Original Article

Retinal Screening of Workers Exposed to Mercury Vapor Using Electroretinography

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Abstract

Background: Mercury vapor is a harmful agent affecting the nervous, digestive, and immune systems. The visual system may also be affected due to exposure to mercury vapor. The present study aims to investigate the potential effects of mercury vapor on the retina of the workers exposed to this destructive agent using electroretinography.
Material and Methods: Twelve male workers aged 25- 45 years exposed to mercury vapor in different related occupations were selected for the present research work. Electroretinography (ERG) was examined for all participants in the case group. Amplitude (μv) and latency (msec) of ERG b wave were measured for all patient group participants; the same procedure was repeated for 12 participants of matched age and sex with the normal retinal condition. The results obtained in the case and control groups were compared to investigate the differences between the two groups using SPSS Version 22.
Results: No statistically significant differences were found in terms of demographic variables, i.e., age, whereas the two groups were significantly different in terms of BCVA. Moreover, a significant difference was found between the two groups regarding amplitude of ERG b wave ($P < 0.001$), whereas no significant differences were found in terms of latency of ERG b wave between case and control groups ($P = 0.461$).
Conclusion: Results of the present study showed that mercury vapor could affect the retina of workers, which can be measured and diagnosed by the amplitude of ERG, b wave.
Keywords: Mercury Vapor; Human; Retina; Electroretinography.

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Introduction

Mercury vapor can affect different organs of the human body, including the visual system. The electrophysiological technique of vision, such as visual evoked potential (VEP), electrooculography (EOG), and electroretinography (ERG), is among the efficient techniques to survey different physiological & pathological conditions of the visual system.

Shushtarians S.M et al., in 1999, worked on menstrual cycles of female subjects using VEP and showed that latency of VEP, P100 peak is delayed during menstruation, which was attributed merely to the hormonal alterations in this period [1].

Sarzaeim F et al., 2022, investigated VEP changes in patients receiving anti-epileptic medications. They reported that the VEP parameter, i.e., the latency of VEP, P100 peak, get delayed due to these medications leading to the pathological condition of the visual pathway in these patients [2].

The toxic effect of hydroxychloroquine (HCQ) on the retina of patients with rheumatoid arthritis was investigated by Allahdaddy F. et al. in 2016. The authors concluded that EOG is a suitable technique to diagnose the adverse effect of HCQ on the retina [3].

Tajik F et al. in 2018 studied the role of EOG in diagnosing retinal pathological changes in patients undergoing treatments with amiodarone which can be measured by the Arden index (AI) of EOG [4].

Recently, Sarzaeim F et al. evaluated the pathological condition of road drilling machine operators' retinas. They found that the retina gets affected due to vibration caused by these machines in these workers, which can be measured by ERG [5]. Keramti S et al. assessed the retinal changes of prolactinoma patients using flash electroretinography, which showed that the retina remains intact [6].

Many studies have shown the usefulness of different electro-ophthalmological techniques in different pathological conditions [7-16].

Thus, the present study was conducted to investigate the potential toxic effect of mercury vapor on the retina using full-field electroretinography.

Material and Methods

Twelve male subjects aged 25-45 years with different occupational activities with excessive exposure to mercury vapor were selected for the present work.

BCVA (Best corrected visual acuity) was measured in the whole case group. Electroretinography was examined in the total population using the ISCEV protocol. Mangoni machine was used to record ERG in all groups. Three electrodes, i.e., ground, reference, and active, were used to connect the patients to an electrophysiology machine capable of recording ERG. Ground, reference, and active electrodes were placed on the forehead, vertex, and cornea (Hard contact lens), respectively.

Amplitude (µv) and latency (msec) of ERG b wave was measured in the case group. The same procedure was repeated for 12 (male) age-matched subjects with healthy visual systems, mainly the retina. The results obtained in two groups were compared for the probable differences using SPSS version 22.

This study has been accepted by ethical committee of Tehran Islamic Azad University of Medical Sciences; ethical code :IR.IAU.TMU.REC.1399.372.

Results

Table 1 presents the demographic characteristics of patients in the case and control groups showing no statistically significant difference

Table 1: Demographic characteristics in case and control group

Variable	Number of participants	groups (Mean ± SD)		P value*
		Control	Case	
Age	12	35.33 ± 7.95	35.83 ± 7.68	0.71
Visual Acuity (LogMar)	12	0 ± 0	0.066 ± 0.049	0

* Based on Mann-Whitney U Test

Table 2: Measurement of mean latency and amplitude of ERG, b wave in case and control groups

Variable	Number of participants	groups (Mean ± SD)		P value*
		Control	Case	
Latency (msec)	12	43.75 ±1.48	44.08 ±1.61	0.461
Amplitude (µv)	12	108.29 ±7.1	90.83 ±11.73	0

* Based on Mann-Whitney U Test

between the two groups regarding age (P = 0.71), and a significant difference between the two groups in terms of BCVA (P < 0.001).

Table 2 presents the results of measurement of mean amplitude and latency of ERG, b wave, showing a significant difference between the two groups in terms of amplitude (P <0.001), whereas no significant differences is found in terms of latency (P = 0.461).

Discussion

Exposure to mercury vapor can cause different symptoms. Retina, a part of the visual system, may also get affected by mercury vapor.

The present study showed that the amplitude of ERG, b wave is reduced in these patients, which is an indication of pathological changes of bipolar and muller retina cells [17]. The result of the present study is supported by the following studies.

Pastor idoate S et al., in 2021, conducted extensive research on different parts of the visual system, including retina full-field electroretinography. They found that the amplitude of ERG, b wave is reduced, which supports the finding of the present study [18].

Another study was conducted by Ventura D F in 2004. They examined the retinal function of 43 workers contaminated by mercury using full-field ERG and compared the result with 21 participants in the control group. They found that full-field ERG amplitude from patients was smaller than those of the control [19], further supporting the findings of the present study.

Conclusion

Mercury vapor can affect the retina of human beings, which can be measured by full-field electroretinography b wave.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.