

Original Research Article

Visual Outcome Following Endoscopic Optic Canal Decompression in Compressive and Traumatic Optic Neuropathy- A Prospective Observational Study

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Abstract: Aim of the study is to assess the effect of Latency (Interval between onset and treatment), Underlying pathology and Pre-operative vision, on the visual outcome in case of Compressive Optic Neuropathy and Latency (Interval between onset and treatment), Intra operative findings and Pre-operative vision, on the visual outcome in case of Traumatic Optic Neuropathy. This study was conducted in the ENT Department along with the ophthalmology department at Sundaram Medical Foundation, Chennai, 160 bedded community based hospital. Prospective observational study conducted from July 2007 to July 2009. This prospective observational clinical study was done to assess the visual outcome following endoscopic optic canal decompression among 24 patients (14 traumatic and 10 compressive) at our institution, who were followed up for 1 month after surgery. Patients were included as per inclusion criteria formulated for this study & were analyzed with respect to their pre-operative & post-operative vision using visual analog score. The data was analyzed in "SPSS10 for Windows (Statistical Package for Social Sciences)" software. The accuracy and the other characteristics are determined by its independent comparison with its "Gold standard test" by constructing 2x2 tables. Visual improvement was assessed using Log MAR score and recorded in the first post-operative day, 1 week later and at the end of 1 month. From the result it was concluded that, in compressive optic neuropathy, latency was not a significant factor to influence the visual outcome. Pathology and pre-operative vision were found to be contributory factors on visual improvement following endoscopic optic canal decompression. In traumatic optic neuropathy, latency and pre-operative vision were found to be contributory factors on visual improvement following endoscopic optic canal decompression. Type of intra-operative finding was not a significant factor to influence the visual outcome. The observations & results of our study of endoscopic optic canal decompression are in comparison to similar studies reported in recent world literature.

Keywords: Endoscopic Optic Canal Decompression, Visual Analog Score, Optic Neuropathy, Logarithm of the Minimum Angle of Resolution (log MAR) Scale

INTRODUCTION

The intra-canalicular part of the optic nerve is around 9mm, situated in the lateral wall of the sphenoid sinus, surrounded by bone and is relatively immobile, making the optic nerve vulnerable in lesions compressing the optic nerve and following trauma. Endoscopic Optic Canal Decompression (EOCD) is a less invasive extra cranial approach to anterior part of the optic nerve canal [1]. The hallmark of Compressive Optic Neuropathy (CON) is a slowly progressive visual loss typically a central scotoma and a Relative Afferent Pupillary Defect (RAPD). Common compressive lesions include

Allergic fungal sinusitis, Mucormycosis, Mucocele, Fibrous dysplasia and Osteoma.

Traumatic optic neuropathy (TON) refers to an acute injury of the optic nerve secondary to trauma. The optic nerve axons may be damaged either directly or indirectly and the visual loss may be partial or complete. An indirect injury to the optic nerve typically occurs from the transmission of forces to the optic canal as in blunt head trauma. Direct injury results due to an anatomical disruption of the optic nerve fibers from

penetrating orbital trauma, bone fragments within the optic canal, or nerve sheath hematoma [2].

In addition to thorough ophthalmic examination done for all the patients, Computerized tomography of paranasal sinuses gives us vital information such as underlying pathology in the sinuses and degree of involvement of the optic nerve.

Initial medical management with mega dose of IV steroids helps in relieving the oedema of the nerve. Operative modality by Endoscopic optic canal decompression is used in selective group of patients to approach the intracanalicular part of the optic nerve to treat pathological lesions as in compressive neuropathy and to relieve pressure over the nerve as in traumatic neuropathy [3, 4]. We have done a prospective study in these patients, who were treated with corticosteroid and endoscopic optic canal decompression as combined therapy protocol [5]. The visual outcome results in this group were correlated with the surgical finding.

MATERIALS AND METHODS

Endoscopic optic canal decompression [6] has been performed at our institution, since its introduction 2004. Till date 40 patients have successfully undergone this procedure at our institution with gratifying results. This prospective study was conducted over a period of 24 months from July 2007 to June 2009. The principal aim of our study was to assess the visual outcome of the Endoscopic optic canal decompression in a consecutive series of 24 patients with diminution in vision, secondary to optic nerve pathology and was followed up over a period of one month. All these patients were selected based upon the inclusion and exclusion criteria for the study, as formulated below.

