بسم الله الرحمن الرحيم

قالوا سبحانك لا علم لنا إلا ما علمتنا
إنك أنت العليم الحكيم
صدق الله العظيم

Optical Coherence Tomography Angiography of Optic Disc Perfusion in Primary Open Angle Glaucoma

By
Basma G. Ahmed (MS)
Said M. Shalaby (MD)
Waleed A. Allam(MD)
El-Sayed A. Nassar (MD)

Tanta University

Introduction

Glaucoma is a major disease that potentially results in irreversible blindness.

It is characterized by characteristic changes of;

- ONH
- RNFL
- Visual field.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Introduction

Intraocular pressure is a major risk factor and **was recognized as the only cause of neural tissue loss at the ONH**.

Many studies revealed that IOP reduction alone cannot prevent VF loss progression in all patients.

So, it was suggested that **vascular factors** **play a critical role in glaucoma development.**

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Introduction

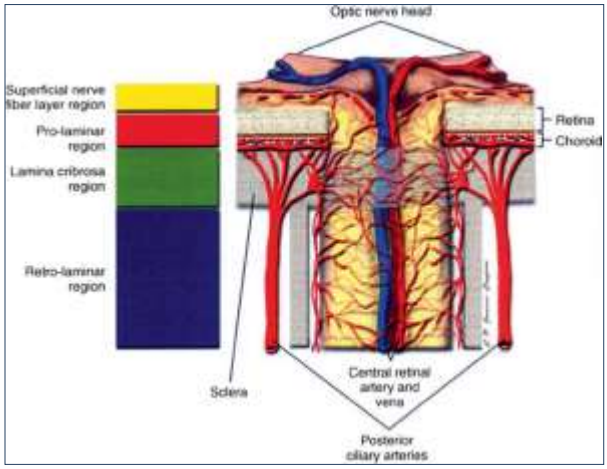
However, till now it remains unclear whether the decrease in blood flow in glaucoma is **the cause or the result** of GON.

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Review of literature

Blood Supply of the ONH

- Mainly from the short posterior ciliary arteries.
- Branches in the superficial layer that arise from CRA.
- CRV is the sole significant route of venous drainage.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Review of literature

Factors Influencing the ONH Blood Flow

Many factors that finally determine the state of the ONH circulation.

- ❑ Ocular Perfusion pressure (OPP).
- ❑ Auto regulation.
- ❑ Arterial Blood Pressure (ABP) .
- ❑ Endothelial Derived Vasoactive Agents.
- ❑ Calcium Channel Blockers (CCBs)
- ❑ Intraocular Pressure.
- ❑ Resistance to Blood Flow.

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Review of literature

Mechanisms of glaucomatous optic neuropathy

1.Neural tissue loss :

RGCs and higher neural cell loss:

a-Apoptosis

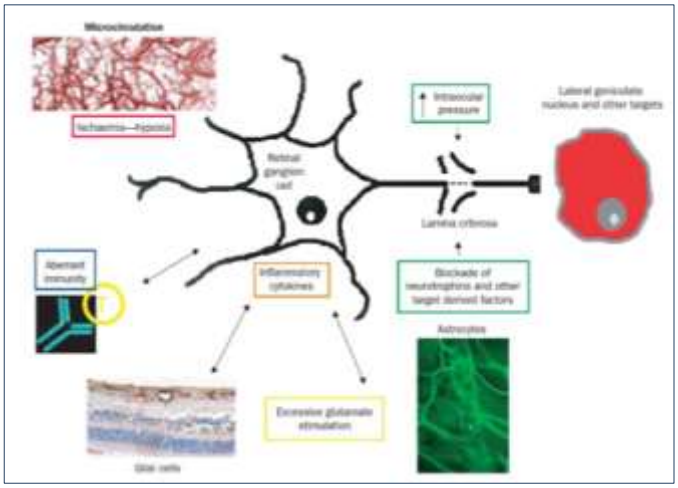
b-Oxidative stress

c-Glutamate mediated toxicity

2.Glial cells activation

3.Tissue remodeling

4.Vascular ischemic factor



Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Review of literature

Optical coherence tomography angiography (OCTA)

OCTA is a new imaging technology that provides:

- **A non-invasive.**
- **High resolution.**
- **Three dimensional images of the fundus microcirculation.**

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Review of literature

Optical coherence tomography angiography (OCTA)

Technical principle

OCTA images are essentially **motion contrast images** based on that in a static eye the only moving structure is blood cells inside the vessels. This requires repeated consecutive B-scans at the same section.

