

Original Research Article

The association between post traumatic amnesia and visual photosensitivity in mild traumatic brain injury

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ABSTRACT

Background: Visual symptoms are a common occurrence following mTBI. Among visual symptoms, Visual photosensitivity is a frequent manifestation post mTBI, which can disrupt the normal lifestyle of any individual resulting in social and professional distress. Post traumatic amnesia is one of the markers of severity in mTBI. Authors have studied the association between visual photosensitivity and post traumatic amnesia following mTBI. The aim of this study is to find out the association between Visual Photosensitivity and post traumatic amnesia in patients with mild traumatic brain injury.

Methods: Hospital based prospective, analytical, observational study. A total of 300 patients with the diagnosis of mTBI were studied. Diagnosis of mTBI was based on the WHO Operational criteria for clinical identification of mTBI. VLSQ-8 Questionnaire was used in this study to diagnose and monitor the progress of visual photosensitivity in patients with mTBI. The Galveston Orientation and Amnesia Test (GOAT) was applied to assess post traumatic amnesia. The study period was from July 2017 to March 2019. Each patient with mTBI who developed visual photosensitivity was followed up for 1 year after the appearance of their symptoms.

Results: Thus the main observations of this study were (i) There is a strong possibility of developing visual photosensitivity among the group of patients who presented with the history of post traumatic amnesia following mild traumatic brain injury ($p=0.0008$)(ii) if a patient with mild traumatic brain injury suffers from visual photosensitivity, possibility of his/her symptoms persisting beyond 6 months increases significantly if there is history of post traumatic amnesia ($p=0.0001$).

Conclusions: This result will help in providing information regarding prognosis of visual photosensitivity following mild traumatic brain injury.

Keywords: Mild traumatic brain injury, Post traumatic amnesia, Prognosis, Social and professional distress, Visual photosensitivity

INTRODUCTION

Traumatic brain injury is a major cause of death and disability with an estimated incidence of 10 million cases per year.¹ The vast majority are so called Mild Traumatic Brain Injuries (mTBI) are at least tenfold more prevalent than more severe injuries.² While the likelihood of

favorable recovery from mTBI within a few months is high, a proportion of patients experience long-standing cognitive, emotional, and/ or somatic symptoms that interfere with work, school, and/or family responsibilities.³⁻⁶ Visual symptoms associated with moderate and severe traumatic brain injury are usually profound and have historically overshadowed the impact

of mTBI. Even mTBI can significantly affect visual functions. This is due to the fact that about 70% of the brain's sensory processing is visual related.^{7,8}

The most common visual deficits associated with mTBI are oculomotor dysfunction (accommodative, version, vergence) and their associated reading problems, photosensitivity and visual field defects.⁸⁻¹¹

Visual photosensitivity is an abnormal intolerance to light. It is a subjective symptom associated with a number of ophthalmic and neurological conditions. Visual photosensitivity causes discomfort when the eyes are exposed to natural or artificial light sources outdoors or indoors. Glare, involuntary blinking, squeezing of eyelids and watering in bright light or bright colours can be symptoms associated with visual photosensitivity. In severe cases patient can complain of headache, nausea and blurring of vision.⁹ Watching TV, reading, driving, working on computers, walking outside in sunlight also can become limited.

Visual Photosensitivity following mTBI can cause mild discomfort to significant pain and can affect a person's ability to lead a regular life and perform normal activities.

Post traumatic amnesia is defined as the period of time from last memory before trauma until the return of normal continuous memory when the individual is continuously oriented and demonstrates consistent recall.¹²

The risk of neuro-cranial complications after a brain injury in which patients did not experience loss of consciousness or post traumatic amnesia is only a quarter of the risk of individual that do experience loss of consciousness or post traumatic amnesia. Duration of post traumatic amnesia is one of the best predictors of severity of brain injury.^{13,14}

There is almost no literature or studies available on post traumatic amnesia and its association with visual photosensitivity.

The purpose of this study was to find out the association between post traumatic amnesia and visual photosensitivity in patients with mild traumatic brain injury and its implication on prognosis.

METHODS

This is a hospital based prospective, analytical, observational study.

Inclusion criteria

All patients attending the Neurosurgery out patients department or Casualty of Pradyumna Bal Hospital, KIMS, KIIT University Bhubaneswar, clinically

diagnosed as Mild Traumatic Brain Injury (mTBI), above the age of 10 years were included in the study.

Exclusion criteria

All patients diagnosed as mTBI with glaucoma, dry eye, retinal diseases, iritis, vitreous hemorrhage, central corneal opacities, advanced cataract or history of any ocular surgery, repeated mTBI, migraine or psychiatric illness were excluded from the study.

All patients underwent a detailed history taking, systemic and ophthalmic examination including BCVA (Best corrected visual acuity), Color vision, tonometry, gonioscopy, schimer's test, TBUT (Tear film breakup time), OCT RNFL (Retinal nerve fiber layer) and HVF (Humphrey visual field analysis).

All patients were asked to fill up the photosensitivity questionnaire (VLSQ-8) forms.¹⁰ All the patients underwent the Galveston Orientation and Amnesia Test (GOAT) for determining post traumatic amnesia.

The study period was from July 2017 to March 2019. Each patient with mTBI who developed visual photosensitivity was followed up for 1 year after the appearance of their symptoms.

Diagnosis of m TBI was based on the WHO Operational criteria for clinical identification of m TBI: (I) One or more of the following: Confusion or disorientation, loss of consciousness for 30 minutes or less, post traumatic amnesia of less than 24 hours duration and/or other transient neurological abnormalities such as focal signs, seizures and intracranial lesions not requiring surgery. (II) A Glasgow coma scale of 13-15 after 30 minutes post injury or at presentation to the hospital.

