Pattern Electroretinogram Changes in Patients with Primary Open-angle Glaucoma in Correlation with Visual Field and Optical Coherence Tomography Changes

ASMAA MAHMOUD ELGOHARY

ASSISTANT LECTURER , OPHTHALMOLOGY DEPARTMENT ,

TANTA UNIVERSITY

Accepted for publication in
European Journal of Ophthalmology
https://doi.org/10.1177/1120672119872606

Authors:

Asmaa M Elgohary

Hazem A Elbedewy

Hisham A Saad

Tarek M Eid

Ophthalmology Department, Faculty of Medicine
Tanta University, Tanta, Egypt

Financial disclosure for all authors: None

The aim of this study

To study **pERG changes** in POAG patients in **correlation** with **visual field** changes and **OCT** measurements of **RNFL thickness** in the peripapillary region in an attempt to evaluate the **clinical value of pERG as an objective test of functional deficit** in glaucoma.

Why POAG

POAG is a major health problem.

Its **diagnosis** depends on detecting its characteristic **optic disc & visual field changes.**

Why Visual field

- ▶ being subjective,
- ▶ time consuming,
- ▶ not user friendly,
- ▶ and less sensitive for detection of early damage in glaucoma
- ▶ as it reveals **glaucomatous defects only when 30%–40% of the fibers have already been lost**
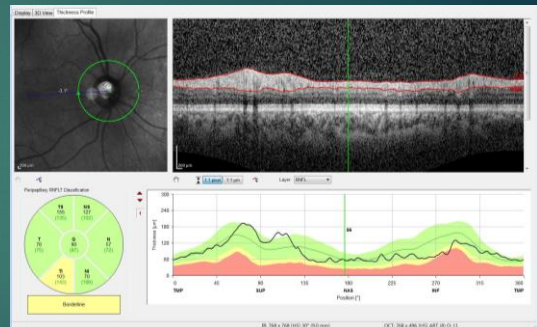

Why OCT

Measuring the **RNFL thickness** highlight and **quantify** structural damage in glaucoma.

The test is **objective**, easy to perform, and interpret.

Macular ganglion cell layer and inner plexiform layer (**mGCIPL)** thickness is used in follow-up glaucoma patients

Why pattern ERG

pERG is frequently altered in glaucoma suspects (GS) and patients with early glaucoma in comparison to normal controls.

 Abnormal pERG responses were recorded in approximately 71% of eyes with no visual field changes.

Bridging the gap of early detection.
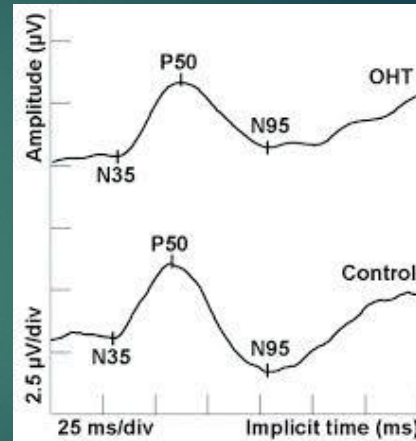
Patients & Methods

81eyes of 81 participants

**50 eyes POAG patients**

16 eyes Glaucoma suspect

15 eyes Normal (control group)

Patients and Methods

▶ The study participants were recruited from *the outpatient clinic of Ophthalmology Department, Tanta University, Tanta, Egypt*

▶ Subjects were enrolled in a prospective comparative study

▶ All eyes had

  ▶ *visual field testing* using 24-2 Humphery standard automated perimetry,

  ▶ *peripapillary RNFL average thickness* using the 3.4 mm circular scan of the Heidelberg OCT spectralis and

  ▶ *Pattern ERG* using CSO RetiMax device in accordance with the International Society for Clinical Electrophysiology of Vision (ISCEV) guidelines
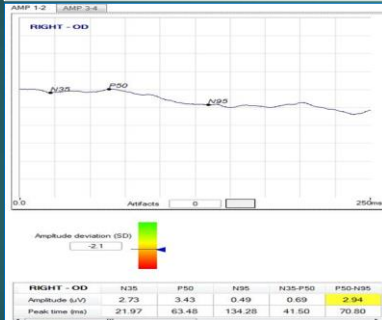
Pattern electroretinogram (ERG)

▶ Reflects the electrical activity of *RGCs* in the retina

▶ Used to detect loss of function of *RGCs in glaucoma*

▶ The stimulus used for pERG recording is a *black and white reversing checker board*

▶ *Diagram* of the pattern ERG. The major negative (N) and positive (P) waves are labeled according to their typical peak time.