Review of literature

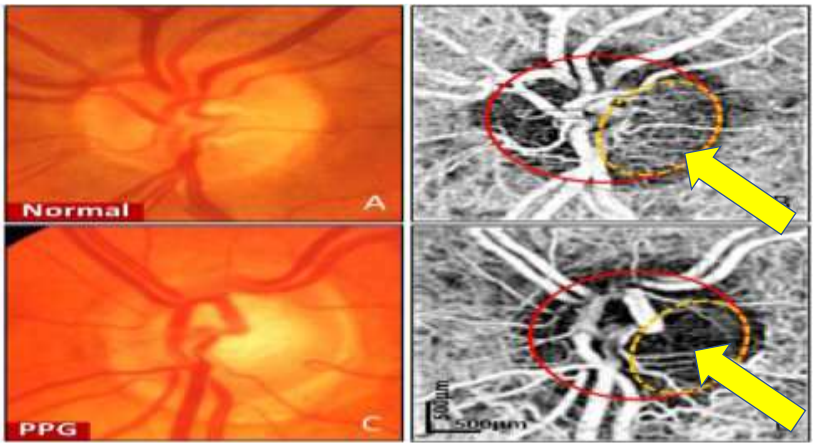
OCTA role in POAG

OCTA is a characteristic technique giving ;

- **3D visualization** of ONH vasculature.
- **near-automated quantification** of disc perfusion and vessel density.

This allows better understanding of the pathophysiological processes in glaucoma.

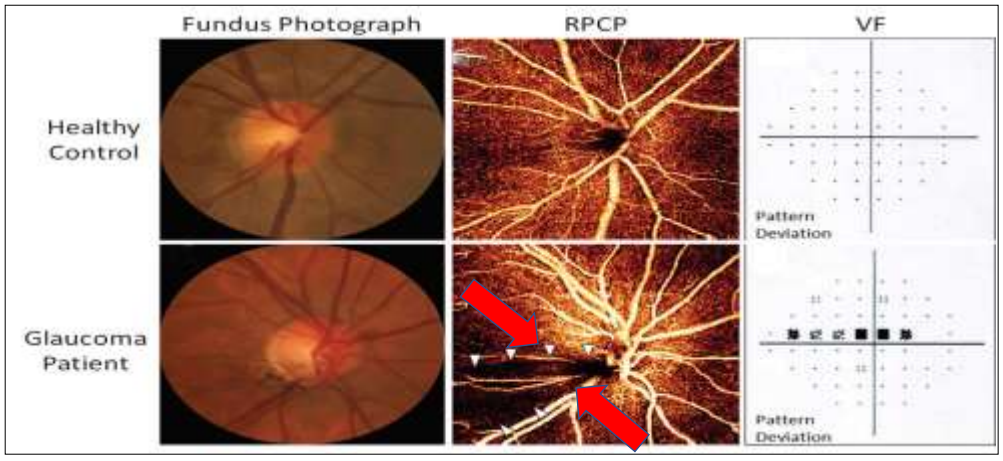
Review of literature



Attenuated micro vascular net work ONH

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Review of literature



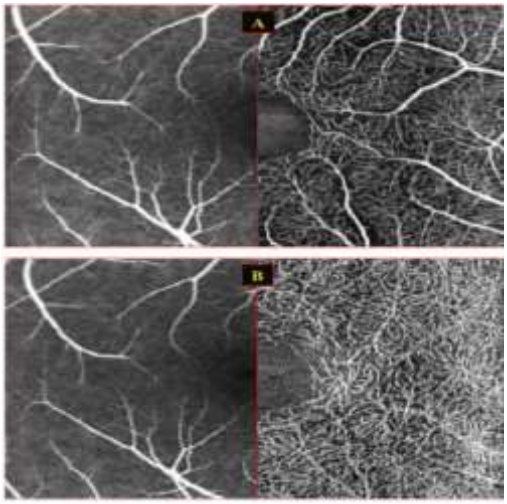
Focal capillary dropout in the infra-temporal area PPCP

