ORIGINAL ARTICLE

VISUAL OUTCOME OF TRAUMATIC OPTIC NEUROPATHY AFTER STEROID TREATMENT IN KARIADI HOSPITAL

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ABSTRACT

Introduction: *The occurrence of Traumatic Optic Neuropathy (TON) often occurs in the form of head injuries resulting from traffic accidents. TON is an important cause of impaired visual function which may be improved with steroid therapy.*

Objective: *To determine the visual outcome in patients with TON treated with steroids in Kariadi Hospital, Semarang*

Methods: *This research was a retrospective study. Thirty patients (20 males and 10 females) with TON in ophthalmology clinic, Kariadi Hospital Semarang between Januari 2019 and December 2020. Visual acuity, contrast sensitivity and color blindness test were included data from medical record. Steroid therapy were divided into 3 groups. Intraveous steroid injection alone, intravenous steroid followed with oral steroid, and oral steroid alone. The Wilcoxon and paired-t test as comparison test of pre-post therapy in one group and friedman test as comparison test in 3 groups.*

Results: *There were 5 cases that received intravenous steroid, 18 cases received intravenous steroid with oral steroid, and 7 cases received oral steroid. There were difference visual acuity in intravenous steroid with oral steroid ($p = 0.001$), visual acuity in oral steroid ($p = 0.017$), and color blindness test in intravenous steroid with oral steroid in pre-post therapy groups ($p = 0.036$). There were no difference in visual acuity, color blindness test, and contrast sensitivity between pre-post therapy groups when compared between 3 groups ($p= 0.692$, $p =0.368$, $p=0.273$).*

Conclusion: *Patients with TON had better visual outcome after treated with intravenous steroid followed with oral steroid.*

Keywords: *Traumatic Optic Neuropathy, Steroids, Visual Outcome*

INTRODUCTION

Traumatic Optic Neuropathy (TON) is a condition in which acute injury to the optic nerve from direct or indirect trauma results in vision loss. The severity of optic nerve damage may range from simple contusion to complete avulsion of the optic nerve. [1] The incidence following blunt or penetrating trauma is 0.7 to 2.5%. [2,3] Studies have shown that approximately 40-60% of patients present with severe visual loss of light perception or worse. [4] The most common cause of TON is indirect injury to the optic nerve, which is thought to be the result of transmitted shock from an orbital impact to the intracanalicular portion of optic nerve. Direct TON can result from penetrating injury or from bony fragments in the optic canal or orbit

piercing the optic nerve. Orbital hemorrhage (orbital compartment syndrome) and optic nerve sheath hematoma can also cause TON by direct compression. There are no known risk factors for TON. In the International Optic Nerve Trauma Study, 85% of patients with indirect TON were male and the average age of patients with TON was 34.[1] The most common mechanisms of injury were motor vehicle accident, bike accident, fall and assault. The main treatment options for TON are: systemic steroids, surgical decompression of the optic canal, combination of steroids and surgery and observation (conservative management) alone.[5] This study aim to determine the visual outcome in patients with TON treated with steroids in Kariadi Hospital, Semarang

METHODS

This research was a retrospective study. Thirty patients (20 males and 10 females) with indirect TON in ophthalmology clinic of Kariadi Hospital Semarang between Januari 2019 and December 2020. A diagnosis of TON was made on decreased visual acuity after history of head trauma. Visual acuity, contrast sensitivity and color blindness test were included in the data from medical record. Visual acuity was measured by snellen chart and converted to logMAR, contrast sensitivity test was measured by LEA numbers (low contrast flip chart), and color blindness test was measured by ishihara. Steroid therapy were divided into 3 groups. Intravenous steroid injection alone, intravenous steroid followed with oral steroid, and oral steroid alone. The exclusion criteria include eyes with penetrating trauma, direct TON (optic nerve avulsion, optic nerve transection, optic nerve sheath haemorrhage), and post traumatic visual loss not related to optic nerve dysfunction (traumatic cataract, retinal detachment, vitreous haemorrhage).

The Wilcoxon and paired-t test as comparison test of pre-post therapy in one group and friedman test as comparison test in 3 groups.

RESULTS

This study was enrolled by 30 patients, 20 male (66.7%) dan 10 female (33.3%) with average age 28,6 ± 6,98. The average baseline visual acuity was 1.17 ± 0.99, color blindness was 18.2 ± 14.97, and contrast sensitivity was 4.33 ± 4.55. (Table 1).

Table 1. Demographic and clinical characteristic

	IV Steroid	IV Steroid + Oral Steroid	Oral steroid	Total
Age				
Mean ± SD	28,60 ± 6,97	40 ± 8,31	39,2 ± 17,33	28,6 ± 6,98
Median	33	45	39	33
Range	21-35	31-48	17-59	21-35
Sex				
Male	7 (100)	5 (100)	8 (44,44)	66.67
Female	0 (0)	0 (0)	19 (55,56)	33.33
Visual acuity				
Pre				
Mean ± SD	1.92 ± 0.77	1.17 ± 1.04	1.34 ± 1.25	1.17 ± 0.99
Median	2.48	0.69	0.69	0.69
Range	1.08-2.48	0.3-2.7	0.3-2.7	0.3-2.7
Post				
Mean ± SD	1.64 ± 0.58	0.99	1.04 ± 1.32	0.89 ± 0.90
Median	1.78	0.5	0.22	0.5
Range	1.09-2.48	0.1-2.48	0-2.48	0-2.48
Color blindness				
Pre				
Mean ± SD	3.2 ± 4.38	18.8 ± 15.53	22.29 ± 17.02	18.2 ± 14.97
Median	0	18	21	18
Range	0-8	0-38	0-38	0-38
Post				
Mean ± SD	4 ± 5.48	16.4 ± 14	22.29 ± 17.02	16.4 ± 13.25
Median	0	14	21	14
Range	0-10	0-38	0-38	0-38
Contrast sensitivity				
Pre				
Mean ± SD	2 ± 2.74	6.25 ± 5.15	0.89 ± 0.61	4.33 ± 4.55
Median	0	10	1.25	1.25
Range	0-5	0-10	0-1.25	0-10
Post				
Mean ± SD	1 ± 1.37	4.25 ± 3.91	0.89 ± 0.61	3.67 ± 3.69
Median	0	5	1.25	1.88
Range	0-2.5	0-10	0-1.25	0-10

