



PRE INTERVENTION VISUAL EVOKED POTENTIAL IN THE ASSESSMENT OF VISUAL OUTCOME FOLLOWING OPTIC NERVE INJURY ASSOCIATED WITH TRAUMATIC BRAIN INJURY.

Neurosurgery

Dr. L. Feroz Ahamed M.S., MCh. Asst. Professor Neurosurgery Govt. Mohan Kumaramangalam Medical College Salem, Tamilnadu, India.

Prof. H.M. Baba Dhoulath Khan M.S., MCh. Associate professor of neurosurgery Govt. Mohan Kumaramangalam Medical College Salem, Tamilnadu, India.

Dr. Aravinth Kumar. A.* M.B.B.S., Resident in Neurosurgery Institute of Neurosurgery Madras Medical College Chennai – 600003 Tamilnadu, Chennai, India *Corresponding Author

ABSTRACT

AIM: Traumatic optic neuropathy is a devastating complications of head injury. The improvement in vision after treatment has a significant impact on the prognosis. This study analyses the association between pre interventional visual evoked potential and the post interventional visual outcome.

Methods: In this study 56 patients with mild and moderate head injury with associated optic nerve injury were included. Patients with pre existing optic nerve disease were excluded. Clinical assessment of the patient's vision and visual evoked potential were recorded. Patients were treated by medical and surgical methods accordingly. Statistical analysis was done using IBMSPSS software.

Results: Patients with abnormal waves in VEP showed significant improvement in vision. Patients who had absent waves in VEP showed poor recovery in vision.

Conclusion: Visual evoked potential is an excellent tool to assess the visual outcome in patients with optic nerve injury in the setting of traumatic brain injury

KEYWORDS

1. Optic Nerve Injury, 2. Traumatic Brain Injury (TBI), 3. Visual Evoked Potential (VEP) 4. Visual Acuity

INTRODUCTION

Traumatic optic neuropathy (TON) is one of the devastating complications of head injury. It is noted in 0.5 to 3% of head injuries. According to the largest Canadian epidemiological study from multiple adult trauma centres, two thirds of patients with traumatic optic neuropathy had associated significant head injury, whereas only 2.3% patients with head injury had optic nerve injury (Pirouzmand, 2012¹). AK Mahapatra and Bhatia conducted a large study of optic nerve injury in head injury patients in AIIMS and found that, the incidence of optic nerve injury in head injury is 1.5% (Mahapatra, Visual problems following head injury, 2014²).

Majority of optic nerve injuries happened because of acceleration and deceleration injury. The incidence was common among young adult males (al R. s., 2008³). RTA is the most frequent cause for TON, followed by falls and assaults. The optic nerve injury is often associated with significant head injury and faciomaxillary injury.

Optic nerve injury can be divided into direct or indirect injury (Mahapatra, visual problems in head injury, 2014²). The direct injury results from sharp object trauma, in which damage to the optic nerve occurs due to penetrating injuries, optic nerve avulsion or due to laceration caused by bony fragments. Whereas indirect injury is caused by transmission of shock waves or forces from a distant site to the optic nerve. Indirect injuries are more common than direct injuries in head injury patients. The prognosis of direct injury is very poor (Wai, 2015⁴). Regarding the management, there is no evidence based guidelines for the management optic nerve injury with steroids, surgical decompression or observation (al H. j., 2010⁵)

MATERIAL AND METHODS

Nature of study: Prospective study

Total cases studied: 56

Place of study : Institute Of Neurosurgery, Madras Medical College, Chennai.

PATIENT SELECTION:

INCLUSION CRITERIA

1. Patients with mild head injury (GCS-13 to 14) and those recovering from moderate head injury (GCS-9 to 12).
2. Patients showing clinical evidence of optic nerve injury.

EXCLUSION CRITERIA

1. Patients with severe head injury and critically ill patients.
2. Patients with past history of optic nerve, orbit and corneal damage.
3. Patients not consenting to participate in this study.
4. Patients who deteriorated neurologically after admission.
5. Paediatric patients excluded from this study.

CLINICAL ASSESSMENT

All the patients in this study were evaluated clinically, with VEP study and by imaging at the time of admission, at 48 hrs, 7th day and at the time of discharge. Pupils, visual acuity, field of vision and colour vision were tested using following parameter

VISUAL EVOKED POTENTIALS

In this study, VEP was done using pattern reversal technique. After resuscitating the patients for head injury, preintervention VEP was taken.

STATISTICAL ANALYSIS:

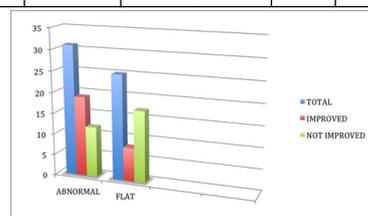
The above statistical procedures have been performed by the statistical package IBMSPSS statistics-20. The P-values less than or equal to 0.05 ($P \leq 0.05$) were considered as statistically significant.