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

OCTA versus FA and ICGA

Review of literature

Differences	OCTA	FA & ICGA
Invasiveness	No	Yes
Dye dependence	No	Yes
Image dimensions	3D	2D
Field of view	Small	Wide
Time sequence	No	Yes
Staining & leakage	No	Yes
Segmentation	Yes	No
Contraindications	No	Yes

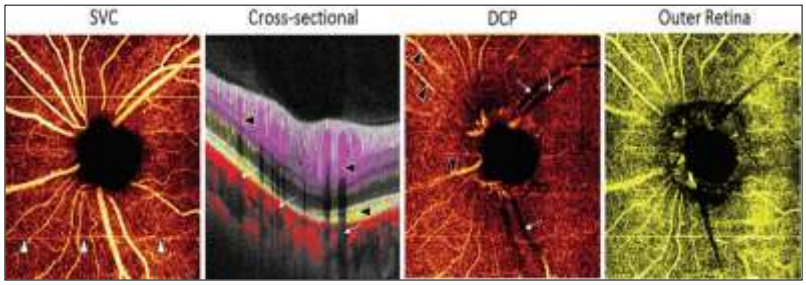


Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

OCTA disadvantages or Limitations

Review of literature

- **small field of view** (but now there is extended field OCTA).
- **Inability to show leakage and staining.**
- **Artifacts :**
  - **Image artifact**
  - **Motion artifact**
  - **Projection artifact**



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Aim of the work

This study aimed to investigate **optic disc perfusion differences** between normal and primary open angle glaucoma eyes **using optical coherence tomography angiography.**

Patients and methods

Study sample

It was carried out on 45 glaucomatous eyes of 45 patients attending Tanta University Hospital and 30 eyes of 30 subjects of age matched normal controls.

As regard IOP POAG patients were grouped into :

- Normotensive patients (NTG) (IOP < 21mmhg).
- High-tension patients (IOP > 21mmhg).

As regard age of onset high tension patients were divided into:

- Juvenile Onset POAG (JPOAG) (age of onset > 3years & < 40 years).
- Adult Onset High Tension POAG (AO HTPOAG) (age of onset >40 years).

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Patients and methods

Normal control individuals were divided into 2 age matched groups:

.Normal 1: control group for NTG and AO HTPOAG groups (20 eyes).

.Normal 2: control group for JPOAG group (10 eyes).

So, the study had 5 groups:

- **Normal 1:** control group for NTG and AO HTPOAG groups (20 eyes).
- **Normal 2:** control group for JPOAG group (10 eyes).
- **NTG group** (15eyes).
- **JPOAG group** (15 eyes).
- **AO HTPOAG group** (15 eyes).

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Patients and methods

Patients

#Inclusion criteria:

Patients suffering from POAG with the following criteria:

- Presence of GON.
- RNFL defect that is visible in red free slit lamp biomicroscoy or red free fundus photography.
- Glaucomatous VF changes.
- Open angle in gonioscopic examination.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Patients and methods

Exclusion criteria: (for all)

- Any retinal disease affecting retinal vascularity as BRAO and BRVO.
- Any media opacity interfering with clinical examination or investigations (corneal opacity, dense cataract, VH and RD).
- Any disease that may cause VF loss or OD abnormalities.
- Any physical and or mental handicapping preventing investigation.
- Patients with previous ocular laser and or intraocular surgery.

Patients and methods

Methods

1. Complete history taking.

- **Past history**
- **Family history:** glaucoma in 1st degree relatives.
- **History of the disease (glaucoma) : onset ,duration ,topical medication.**
- **History of other ocular diseases or surgical intervention.**

2. Systemic blood pressure and pulse rate measurement.

Patients and methods

3. Complete ophthalmologic examination :

a) visual acuity measurement :

(UDVA, CDVA) using Snellen chart in decimal notation.

b) Anterior segment examination using slit lamp: for any abnormality.

c) Gonioscopic examination :

The anterior chamber angle was examined **using Goldmann 3 mirror** contact lens. Four quadrants (upper, lower, nasal and temporal) are examined carefully **to exclude closed angle glaucoma.**