Inclusion criteria were progressive diminution of vision with radiological evidence of Compressive optic neuropathy of varying pathology (or) diminution or loss of vision following trauma. Patient with the following conditions were excluded from the study: Thyroid (Graves) orbitopathy, previous surgery for diminution of vision, associated intracranial injury, Globe injury, Vitreous and Retinal Hemorrhage, Retinal detachment.

Post op log MAR – Pre op log MAR

$$\text{Visual Improvement \%} = \frac{\text{Pre-injury log MAR} - \text{Pre op log MARS}}{\text{Pre-injury log MAR} - \text{Pre op log MARS}} \times 100\%$$

Ethics

As our study was based on operative findings as gold standard, the study protocol was approved by ethical committee and only routine drugs were used. Informed Consent was obtained for all our patients. The procedures followed were in accordance with the ethical standards of the responsible committee on

After obtaining informed consent for participation in the study, the selected cohort of 24 patients underwent a complete clinical examination with Diagnostic Nasal Endoscopic assessment and complete ophthalmological examination. As most of our patients are referred from other ophthalmological institutions there were already diagnosed and started on megadose corticosteroids before referral.

The selected cohort of 24 patients, were prepared for Endoscopic optic canal decompression and were operated by the same surgical team between the periods from July 2007 to June 2009. Intra-operative findings (Gold standard) such as pathology, sinus involvement, canal dehiscence and compression of the nerve in case of compressive and Optic canal fracture, lateral wall of sphenoid fracture and bony fragment impinging on the optic nerve in case of traumatic optic neuropathy were documented. For our study convenience, latency (Interval between onset and treatment) period was grouped into 4 as 1<6 hours, 2.6 hours-48 hours (2days), 3.2 days -2 weeks and 4>2 weeks.

Visual outcome was analysed based on latency, pathology and presenting vision in compressive and on latency, intraoperative findings and presenting vision in cases of traumatic optic neuropathy. For a quantitative assessment of the degree of visual improvement following surgery, the visual acuity was converted to the logarithm of the minimum angle of resolution (log MAR) scale per the given conversion chart and the percentage improvement was calculated [7]. The percentage improvement was calculated as the quantum of improvement following surgery (postoperative vision versus preoperative vision), as a proportion of the preoperative visual deficit (pre-injury vision versus preoperative vision). Because pre-injury vision was never directly recorded by us, this was based on previous records, if available. In situations where no such records were available and the patient reported pre-injury equivalent vision in both eyes, the contra lateral visual acuity was recorded and presumed equivalent to the pre-injury vision.

human experimentation (institutional) and with the Helsinki Declaration of 1975, as revised in 2000.

Statistical Analysis

The data was analyzed using “SPSS-10 for Windows (Statistical Package for Social Sciences)” software. Non-parametric test of statistical significance for

bivariate tabular analysis used to test the association between two variables. The Chi-square test is used in testing of goodness of fit, Testing of association and Testing of homogeneity. The calculated value is compared against the tabulated value (reference value) for (n-1) degree of freedom. If the calculated value is more than the expected value, then it is concluded that there's a statistically significant association between the two variables and vice versa.

RESULT & DISCUSSION

Compressive Optic Neuropathy

The Compressive Optic Neuropathy was presented in the table 1. Minimum age was 28 years and maximum was 67 with the average age of 45 years. Males predominated in our study. Allergic Fungal Rhino sinusitis (AFRS) was the most common presentation in our study group (6) followed by Mucocele (2). Fibrous dysplasia and Mucormycosis was seen in 1 each. Figure 1, shows the endoscopic picture of optic nerve in sphenoid sinus lateral wall.