RESULTS

Significance of Pre Intervention VEP

TABLE-1: Association between Abnormal and Flat VEP waves with visual outcome

VEP WAVES	Visual acuity			X ²	df	Sig
	Improved	Not Improved	Total			
ABNORMAL	19	12	31	4.755	1	P<0.05
FLAT	8	17	25			
TOTAL	27	29	56			



The above association was statistically significant ($P < 0.05$).

DISCUSSION

The study subjects, namely, patients with traumatic optic neuropathy with head injury, patients were described in terms of their demographic characteristics like age and sex and they were described in terms of their clinical features. The improvements of patients after they underwent medical and surgical procedures were analyzed and interpreted from admission to discharge according to the type of variables. The improvements in terms of continuous measures were applied by parametric tests and categorical variables were applied by non-parametric tests.

VISUAL EVOKED POTENTIALS (VEP)

Visual evoked potentials is a very good indicator of the integrity of visual pathway. Till the 1980s VEP was not used in optic nerve injury patients. Shaked et al in 1982, reported a case and highlighted the importance of VEP in traumatic optic neuropathy. Nau et al, in 1987 reported poor outcome in patients having no waves. Mahapatra et al and Tandon et al repeatedly showed better visual recovery in patients with abnormal or normal VEPs. They also showed that patients with repeated absent waves had no visual recovery^{2,4}.

VEP represented the cortical response to light stimulus. VEP results can be categorized into normal, abnormal or absent depending upon their wave formation, amplitude and latencies. Latencies longer than 2 Standard Deviation of the control were considered as abnormal. VEPs are routinely done within 48hrs of initial evaluation and test is repeated within 10 days to assess the improvement. Light emitting diode visual evoked potentials is used in unconscious patients.

Patient who are showing repeated absent waves in VEP studies, will not improve after surgical decompression^{2,4}.

There are two types of VEP technique as follows:

- (i) Pattern Reversal Technique
- (ii) Flash VEP

In our study, the pattern reversal technique was followed

TREATMENT

The patients were grouped into

- (i) Steroid alone group
- (ii) Combined modality group (steroid treatment followed by surgical decompression)
- (iii) Observation group.

All the patients in steroid alone and combined modality group were initially treated with Injection Methylprednisolone 500mg BD and assessed their visual improvement after 48hrs.

STEROID GROUP

1. Patients who showed rapid improvement in vision following steroid treatment.
2. Patients who are not having bony compression, optic nerve sheath haematoma and nerve edema in imaging study.
3. Patients who didn't showed any evidence of visual recovery and VEP study revealed flat waves

COMBINED MODALITY GROUP (STEROID FOLLOWED BY SURGICAL DECOMPRESSION)

1. Patients who were initially treated with steroids who showed minimal improvement and then became static and their imaging showing optic nerve compression by bony fragments.
2. Patients who had delayed visual dysfunction and their imaging showing optic nerve edema, nerve sheath haematoma and optic canal fracture with bony compression.

All the patients in this group initially received steroids they were reassessed after 48hours. If the patients had slow improvement or static visual acuity or developed delayed deterioration and their imaging showed optic nerve compression by bony fragments, they were taken up for surgery. If patients image showed compression from medial optic canal wall by fractured bony fragments or optic nerve edema, they were taken up for transnasal endoscopic decompression of medial orbital wall and medial optic canal. If patients imaging showed compression from lateral orbital wall or lateral wall of optic canal by bony fragments, they were taken up for lateral orbitotomy and removal of bony fragments. In the post operative period, steroids were continued and tapered later. They were reassessed for clinical visual recovery after 48 hours and 7 days.

OBSERVATION GROUP

1. Patients having NIDDM with fluctuating sugar value.
2. Patients having multiple brain contusions with fluctuating neurological status.
3. Patients who recovered spontaneously from their visual dysfunction.
4. Patients who presented late and their fundus showed optic atrophy.

In observation group for TON, patients were not started on steroids or they did not undergo any surgical treatment. They were treated for head injury alone. For optic nerve injury, they were only observed and evaluated periodically.

In our study from a total of 56 patients, 31 patients had abnormal VEP waves and Eight patients had flat VEP waves. From the 31 patients with abnormal VEP waves, 19 (61.2%) patient had clinical improvement in visual acuity and 12 (38.8%) patients did not improve. from the 25 patients who had flat VEP waves visual acuity improved in 8 (32) patients and did not improve in 17 (68%) patients.

The statistical analysis shows that there is a significant improvement in visual acuity in those patients with abnormal VEP waves when compared to those patients with flat VEP waves.

CONCLUSION

The visual evoked potential is an easily available and affordable electrophysiological investigation procedure. It is easily available and accessible to all. The result of this study along with the easy availability and low cost makes visual evoked potential an excellent tool to assess the visual outcome in patients with optic nerve injury the setting of traumatic brain injury.

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