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Original research article

Analytical analysis of the impact of smoking on the VEP response in smokers: an institutional based study

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Abstract

Analytical analysis of the impact of smoking on the VEP response in smokers: an institutional based study

Aim: to explore the effect of smoking on the VEP response among smokers.

Materials and Methods: The present prospective case-control study was conducted in the Department of Physiology, ICARE Institute of Medical Science and Research & Dr. Bidhan Chandra Roy Hospital, Haldia, West Bengal, India. Age matched 100 male smokers and 100 male non smokers were recruited. Data was statistically analyzed.

Results: The male subjects selected with mean age of 45.76 years. Visual evoked potential was affected in smokers with prolongation of latency and decrease in amplitude of P100 in both the eyes than non smokers, with is statistically highly significant.

Conclusion: concluded that Visual Evoke Potential was affected in smokers with prolongation of latency and decrease in amplitude of P100 in both the eyes when compared to non smokers.

Keywords: Smokers, VEP, P100, Latency

Introduction

Per year, the International Health Organization reports that smoking causes 5 million premature deaths worldwide.1 Every year, over 6,00,000 Indians between the ages of 25 and 69 die as a result of smoke.[2] Nearly 120 million people in India currently smoke tobacco or use bidis.[3] According to the Global Adult Tobacco Survey 2010, the current percentage of male tobacco smokers in India is 24.3 percent.[4] It is by far well established that the smoking affects the blood flow. Many researchers quote that as smoking alters the normal circulation, it has significant effects on cerebral perfusion as well and may lead to alteration in physiology regulated by the area of brain suffering hypoperfusion.[5]

Smoking increases the risk of macular degeneration, cataracts, and poor eyesight. Of the 40,000 active substances in tobacco smoke, most are hazardous to human health. These toxic chemicals affect ocular tissues through ischemic or oxidative mechanisms.[6] Many common ophthalmological disorders such as retinal vein occlusion, age-related macular degeneration, cataract, anterior ischemic optic neuropathy, thyroid ophthalmopathy, and primary open angle glaucoma have been found to be associated with smoking. Diminished retinal sensitivity and peripheral scotomas in the visual fields have been observed in healthy heavy smokers.[7,8]

The effect of smoking on visual pathway can objectively be very well observed through visual evoked potential (VEP). This is a quick neurophysiologic, low-cost, non-invasive test which assesses the functional integrity of visual system. Through this, the study tried to observe and analyze the alterations in VEP in smokers. The aim of this study was to explore the effect of smoking on the VEP response among smokers.

Material & Methods

Study Design

The present prospective case-control study was conducted in the Department of Physiology, ICARE Institute of Medical Science and Research &Dr.Bidhan Chandra Roy Hospital, Haldia,West Bengal, India for 15 months

The study protocol was reviewed by the Ethical Committee of the Hospital and granted ethical clearance.

Inclusion criteria

Cases

- Patient who signed the "informed consent" form
- Male Patients ≥ 18 years of age
- History of smoking ≥15 cigarettes daily for at least 3 years

Controls

- Age matched
- Nonsmokers who did not smoke

Exclusion criteria

- Patients <18 years of age
- History of alcohol consumption
- Patients having preexisting ophthalmic complication
- Patients having a history of any neurological disorder
- Patients with history of diabetes mellitus and hypertension

Methodology

For all the participants the complete clinical history and physical examination followed by relevant clinical investigation were carried out and demographic data and smoking history was recorded.

VEP recordings were done in accordance with the standardized methodology of the International Federation of Clinical Neurophysiology committee recommendations and the International Society for Clinical Electrophysiology of Vision guidelines, and montages were kept as per the 10-20 International System of electroencephalogram (EEG) electrode placements.[9-11] The reference electrode (Fz) was placed 12 cm above the nation, the ground electrode (Cz) at the vertex, and the active electrode (Oz) at approximately 2 cm above the inion.

The study parameters included P100 latency which is the time interval between the onset of a visual stimulus and the first maximum positive deflection or excursion of the VEP signal and P100 amplitude which is measured from the peak of N70 to trough of P100 wave.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages.

Results

Table 1: demographic profile

Variables	Mean ± SD	
	Case	Control
Age	45.76±3.81	44.71±3.63
BMI	27.21±2.31	26.44±2.11
Duration of Smoking	5.79±1.81	-
Number of cigarettes per day	17.81±3.98	-

Table 2: Comparison of P100 wave latency in the right and left eyes among groups

P100 latency (ms)	Mean ± SD	
	Case	Control
Right Eye	115.76±7.11	94.71±3.13
Left Eye	115.21±7.21	95.04±3.01

Table 3: Comparison of P100 amplitude in the right and left eyes among groups

P100 amplitude (µvolts)	Mean ± SD	
	Case	Control
Right Eye	3.76±3.41	5.71±3.43
Left Eye	3.21±2.61	5.44±2.11

Discussion

This study was taken up to study the effects of cigarette smoking on vision through electrophysiological technique like VEP and by measuring visual reaction time. In this study the male subjects selected with mean age of 45.76 years. This study was taken up to study changes in VEP before clinical signs and symptoms related to vision appear in smokers.