Table1: Compressive Optic Neuropathy

Pathology	Presenting Vision	Log MAR	Post-Operative Vision	Log MAR	% In Vision Improvement
AFRS	No PL	-4.70	6/12	-0.30	93.61
AFRS	No PL	-4.70	PL	-3.70	21.27
Mucocele	No PL	-4.70	No PL	-4.70	0
Mucormycosis	No PL	-4.70	No PL	-4.70	0
Fibrous Dysplasia	No PL	-4.70	PL	-3.70	21.27
Pathology	Presenting Vision	Log MAR	Post-Operative Vision	Log MAR	% In Vision Improvement
AFRS	PL	-3.70	6/24	-0.60	83.78
AFRS	PL	-3.70	6/36	-0.70	81.08
AFRS	PL	-3.70	6/6	0.00	100
AFRS	PL	-3.70	6/60	-1.00	72.97
Mucocele	PL	-3.70	6/18	-0.48	87.02

(P=0.189)

(10 cells (100%) have expected count less than 5. The minimum expected count is 0.10)



Fig1: Endoscopic picture of optic nerve in sphenoid sinus lateral wall

Latency

Most of our patients presented between 1 week to 3 months after the onset of symptoms, none of our patient presented less than 1 day.

Correlation of Latency with Visual Outcome

We could not find a correlation between the latency and the visual outcome (P=0.046), this is probably due to small group of patients with varying pathology which supports similar results observed by Sleep *et al.*; [8].

Correlation of Pathology and Post-operative Visual Outcome

In our study the post-operative visual outcome was not uniform for the specific pathology (P=0.068).

1. Though some patients with AFRS showed good visual improvement up to 20/20 (100%), this was not a standard finding in other patients of the same group. This was probably due to varying extent of the pathology in different patient and associated comorbid conditions.

2. Aggressive nature of the disease and associated uncontrolled diabetes could be the contributing factors for the poor visual outcome in patient with mucormycosis.
3. Though one of the patient with mucocele improved to 20/62 (87.02%) the same was not seen in the second patient which is unexplained.
4. The patient with fibrous dysplasia had involvement of the optic canal there by the poor post-operative visual outcome could be explained.

Pre-operative Vision Vs Post-operative Visual Outcome

Patients with Perception of light at presentation had significant improvement in postoperative vision when compared to patients who presented with no perception of light ($P=0.189$). Pletcher *et al.*, mentioned in his study mean visual improvement was from 20/300 to 20/30 and visual improvement was seen in 7 of his 10 decompressions [9]. In our study the visual outcome was from no perception of light to 20/40 up to 20/20 and visual improvement was seen in 5 of 10 patients. Patients who did not improve in their vision had multiple co morbidity.

Traumatic Optic Neuropathy

The findings of Traumatic Optic neuropathy was shown on table 2. Minimum age was 6 years and maximum was 47 with the average age of 32 years with Male predominance. Figure 2 and 3, CT-PNS of Compression of right optic nerve by hyper intense lesion in right sphenoid sinus and Compression of right optic nerve by bony segment in lateral wall of right Ethmoid sinus respectively.



Fig2: CT-PNS: Compression of right optic nerve by hyper intense lesion in right sphenoid sinus



Fig3: CT-PNS: Compression of right optic nerve by bony segment in lateral wall of right Ethmoid sinus

Latency at Presentation

None of our patients presented within 6 hours of injury. Most of our Patients presented between 6 hours and 2 weeks. Few presented later than 2 weeks.

Effect of Latency on % Visual Improvement

Patients presented between 6 hours to 2 weeks had better visual improvement when compared to patients presented after 2 weeks. Thus in our study there was a correlation between Latency of presentation and visual outcome ($P=0.271$). Previous study conducted by Rajiniganth *et al.*; [10] and Thakar *et al.*; [11] showed that the time lapse after injury, was a significant factors to correlate visual prognosis after treatment.

Correlation of Intraoperative Finding and Visual Outcome

It was noted that visual outcome was not dependent on the presence of single or multiple findings ($P=0.046$). 50% of patients with single finding improved, 60% patients with 2 coexisting findings had visual improvement and 33% patients with 3 coexisting findings had visual improvement.

Patients with Lateral wall of sphenoid fracture had poorer visual outcome whereas patients with optic canal fracture had better visual outcome. Study by Gupta *et al.*; [10] have reported that patients with canal fracture or compression of the nerve (Bony fragment impingement in the optic canal) intra-operatively had better visual outcome following EOND this was not seen in our study.