▶ The *P50 peak time & amplitude, the N95 peak time & amplitude and the P50-N95 peak time & amplitude* were recorded and used for analysis
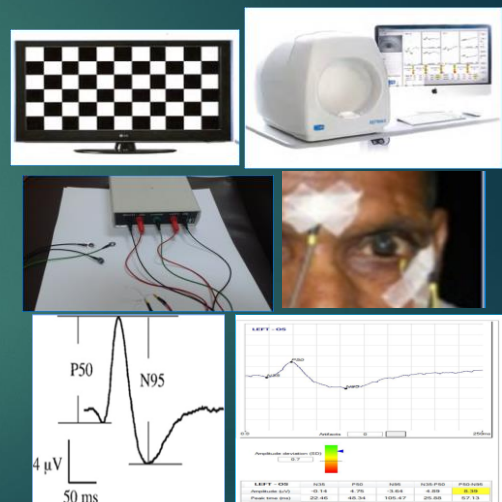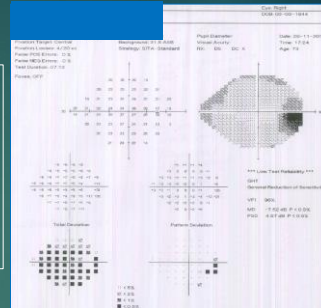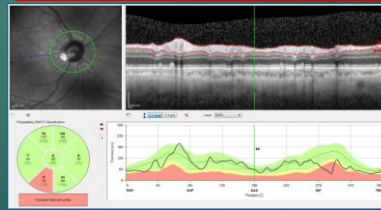
Case study

- **74-year old male,**
- **BSCVA 0.5 on the decimal scale,**
- **C/D ratio was 0.65**
- **IOP 16 mmHg**
- **Controlled on two antiglaucoma drops for 9 years**

Humphrey 24-2 visual field test

Pattern ERG findings

OCT ex of peripapillary RNFL thickness

Results

The VF MD and the peripapillary RNFL average thickness of the three main groups (normal, GS, and POAG) showed significant difference (p < 0.001).

|	Normal	Glaucoma suspect	POAG	ANOVA P value
VF MD (dB) Mean ± SD	-1.33 ± 1.42	-1.97 ± 1.59	-10.22 ± 7.13	< 0.001
RNFL thickness (µ) Mean ± SD	101.20 ± 8.35	99.68 ± 10.33	74.79 ± 23.07	< 0.001

Significant difference was found in P50 peak time, N95 amplitude, and P50–N95 amplitude between GS and POAG patients

	Normal (n=15)	Glaucoma suspect (n=16)	POAG (n=50)	p value (ANOVA test)
	Mean ±SD	Mean ±SD	Mean ±SD	
P50 Peak time (ms)	49.02 ±2.77	46.66 ±2.43	51.35 ±8.57	0.022
P50 amplitude (µV)	2.70 ±1.20	3.07 ±1.60	2.58 ±2.27	0.010
N95 Peak time (ms)	93.42 ±9.52	97.53 ±10.09	105.29 ±17.60	0.022
N95 amplitude (µV)	-1.77 ±1.16	-2.28 ±1.30	-1.28 ±1.60	0.392
P50-N95 Peak time (ms)	44.40 ±10.06	50.87 ±9.68	53.93 ±15.65	0.040
P50-N95 amplitude (µV)	4.47 ±1.70	5.35 ±2.43	3.87 ±2.67	0.021

Correlation of various pattern ERG parameters with age, visual field mean deviation, retinal nerve fiber layer thickness in all study eyes using Spearman's correlation coefficient test