Analysis of this study showed that VEP was affected in smokers with prolongation of latency and decrease in amplitude of P100 in both the eyes when compared to non smokers. An increase in VEP latency clinically means degeneration in the quality of sight. Study by Rose FC, on smokers with optic neuritis found that there was high incidence of colour vision defects in smokers when compared with non smokers. Vascular effects of smoking may be due to a direct effect of nicotine which could act either by depressing retinal ganglion cell function, block transmission in demyelinating nerve fibers, blocking synaptic transmission at lateral geniculate body or depressing receptor cells in striate cortex.[12]

Smoking is also associated with deficiencies in auditory-verbal learning or memory, general intellectual abilities, visual search speeds, processing speed and executive functions.[13]

The delayed response to visual stimuli in smokers might be due to various patho-physiological changes probably like atherosclerosis of arteries and arterioles supplying cerebral hemisphere. This may be the result of tobacco smoking which leads to abnormal increase in total blood triglycerides, enhanced blood coagulability due to increased fibrinogen. There is reduction in small airways function with low levels of PaO2 and PaCO2 which might lead to decreased cerebral blood flow. Smokers develop elevated carboxyhaemoglobin levels which might impair function of central nervous system by affecting oxygen transport and its utilization leading to cognitive dysfunction and perceptual motor delay in smokers.[14]

Though there are different opinions regarding effects of smoking on VEP, studies suggest that immediately after smoking reaction time becomes faster than baseline[15] and there is

increased amplitude, decreased latency of P100 produced due to the stimulant effect of nicotine on CNS.[16]

Conclusion

As compared to non-smokers, smokers' Visual Invoke Ability was impaired, with a longer latency and lower amplitude of P100 in both eyes. In clinical terms, an improvement in VEP latency indicates deterioration in vision quality. A broad population-based research is expected to generalise the findings. The anomalies in the VEP are nonspecific and do not suggest a particular aetiology.

References

1. Gupta PC. Tobacco control in India. Ind J Med Res. 2006;123:579-82.
2. Reddy KS, Gupta PC. Report on tobacco control in India. New Delhi: Ministry of Health and Family Welfare, Government of India; 2004.
3. Rani M, Bonu S, Jha P, Nguyen SN, Jamjoum L. Tobacco use in India: prevalence and predictors of smoking and chewing in a national cross sectional house-hold survey. Tob Control. 2003;12(4):4-4.
4. Government of India. Ministry of Health and Family Welfare. Global Adult Tobacco Survey, India Report, 2009-2010.
5. Boms N, Yonai Y, Molnar S, Rosengarten B, Bornstein NM, Csiba L, et al. Effect of smoking cessation on visually evoked cerebral blood flow response in healthy volunteers. J Vasc Res 2010;47:214-20.
6. Talhout R, Schulz T, Florek E, van Benthem J, Wester P, Opperhuizen A, et al. Hazardous compounds in tobacco smoke. Int J Environ Res Public Health 2011;8:613-28.
7. Friedman J, Meares R. Tobacco smoking and cortical evoked potentials:An opposite effect on auditory and visual systems. Clin Exp Pharmacol Physiol 1980;7:609-15.
8. Gundogan FC, Erdurman C, DurukanAH, Sobaci G, Bayraktar MZ. Acute effects of cigarette smoking on multifocal electroretinogram. Clin Exp Ophthalmol 2007;35:32-7.
9. Odom JV, Bach M, Brigell M, Holder GE, McCulloch DL, Tormene AP, et al. ISCEV standard for clinical visual evoked potentials (2009 update). Doc Ophthalmol 2010;120:111-9.
10. Celesia GG, Bodis-Wollner I, Chatrian GE, Harding GF, Sokol S, Spekreijse H, et al. Recommended standards for electroretinograms and visual evoked potentials. Report of an IFCN committee. Electroencephalogr Clin Neurophysiol 1993;87:421-36.
11. American Clinical Neurophysiology Society. Guideline 5: Guidelines for standard electrode position nomenclature. J Clin Neurophysiol 2006;23:107-10.
12. Smoking and optic neuritis. Postgraduate Medical J. 1975;51:382– 385.
13. Mostafa S, Kamal S. Cognitive function and electroencephalogram in chronic tobacco smokers. Egypt J Neurol Psychiat Neurosurg. 2009;46(2):377–383.
14. Deshpande KP, Phatak VK, MS. The study of auditory and visual reaction times in chronic smokers. Int J Med Health Sci. 2013;2(1):18–22.
15. Afshan A, Bhutkar MV, Reddy R, Patil RB. Effect of chronic smoking on intraocular pressure and audio-visual reaction time. Int J Biol Med Res. 2012;3(2):1760–1763.
16. Woodson PP, Baettig K, EtkinMW, Kallman WM, Harry GJ, Kallman MJ. Effects of nicotine on the visual evoked response. Pharmacol Biochem Behav. 1982;17(5):915–920.

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