Original Article

Comparison on Photopic Electroretinogram Negative Response between Young and Old Lewis Rats

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Abstract

Purpose: To investigate and compare the latency and amplitude of the electroretinogram (ERG) photopic negative response (PhNR) between young and old Lewis rats.

Methods: Thirteen Lewis rats were divided into two groups according to ages, young group (3-month old, n=5) and old group (24 month old, n=8). The ERGs of the left eyes were measured and the latency and amplitude of a-wave, b-wave and PhNRs were recorded and compared according to ages. The mean values between two groups were statistically analysed by t-test.

Results: The latency of PhNRs was evidently prolonged in old group and showed significant difference (P<0.05). There was no statistically significant difference between two groups regarding the amplitude and latency, and no significant difference was noted in the amplitude of PhNRs.

Conclusion: The prolonged latency of PhNR in aged rats possibly associate with the influence of aging upon retinal ganglion cell layer (RGCL). (***Eye Science 2011; 26: 171-172***)

Keywords: aged; rat; ERG; PhNR

It has been known that visual function declines as age increases. However, desirable parameters evaluating the function of aged retinal ganglion cells (RGCs)are still lacking. The electroretinogram (ERG) photopic negative response (PhNR) is able to specifically reflect the function status of RGCs, which can be applied into clinical and fundamental studies treating optic nerve-related diseases. This study is designed to identify aging manifestations in RGCs presented by aged rats using PhNR, therefore young counterparts were selected as comparing controls.

Materials and methods

Experimental animals

Thirteen healthy and clean Lewis rats were divided into young group (3-month old, n=5) and old group (24-month old, n=8) according to ages. All rats were fed under the same normal conditions.

Visual electrophysiology

Flicker ERG examination was performed by Roland RETI scan 3115 system (Germany). Small-sized Ganzfeld full-field stimulator was utilized. All rats were anesthetized by intraperitoneal injection of ketamine and 10 mg/ml xylazine mixture (1:1) prior to formal examination. After general anesthesia, full mydriasis was given to left eyes by compound tropicamide eye drops.

The electrode of contactlens was properly placed. Reference and ground electrodes were fixed to ear and tail on the side of test eye, respectively. Photopic ERG was recorded, low frequency cut-off of amplifier 0.2 Hz, high frequency cut-off 300 Hz, flash brightness 3.0 cd·s/m^2, background brightness 3.0 cd/m^2, flash stimulation frequency for cone 0.9 Hz, and average values were obtained from eight repetitions. The latency and amplitude of a-wave, b-wave and PhNR were observed and analysed, respectively.

DOI: 10.3969/g.issn.1000-4432.2011.03.009

Foundation item: Development Program for Innovative Young Talents in Colleges and Universities in Guangdong Province (grant No.LYM08057); Internal Project of Joint Shantou International Eye Center of Shantou University and The Chinese University of Hong Kong (07-11).

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Statistical analysis

SPSS 13.0 software was utilized for statistical analysis. The means between two groups were compared using independent sample *t*-test. $P<0.05$ was regarded as statistically significance.

Results

The latency of PhNR in aged rats was significantly prolonged compared to that in younger counterparts ($P=0.021$). No significant difference was noted neither in terms of the amplitude and latency between *a*-wave and b-wave nor regarding amplitude of PhNR($P>0.05$), as shown in tables 1 and 2.

Table 1 The amplitude of ERGs in rats between young and old rats (Mean±S.D.)

Group	No.	Amplitude of a-wave (μV)	Amplitude of *b*-wave (μV)	Amplitude of PhNR (μV)
Young group	5	3.68±1.59	51.6±12.33	16.08±1.64
Old group	8	3.12±2.46	51.32±29.42	18.71±4.76
P		*P*=0.64	*P*=0.978	*P*=0.812

Table 2 The latency of ERGs in rats between young and old rats (Mean±S.D.)

Group	No.	Latency of *a*-wave (ms)	Latency of *b*-wave (ms)	Latency of PhNR (ms)
Young group	5	10.29±2.12	44.42±1.18	106.23±13.57
Old group	8	11.11±6.82	47.77±5.05	121.67±13.31*
P		*P*=0.299	*P*=0.07	*P*=0.021

Discussion

PhNR is the first negative wave which closely follows b-wave of cone cells during photopic ERG examination[1]. The occurrence of PhNR correlates with the activity of neurite and axon located in amacrine cells or ganglion cells, and specifically reflects the function of RGCs and their axons. Previous researchers systematically analysed photopic flicker ERG of normal rats and acquired relatively stable wave shape[2].

In this study, the extended latency was noted while no apparent changes in a- and b-wave were observed in the aged rats compared with young counterparts, suggesting that more evident variations were observed in RGCs rather than in retinal cone and rod cells[3]. The prolonged latency of elderly rats may associate with decreased amount of axons in RGCs[4] or slower speed of electrical conduction induced by myelin sheath degeneration. The results in this study revealed that the changes in the amplitude of PhNR in aged rats were unobvious, assuming that the number of RGCs probably did not decrease significantly, which was inconsistent with the declined intensity of RGCs in aged animals as reported previously[5]. Our research team has previously found that the area of retina in elderly rats was enlarged compared with that in younger counterparts. However, no significant difference was noted between aged and young rats in terms of the total count of RGCs[6], which has been also validated by Harman's study[4].

This study preliminarily evaluates RGC functions in rats of varying ages by analyzing PhNR wave. In addition, Lewis rats used in current study have shorter latency than 124.6±8.5 ms presented by SD rats in our previous research[2], indicating that special attentions should be paid to the discrepancy in different rats species.

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