Pattern ERG parameters	Age (years)		Visual field MD (dB)		OCT RNFL thickness (µm)	
	r	p	r	p	r	p
P50 peak time (ms)	0.532	<0.001	-0.175	0.119	-0.167	0.135
P50 amplitude (µV)	-0.296	0.007	0.262	0.018	0.009	0.936
N95 peak time (ms)	0.227	0.041	-0.214	0.055	-0.197	0.077
N 95 amplitude (µV)	0.271	0.014	-0.214	0.055	-0.430	<0.001
P50-N95 peak time (ms)	0.085	0.446	-0.166	0.139	-0.145	0.195
P50-N95 amplitude (µV)	-0./397	<0.001	0.382	<0.001	0.360	0.001

Scatterplots display showing correlations of some pattern ERG parameters and visual field mean deviation (A) and retinal nerve fiber layer thickness measured by optical coherence tomography (B)
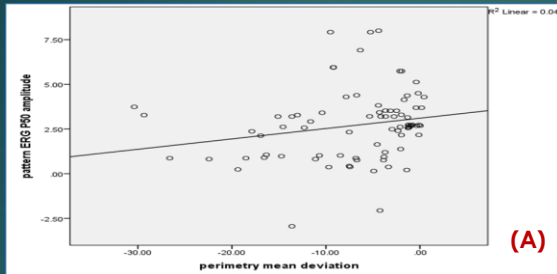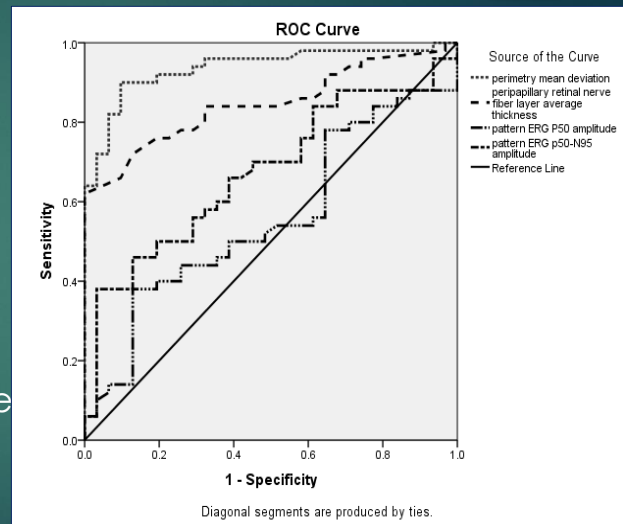
Significant positive correlation of VF MD on one hand with pERG P50 amplitude

(A)

Significant negative correlation of the peripapillary RNFL average thickness with N95 Amplitude

(B)
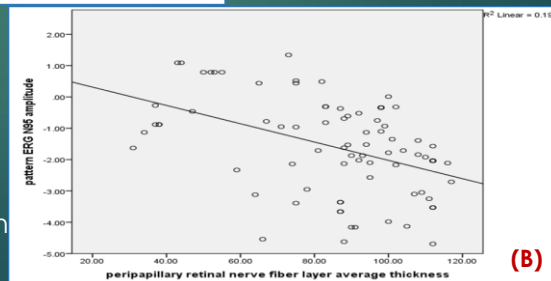
Results

▶ On performing the receiver operating characteristic (ROC) curve analysis, the areas under the curve (AUCs) were 0.610, 0.677, and 0.645 for P50, N95, P50–N95 peak times, respectively.

▶ The AUCs for P50–N95 amplitude and N95 amplitude were 0.674 and 0.643,

Conclusion

- Significant positive correlation between VF MD and pERG P50 amplitude and P50–N95 amplitude.
- Significant positive correlation was also found between VF MD and peripapillary RNFL thickness
- N95 amplitude had significant negative correlation with peripapillary RNFL thickness and the P50–N95 amplitudes had a significant positive correlation with the peripapillary RNFL thickness.

Conclusion

Pattern ERG, together with OCT as a tool for structural assessment of the optic nerve head and peripapillary RNFL, can be a very helpful combination in glaucoma diagnosis especially when a reliable perimetry cannot be obtained.

THANK YOU