Table-2: TRAUMATIC OPTIC NEUROPATHY

Patient No	Intra Operative Finding	Presenting Vision	Log MAR	Post Operative Vision	Log MAR	% In Vision Improvement	Latency
1	Sphenoethmoidal Fracture	No PL	-4.70	3/60	-1.30	72.34	2d-2 wks
2	Sphenoethmoidal Fracture	No PL	-4.70	2/60	-1.40	70.21	6-48hrs
3	Optic canal fracture + Bony fragment impingement in the optic canal	No PL	-4.70	2/60	-1.40	70.21	2d-2 wks
4	Sphenoethmoidal Fracture	No PL	-4.70	1/60	-1.70	63.82	2d-2 wks
5	Sphenoethmoidal fracture + Bony fragment impingement in the optic canal	No PL	-4.70	PL	-3.70	21.27	2d-2 wks
6	Sphenoethmoidal fracture Bony fragment impingement in the optic canal	No PL	-4.70	No PL	-4.70	0	>2wks
7	Optic canal fracture Bony fragment impingement in the optic canal	No PL	-4.70	No PL	-4.70	0	>2wks
8	Sphenoethmoidal fracture + Bony fragment impingement in the optic canal	No PL	-4.70	No PL	-4.70	0	2d-2 wks
9	Sphenoethmoidal Fracture	No PL	-4.70	No PL	-4.70	0	6-48hrs
10	Optic canal fracture + Sphenoethmoidal fracture + Bony fragment impingement in the optic canal	PL	-3.70	6/24	-0.60	83.78	6-48hrs
11	Sphenoethmoidal fracture + Bony fragment impingement in the optic canal	PL	-3.70	3/60	-1.30	64.86	2d-2 wks
12	Sphenoethmoidal Fracture	PL	-3.70	2/60	-1.40	62.16	6-48hrs
13	Sphenoethmoidal Fracture	PL	-3.70	PL	-3.70	0	>2wks
14	Sphenoethmoidal Fracture	3/60	-1.30	3/60	-1.30	0	2d-2 wks

(P=0.495)

(20 cells (100%) have expected count less than 5. The minimum expected count is 0.45)

Pre-Operative Vision Vs % Visual Improvement

In our study we observed that the Pre-operative visual acuity had a significant influence on the post-operative visual improvement (P=0.498). 4 out of 9 patients who presented with no perception of light had no visual improvement and remaining 5 visual improvement ranged from 20 to 70%. 3 of 4 patients with perception of light at presentation had visual improvement ranging from 60 to 84%. One patient with 10/200 at presentation had no visual improvement which cannot be explained.

Previous studies showed that, the mean improvement of 45.2% in vision, in patients who were younger than 40 years of age do better than in patients who were 40 years of age or older [12,13]. Interval between injury and surgery, pre-operative visual acuity and the presence of optic canal fracture did not affect outcome. Also found that the dosage or timing of corticosteroid treatment or the timing of optic canal decompression

was not associated with an increased probability of improved visual acuity.

Compressive Optic Neuropathy

CON occurs in elderly, the common mode of onset of visual loss is gradual and progressive. The commonest orbital manifestation is proptosis and the commonest ocular manifestation is reduction in visual field area. Pathology and pre-operative vision has influence on visual improvement whereas latency at presentation did not show any influence on visual improvement.

Traumatic Optic Neuropathy

TON commonly occurs in young male following RTA [14]. Latency and pre-operative visual acuity has influence on visual improvement whereas intra operative findings such as optic canal fracture Sphenoethmoidal complex fracture and bony fragment impinging in the optic canal individually or in combination does not have influence on visual improvement. Treatment with steroid and surgery is

better than no treatment as it has no morbidity and mortality with better results [15]. The protocol is to start injection Methyl prednisolone (30mgm/ kg/day) once suspected or diagnosed as optic neuropathy.

CONCLUSION

From the result it was concluded that, in compressive optic neuropathy, latency was not a significant factor to influence the visual outcome. Pathology and pre-operative vision were found to be contributory factors on visual improvement following endoscopic optic canal decompression. In traumatic optic neuropathy, latency and pre-operative vision were found to be contributory factors on visual improvement following endoscopic optic canal decompression. Type of intra-operative finding was not a significant factor to influence the visual outcome. Moreover, Endoscopic Optic Canal Decompression was found to be free from any mortality or morbidity. EOCD is safe, effective in expert Surgeon. It is less traumatic, with no cosmetic problem with most acceptable among surgeon and patient.

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