, time of presentation to the hospital, visual acuity before treatment, 1st day after intravenous methylprednisolone, 3rdday ,1 month and 3 months after IV steroids and disc color before treatment, 1st day after intravenous methylprednisolone, 3rd day and 1 month after steroid. Most of the patients lost follow-up after one month of follow up in our study so we have discussed vision and disc changes till one month after treatment.

RESULTS

There were 10 cases with indirect traumatic optic neuropathy included in the study. Four cases received IV methylprednisolone and six cases were observed without steroid treatment. There were 2 cases on oral steroid who were excluded from the study.

There were 8 (80%) males and 2 (20%) females with optic neuropathy ranging from age 8 to 49 years old. Forty percents were in age group 21-30 years followed by 31-40 years.

The time of presentation to the hospital in steroid group was within 2 hours to 4 days

Table 1.Time of presentation to hospital in steroid group and conservative group.

Time of presentation	No (%) in IV steroid group	No (%) in No IV steroid group
0-12 hrs	1 (25%)	0(0%)
>48 hrs	3 (75%)	0(0%)
Time of presentation		
5-10 days	0(0%)	2 (33.3%)
11-15 days	0(0%)	2 (33.3%)
>15 days	0(0%)	2 (33.3%)

while in no treatment group it was within 5 days to 1 month after trauma.

Mode of injury in highest number was observed as Road Traffic Accident (RTA) [7 (70%)] followed by falls [2(20%)] and rest [1(10%)] was assaults.

Table 2. Mode of injury.

Mode of injury	No (%) in steroid group	No (%) in no treatment group
Road traffic accident	3 (75%)	4 (66.7 %)
Falls	0 (%)	2 (33.3 %)
Assaults	1(25%)	0 (%)

All cases in our steroid group had mild head injury except one case of physical assault who had no head injury but blunt trauma eye presenting with vision Counting Finger Close to Face (CFCF). In no treatment group,2 cases had mild head injury with vision 6/9 and 6/36; 2 cases had moderate injury with vision 2/60 and 3/60 and the remaining 2 had severe head injury with NPL and PL vision.

The improvement of vision after intravenous methylprednisolone was observed with even CFCF but not with NPL vision in steroid group.

The improvement of vision was observed with 6/36 vision but not with NPL, PL(Perception of light) to 2/60 and 3/60 vision in no treatment group. The vision was

Table 3.Visual acuity (VA) after Intravenous methylprednisolone.

	Patients with IV steroids					
Visual acuity	Time of presentation after trauma	VA at presentation	VA 3 rd day	VA 7th day	VA 1 month	VA 3 months
Case no1	1 hr	6/60	6/9	6/9	6/9	No follow up
Case no 2	3 days	CF	3/60	6/24	6/24	6/18P
Case no 3	6 days	NPL	NPL	NPL	NPL	NPL
Case no 4	4 days	6/60	6/24	6/18	6/12	No follow up

Table 4.Visual acuity (VA) in conservative group.

	Patients with no IV steroids				
Visual acuity	Time of presentation after trauma	VA at presentation	VA 7th day	VA 1 month	VA 3 months
Case no1	5 days	NPL	NPL	NPL	No follow up
Case no 2	7 days	PL	PL	PL	PL
Case no 3	12 days	6/9	6/9	6/9	No follow up
Case no 4	2 days	6/36	6/18	6/18	No follow up
Case no 5	30 days	3/60	3/60	3/60	No follow up
Case no 6	30 days	2/60	No follow up	5/60	5/60

Table 5.Disc color in steroid group.

	Patients with IV steroids					
Disc color	Time of presentation after trauma	Disc at presentation	Disc 3 rd day	Disc 7th day	Disc 1 month	Disc 3 months
Case no1	1 hr	Pink	Pink	Pink	Pallor	No follow up
Case no 2	3 days	Pink	Pallor	Pallor	Pallor	Pallor
Case no 3	6 days	Pink	Pink	Pallor	Pallor	Pale
Case no 4	4 days	Pallor	Pallor	Pallor	Pallor	No follow up

status quo in patient with 6/9 vision.

Majority of cases 3 (75%) had onset of pallor disc by 2 weeks after trauma in steroid group while in no treatment group majority had pallor disc at the time of presentation as

their presentation was late. Though all cases with optic neuropathy ultimately developed

onset of optic atrophy, vision was preserved in those cases with improved vision in a month long follow up period as well. Full-fledged optic atrophy was observed in patients with severe vision loss 4 weeks after the trauma.

In steroid group, color vision improvement was observed 7 days after the treatment with better vision eyes. One case had complete recovery of color vision1 month after the traumawhileother case with better vision showed improvement with single plate reading till 3 months after the trauma. In no treatment group, color vision in better vision eyes was improved only in a month after the trauma. Complete recovery of color vision was not found in conservative group during our follow-up period.

