Original Article

Retinal Screening of Coats Disease Using Electrooculography

Seyed Mohammad Masoud Shushtarian [1,*], PhD; Farhad Adhami-Moghadam [2], MD

1. Department of Biophysics and Biochemistry, Faculty of Advance Science and Technology, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran.
2. Department of Ophthalmology, Faculty of Medicine, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran.

***Corresponding Author:** Seyed Mohammad Masoud Shushtarian
E-mail: mshushtarian@yahoo.com

Abstract:

Background: Coats disease is a retinal disorder characterized by the abnormal dilation of blood vessels within the human retina. This study aimed to evaluate the electrooculography (EOG) in patients diagnosed with Coats disease.
Material and Methods: A total of 11 male patients (20 affected eyes) suffering from Coats disease were selected for this investigation. EOG measurements were conducted on the patient group using the Mangoni machine. Subsequently, the results were compared with an equivalent number of 11 normal participants (20 eyes) following the EOG test. Finally , statistical analysis was carried out.
Results: The case and control groups did not display significant differences in terms of age. However, a notable distinction was observed in the Best Corrected Visual Acuity (BCVA) between the two groups. Moreover, the comparison of the Arden Index (AI) of EOG showed values of 2.21 ± 0.23 and 2.20 ± 0.23 in the control and case groups, respectively. The difference in the mean AI of EOG was not statistically significant between the patients and the normal groups.
Conclusion: The findings of this study indicate that Coats disease does not seem to cause damage to the retina, particularly the retinal pigment epithelium, which is reflected in the Arden Index (AI) of the EOG wave. These results suggest that the retinal pigment epithelium remains relatively unaffected in individuals afflicted by Coats disease, as evidenced by the comparable AI values of the EOG wave between the patient and control groups.

Keywoards: Coats Disease; Retinal Screening; Electrooculography.

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Introduction

Coats disease, a retinal vascular disorder of unknown origin, is characterized by the presence of retinal telangiectasia accompanied by intraretinal and/or subretinal exudation, without apparent retinal or vitreal traction. A range of diagnostic techniques is employed to investigate pathological changes in the visual system, with electrooculography (EOG), visual evoked potential (VEP), and electroretinography (ERG) being commonly utilized electrophysiological approaches for scrutinizing the visual system.

In a recent investigation by Sarzaeim et al. [1] (2022), the impact of anti-seizure medications on the visual pathways of a cohort of 20 patients aged 15 to 20 years was assessed using VEP. Their findings illuminated a delayed latency of the VEP P100 peak in patients undergoing anti-seizure drug treatment, suggesting disruptions within the visual pathway.

Another study by Shushtarian et al. (2017) delved extensively into the effects of occupational vibration on the visual pathways of 50 workers exposed to substantial vibration in a textile factory, utilizing VEP [2]. The study concluded that occupational vibration has detrimental effects on the visual pathways of workers, detectable through VEP testing. Numerous studies have underscored the effectiveness of VEP in detecting diverse pathological changes within the visual system [3-24] . The retina, a crucial component of the visual system, is frequently examined for pathological conditions using EOG and ERG techniques.

Sarzaeim et al. [25] (2022) also explored the impact of hand-arm vibration generated by road drilling machines on 12 male workers using ERG. Their research indicated that occupational hand-arm vibration among road drilling machine operators induces adverse effects on the human retina, evident through modifications in the amplitude of ERG. Similarly, a study by Shushtarian et al. [26] (2008) investigated retinal damages in turner workers exposed to intraocular foreign bodies (± OFB) using ERG. The findings demonstrated alterations in ERG patterns within the patient group compared to the control group, affirming the utility of ERG for such diagnoses. Numerous studies have been conducted on the application of ERG in various pathological conditions affecting the retina [27-37].

Tajik et al (2018) probed the utility of EOG in diagnosing amiodarone toxicity on the retina in patients with cardiac disorders treated with amiodarone. Their study unveiled retinal affection in these patients, measurable through the Arden index (AI) of the EOG technique [38].

Sanaie et al. (2014) conducted a study investigating the effects of ocular toxoplasmosis on the visual system, specifically the retina, in patients employing EOG. Their observations revealed substantial variations in the Arden Index (AI) of EOG between case and control groups, signaling pathological changes in the retina, particularly within the retinal pigment epithelium. Similarly, Sanaz Abdolalizadeh and colleagues (2022) evaluated the retinal condition of patients treated with anti-seizure medications using ERG. Their findings indicated that these medications impacted the retina, resulting in a reduction in the amplitude of the ERG b-wave peak [2].

Material and methods

For the present study, 11 male patients diagnosed with Coats disease, totaling 20 affected eyes, and aged between 35 and 50, were selected. The evaluation of the patients' visual systems was conducted using an E-chart, ophthalmoscope, and retina scope. As a control

Table 1: Demographic Characteristics in Case and Control Based on Hann – Whitney U test

Variable	Number of participants	Groups (Mean ± SD)		P value
		Case	Control	
Age	11	15.4 ± 3.06	15 ± 2.78	0.796 **
sex	11	100 % male	100 % male	0.653 *
VA LogMar	20	0.49 ± 0.14	0 ± 0	0.000 **

group, 11 normal males within the same age range were also included in the study.