There were difference visual acuity in intravenous steroid followed with oral steroid ($p = 0.001$), visual acuity in oral steroid ($p = 0.017$), and color blindness test in intravenous steroid followed with oral steroid therapy in the pre and post therapy groups ($p = 0.036$). Intravenous steroid followed with oral steroid therapy had an effect on improving visual acuity and color blindness when compared in pre post therapy groups. Oral steroid alone therapy may had an effect in terms of pre post visual acuity. (Table 2).

Tabel 2. Results of visual outcome with three treatment groups

	IV Steroid		P value	IV Streoid + Oral Steroid		P value	Oral Steroid		P value
	Pre	**Post**		**Pre**	**Post**		**Pre**	**Post**	
Visual acuity	2.48 (1.08 – 2.48)	1.78 (1.09 – 2.48)	0.458 *	0.69 (0.3 – 2.7)	0.5 (0.1 – 2.48)	0.001 *	0.69 (0.3 – 2.7)	0.5 (0.1 – 2.48)	0.017 *
Contrast sensitivity	0 (0 – 5)	0 (0 – 2.5)	0.157 *	10 (0 – 10)	5 (0 – 10)	0.492 *	1.25 (0 – 1.25)	1.25 (0 – 1.25)	1*
Color blindness	0 (0 – 8)	0 (0 – 10)	0.157 **	18 (0 – 38)	14 (0 – 38)	0.036 **	21 (0 – 38)	21 (0 – 38)	1**

** Wilcoxon test*
***Paired-t test*

There was no difference in visual acuity, color blindness test, and contrast sensitivity between pre post therapy groups when compared between 3 groups (p= 0.692, p =0.368, p=0.273). (Table 3).

Tabel 3. Comparison of visual outcome among the three treatment groups

	IV Steroid	IV Steroid + Oral Steroid	Oral Steroid	P value*
Visual acuity pre post	0 (-0.7 – 0.01)	-0.2 (-0.3 – 0)	-0.3 (-0.47 – 0.22)	0.692
Color blindness pre post	0 (0 – 2)	0 (-10 – 2)	0 (0 – 0)	0.368
Contrast sensitivity pre post	0 (0 – 2.5)	0 (0 – 5)	0 (0 – 0)	0.273

**Friedman test*

DISCUSSION

Thirty patients of this study, 20 male (66.7%) dan 10 female (33.3%) with average age was 28,6 ± 6,98. The average baseline visual acuity was 1.17 ± 0.99, color blindness was 18.2 ± 14.97, and contrast sensitivity was 4.33 ± 4.55. There were 5 cases that received intravenous steroid injection alone, 18 cases received intravenous steroid followed with oral steroid, and 7 cases received oral steroid alone. This study showed that intravenous steroid followed with oral steroid therapy had an effect on improving visual acuity and color blindness when compared in pre post therapy groups. Oral steroid alone therapy may had an effect in terms of pre post visual acuity.

The previous study mentioned that IV megadose steroids had no clear benefit on the visual outcome of patients with TON. Regimen of IV methyl prednisolone as proposed by ONTT (1 g/day for 3 days followed by oral tapering steroids 1 mg/kg for 2 weeks) was safe and

effective in managing TON patients presenting within 3 days of onset of defective vision following trauma even with presenting visual acuity as low as 6/60. Those with baseline vision <6/60 and those managed conservatively did not show statistically significant improvement.

The management of TON is controversial. However, the data in the literature to date has not shown any treatment to be superior to observation. The main treatment options for indirect TON are: systemic steroids, surgical decompression of the optic canal, combination of steroids and surgery and observation alone.[6,7] Some authors have supported the use of high or "mega" dose corticosteroids in TON. This therapeutic regimen has been extrapolated from the National Acute Spinal Cord Injury Study II, which showed a statistically significant improvement in neurologic outcome (motor and sensory) in a subgroup analysis of acute spinal cord injury patients receiving a methyprednisolone 30 mg/kg bolus within eight hours of injury, followed by 5.4 mg/kg/hr for 23 hours.[8] Subsequently however, the CRASH (Corticosteroid Randomization After Significant Head injury) study showed an increased relative risk of death in patients given this regimen after significant head injury.[9] The International Optic Nerve Trauma Study also did not show a difference in final visual acuity between patients with TON that were observed compared with those given steroids.[1] Mouse models have shown promising results with the use of resveratrol after optic nerve crush injury. Surgical intervention for TON was shown to not be beneficial in The International Optic Nerve Trauma Study.[10] Some have supported the use of surgery in certain scenarios such as when a bony fragment is abutting to optic nerve or in the case of an optic nerve sheath hematoma but there is no good data supporting surgery for indirect TON.[11] Prognostic factors for improvement in visual acuity with steroids were the visual acuity at presentation and the time period between the injury and the administration of steroids. Four variables are related to a poor outcome in TON: blood in the posterior ethmoid cells, loss of consciousness, age over 40, and absence of improvement after two days of steroid treatment.[12]

CONCLUSION

Patients with TON had better visual outcome after treated with intravenous steroid followed with oral steroid

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