Table 6. Disc color in conservative group.

	Patients with No IV steroids				
Disc color	Time of presentation after trauma	Disc at presentation	Disc 7th day	Disc 1 month	Disc 3 months
Case no1	5 days	Pallor	Pallor	Pale	Pale
Case no 2	7 days	Pink	Pink	Pallor	Pale
Case no 3	12 days	Pallor	Pallor	Pallor	No follow up
Case no 4	2days	Pink	Pallor	Pallor	No follow up
Case no 5	30 days	Pallor	Pale	Pale	No follow up
Case no 6	30 days	Pallor	No follow up	Pale	Pale

DISCUSSION

The visual recovery after intravenous steroid treatment was rapid and beneficial in our cases with vision better than NPL, recovering on2nd and 3rd day of treatment even in cases presented 4 days after the trauma. The results are same as other studies which revealed improvement of visual outcome though not statistically significant .[4-8] There were not a single case of steroid associated complications observed in our study.

In no treatment group, visual recovery was observed in eyes with better vision only with no improvement with NPL, PL ,3/60 vision and no useful vision recovery with 2/60 vision. This needs further multicentre trial to study the natural recovery course of traumatic optic neuropathy. Color vision improvement was observed in better eyes in steroid group in 7 days after the treatment which was shorter than in the conservative group with better vision, revealing improvement in1 monthafter the trauma.

Optic atrophy occurred in all cases even with steroid treatment within 2 weeks of the acute trauma in our study with no vision deterioration. When including both steroid group and conservative group, ongoing optic atrophy was observed in 2 weeks period in majority which is different from other study which revealed atrophy after 3-6 weeks after trauma.[2]Total optic atrophy was observed in eyes with severe vision loss 4 weeks after the trauma.

Fifty percent (5 cases) had vision <3/60 to PL and NPL in our study which is close to other study revealing 60% cases presenting with vision PL and worse. [2]Severity of vision loss in this study was associated with severity of head injury.

In a similar study done in Eastern Nepal with 11 cases using Megadose steroid followed by tapering dose of oral steroid visual recovery was observed in patients who presented within 2 days of trauma and with better vision than NPL.[9] Majority of cases in this study was RTA followed by fall which was similar to our study finding and other study with RTA being first etiological factor followed by assaults and falls.[2,9] Traumatic optic neuropathy was more common in males [8 (80%)] in our study with 40%of cases in age group 21-30 years which was very similar to other study.[2] But other study in Nepal showed increased incidence of optic neuropathy in males in age group 40 years.[9]

The exact mechanism by which steroid acts is not known clearly.[10-14] It has been thought that steroids decreases intraneural and extraneural edema and relieve optic nerve fibres compression reducing primary and secondary ischemia of the optic nerve.[13]

The initiation of steroid treatment should be the first line of management of optic neuropathy if there is no contraindication in all traumatic optic neuropathy cases presenting as late as 7 days. High dose of steroid was observed safer as compared to megadose steroid with increased mortality in severe head injury cases and with increased retinal ganglion cell death observed in animal models.[15,16] Even low dose steroid (250mg IV methylprednisolone 6hourly) had shown improved visual recovery in better vision eyes of traumatic optic neuropathy in other study.[6] The International Optic Nerve Trauma Study (IONTS) stated that neither corticosteroids nor optic canal surgery should be considered the standard for patients with traumatic optic neuropathy and it is appropriate to make individualized treatment decisions for a particular patient.[8]However, there were more percentage of individuals with better visual outcome with steroid treatment and conservative group than in optical canal surgery groupin IONT study. Carta et al had suggested outline for conservative treatment of traumatic optic neuropathy if there is blood in the posterior ethmoidal cells, age>40 years, loss of consciousness and absence of vision improvement after 48 hours of steroid therapy which all suggest poor prognosis for vision. [17]

Decompression surgery in indirect traumatic optic neuropathy is indicated when vision does not improve after 48 hours of intravenous steroid treatment and transnasal approach is considered as the Gold standard treatment.[18] We did not have any cases with decompression surgery in this study.

CONCLUSIONS

High dose of intravenous methylprednisolone is adequate treatment for the management of indirect traumatic optic neuropathy with better visual outcome and early recovery of vision and it should be started as first line of management in the treatment of all cases of indirect traumatic optic neuropathy unless there is presence of poor prognostic criteria and unless contraindicated.

We suggest further multi-centre large scale study with low dose steroid to determine its role in the treatment of traumatic optic neuropathy and to study natural course of traumatic optic neuropathy.

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