Visual photosensitivity is difficult to diagnose and measure objectively. Jennifer D, Verriotto have developed and validated a Questionnaire VLSQ -8 (Visual Light Sensitivity Questionnaire -8 for diagnosis and assessment of visual photosensitivity).¹⁰

Author have used VLSQ-8 Questionnaire in this study to diagnose and monitor the progress of visual photosensitivity in patients with mTBI.

The Galveston Orientation and Amnesia Test (GOAT) was used to assess post traumatic amnesia.¹⁵ The GOAT was applied within seven days following mTBI depending on the time of arrival of the patients to the hospital. GOAT score of <75 was taken as the cutoff for establishing the diagnosis of post traumatic amnesia following mTBI.

Statistical analysis

Statistical significance between the groups was determined by using Fisher Exact Test. P value ≤ 0.05 was

considered to be significant. All details were recorded in patient data form. Patient consent was taken for participation in the study.

RESULTS

The 300 consecutive patients between the age group of 10 to 62 with the diagnosis of mTBI were studied and analyzed. Out of 300 patients, 186 were male and 114 were females. Mode of injury was road accidents in 59% followed by falls in 20% of patients. Sport related injuries were responsible in 12% of patients and assault in 9% of the patients.

Out of the 300 mTBI patients studied, 52.6% (158) were found to be suffering from post-traumatic amnesia. 54% (162) developed visual photosensitivity following mild traumatic brain injury.

Out of 162 patients who developed visual photosensitivity, 62% (100) patients were having the history of post traumatic amnesia. Among group of patients without the history of post traumatic amnesia only 43% (62) patients developed visual photosensitivity (Table 1).

Table 1: Occurrence of Visual photosensitivity in relation to Post traumatic amnesia.

	mTBI with Post traumatic amnesia	mTBI without Post traumatic amnesia
mTBI with visual photosensitivity	100	62
mTBI without visual photosensitivity	58	80

Table 2: Recovery pattern of Visual photosensitivity in relation to Post traumatic Amnesia.

	mTBI with Post traumatic amnesia	mTBI without Post traumatic amnesia
Visual photosensitivity recovered ≤6 months	45	90
Visual photosensitivity persisted ≥6 months	25	2

A strong possibility of developing visual photosensitivity was noted among the group of patients who presented with the history of post traumatic amnesia following mild traumatic brain injury (p=0.0008). 67% (90) of patients who had developed visual photosensitivity but without

the history of post traumatic amnesia following mTBI recovered within 6 months. The majority of the patients, 92% (25) in whom the symptoms of visual photosensitivity persisted beyond 6 months also suffered from post-traumatic amnesia (Table 2).

The symptoms of visual photophobia following mTBI are likely to persist for a longer period if these patients presented with post traumatic amnesia (p=0.0001).

Thus, the main observation of this study are:

- There is a strong possibility of developing visual photosensitivity among the group of patients who presented with the history of post traumatic amnesia following mild traumatic brain injury.
- If a patient with mild traumatic brain injury suffers from visual photosensitivity, possibility of his/her symptoms persisting beyond 6 months increases significantly if there is history of post traumatic amnesia.

DISCUSSION

The aim of this study was to find out the association between post traumatic amnesia and visual photosensitivity in patients with mild traumatic brain injury and its implication on prognosis. 54% of this patient developed visual photosensitivity following mTBI. The prevalence of visual photosensitivity among different studies was approximately 50% in post mTBI population and 10% in normal population.¹⁶⁻¹⁸

Out of the 300 mTBI patients studied, history of post traumatic amnesia was noted in 52.6% (158) of patients.

The risk of neuro-cranial complications after a brain injury in which patients did not experience loss of consciousness or post traumatic amnesia is only a quarter of the risk of individual that do experience loss of consciousness or post traumatic amnesia. Post traumatic amnesia is one of the best predictors of severity of brain injury.^{13,14}

Photosensitivity may be the result of two types of neural dysfunction: A dysfunction in the baseline light sensor and/or a dysfunction in the neural perceptual gain of light.

The dysfunction of baseline light sensor would most likely involve the Intrinsically Photosensitive Retinal Ganglion Cells (ipRGCs). These cells transmit more global information regarding the ambient light level of the visual environment.¹⁸ Neural perceptual gain of light is possibly controlled by lateral geniculate nucleus.¹⁹

The patients with mTBI with history of post traumatic amnesia may have more profound disruption of ipRGCs and lateral geniculate nucleus thus resulting in strong possibility of developing visual photosensitivity.

At present the literature is non-existent regarding the association of visual photosensitivity and post traumatic amnesia in cases of mild traumatic brain injury. Based on the results of present study it would not be wrong to conclude that there is a strong possibility of developing visual photosensitivity among the group of patients who presented with the history of post traumatic amnesia following mild traumatic brain injury ($p=0.0008$). This study also indicates that the symptoms of visual photophobia following mTBI are likely to persist for a longer period if these patients presented with post traumatic amnesia($p=0.0001$).

A patient whose professional and social life has been disrupted due to Visual photosensitivity following mild traumatic brain injury always wants to know from his treating clinician regarding possible timeline of his recovery or when can he resume his normal activities? This study will play an important role in addressing these questions.

Limitation of this study is that probably this is the only study where association between post traumatic amnesia and visual photosensitivity has been studied. More similar studies may help in reaffirming the observations and results generated by this study.

CONCLUSION

The possibility of developing visual photosensitivity is profound if the individual presents with the history of post traumatic amnesia following mild traumatic brain injury. The recovery from visual photosensitivity is also delayed in patients who have post traumatic amnesia. These observations will help in prognostication.

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