The assessment of electrooculography (EOG) in both the case and control groups was performed utilizing a computerized device known as the Mangoni machine. EOG recordings involved a specific procedure where the patient's eye was pre-adapted to light for a duration of 10 minutes. Subsequently, the patient was directed to rotate their eye simultaneously between three bulbs fixed in front of them for another 10 minutes, during which the corresponding potential changes were measured. The average of these readings constituted the light adaption potential (LAP). Following the light adaptation, the subject underwent a 10-minute dark adaptation period. The same procedure for rotating the eye and measuring potential changes was repeated, representing the dark adaption potential (DAP). The Arden index (AI), calculated as the ratio of LAP to DAP, was derived. Mean and standard deviation calculations were then obtained for both groups. The acquired results from both sets of participants were compared to identify potential disparities between the groups. Statistical analysis was performed using SPSS version 22 for this comparative evaluation.

Results

The study compared demographic data between the case and control groups. The statistical analysis Findings about the Age, Sex, and Visual Acuity are as following.

Age Comparison: There was no statistically significant difference observed in the age of participants between the case (mean age: 15.4 ± 3.06) and control (mean age: 15 ± 2.78) groups (P value = 0.0847).

Sex Distribution: All participants in both groups were male, resulting in no significant differences (P value = 0.653).

Visual Acuity (VA LogMAR): A notable and statistically significant difference was identified in Best-Corrected Visual Acuity (BCVA) between the case (mean LogMAR: 0.49 ± 0.14)and control (mean LogMAR: 0 ± 0) groups, with a p-value of less than 0.01.

Table 1 Shows the demographic findings in the control and case groups. There was no statistically significant between the two groups regarding age (p-value = 0.0847) and sex (all participants were male) where as a significant difference was observed in BCVA (P < 0.01).

EOG Wave Analysis

The Arden Index (AI) of the electrooculography (EOG) wave was measured in both the case and control groups. The examination displayed no statistically significant difference in the Arden Index between the two groups (Case AI: 2.20 ± 0.23, Control AI: 2.21 ± 0.23, p-value = 0.843). The non-significant

Table 2: Measurement of Arden index (AI) of EOG wave in case and groups

Variable	Control	Case	P value
EOG	2.21 ± 0.23	2.20 ± 0.23	0.843

variance in the Arden Index suggests a comparable EOG waveform response in both groups, indicating similar retinal function concerning the electrical potential generated by the retina. These results imply that while there were distinctive differences in visual acuity between the two groups, the EOG wave response, as measured by the Arden Index, remained consistent, pointing towards comparable retinal electrical function despite varying visual acuity levels. Table 2 Shows the measurement for AI of EOG in case and control groups. There was not a statistically significant difference regarding the Arden index between the case and control groups.

Discussion

Understanding Coats Disease and EOG Findings

Coats disease is a rare condition characterized by the aberrant development of blood vessels in the retina, specifically known as retinal telangiectasis. In this study, electrooculography (EOG) was employed to assess the retinas of patients affected by Coats disease. Remarkably, the analysis revealed that the Arden Index (AI) from EOG did not exhibit significant changes among these patients. This suggests that the retinal pigment epithelium (RPE), from which the AI of EOG is derived, remains unaffected in these individuals [38, 39].

A study by Okada H et al (2018) conducted extensive research on patients with macular telangiectasia, using various electrophysiological techniques, including EOG. They reported that no significant changes were observed in the EOG, i.e., the AI, across all 21 patients under study. This aligns with the findings from the present research, indicating the consistency of normal EOG findings among individuals with retinal telangiectasia [40].

Similarly, Schultis SFY et al. (2017) investigated a 52-year-old woman afflicted by macular telangiectasia using diverse diagnostics, including EOG, and found normal EOG readings in this patient. Their study findings further support the consistency of normal EOG outcomes in individuals with macular telangiectasia [41].

Divergent Findings in Sibling Studies

In contrast, Leys A et al. (2000) conducted research on two pairs of siblings suffering from retinal telangiectasis. Their diagnostic assessments, including EOG, revealed subnormal EOG in these sibling pairs. [42] This finding contradicts the present study's results, which observed normal EOG findings in the majority of the 13 subjects under examination. It is important to note that the contradiction could be attributed to the difference in the number of subjects involved in each study. While Leys A et al. examined four individuals, our study encompasses a larger sample size of 13 subjects.

Conclusion

The present study's findings, consistent with previous research examining EOG in retinal telangiectasis-related conditions, indicate a normal EOG response in the majority of

Coats disease patients. The discrepancies in findings, particularly regarding the sibling study, highlight the necessity for further investigation to understand the variability in EOG responses among individuals affected by retinal telangiectasis-related conditions. This underscores the need for larger-scale studies to gain comprehensive insights into the electrical function of the retina in these rare retinal disorders.

Authors ORCIDs

Seyed Mohammad Masoud Shushtarian:
https://orcid.org/0000-0002-6387-9046

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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.