Patients and methods

3. Complete ophthalmologic examination :

d) Intraocular pressure measurement :

- using Goldmann applanation tonometer .
- by the same examiner .
- **in different times in the morning, afternoon and at the evening to avoid diurnal variation and the mean was taken.**

e) Posterior segment examination :

- using slit lamp fundus bio microscopy .
- **OD examination** as regard; its color, C/D ratio, RA , edge, CV and cup asymmetry. **RNFL loss and exposed LC** can be seen.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Patients and methods

3. Complete ophthalmologic examination :

f) Central corneal thickness (CCT) measurement :using **Pachymetry.**

g) Axial length measurement:

by **IOL Master** to detect cases with axial myopia (axial length > 24mm) to be excluded as it may affect vascular density of the retina and OD.

4.Visual field examination: Using **Humphrey Matrix field analyzer** .

Patients and methods

5.Colored fundus photography.

6.Optical coherence tomography of optic disc .

7.Optical coherence tomography angiography of optic disc .

OCT and OCTA were performed using **swept source TOPCON 3D OPTICAL COHERENCE TOMOGRAPHY DRI OCT Triton.**

Patients and methods

Technique of OCT and OCTA Image Acquisition and Processing:

1. All subjects underwent pupillary dilatation using tropicamide1%.
2. The peripapillary RNFLT and macular GCLT were measured.
3. OCTA was performed using 4.5x 4.5 mm scan centered on ONH in all cases. Segmentation was done manually with different slabs to determine vascularity at different levels.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Patients and methods

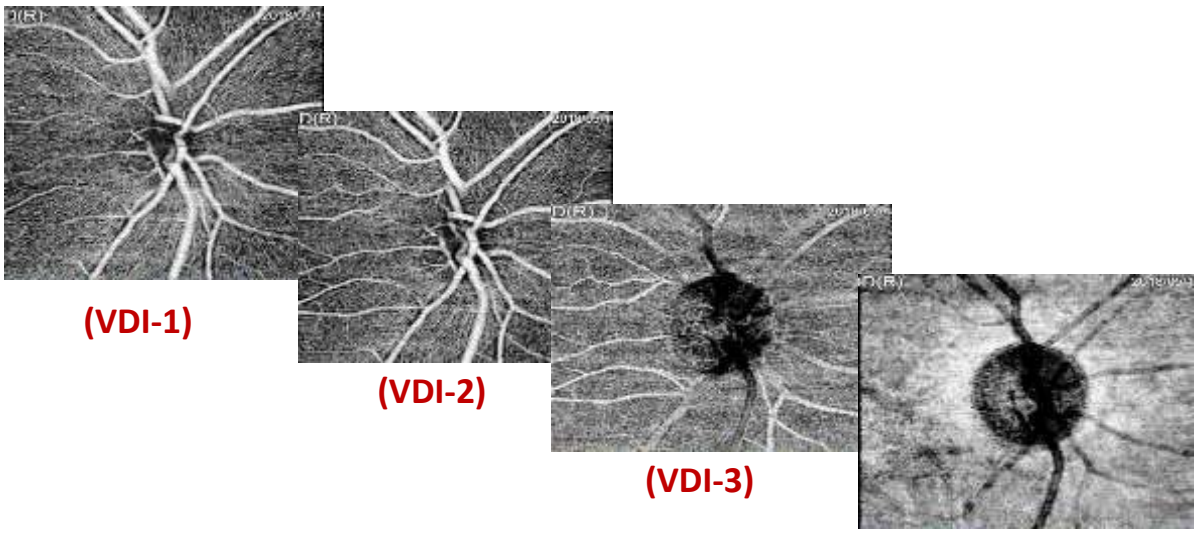
The ONH was assessed in 4 levels:

- **The superficial Papillary level (VDI-1): extends from a point at level of internal limiting membrane to a point at level of outer boundary of inner plexiform layer.**
- **The deep papillary level (VDI-2): extends from a point at level of outer boundary of inner plexiform layer to a point at the outer boundary of outer plexiform layer .**
- **Outer retina level (VDI-3): extends from a point at level of outer boundary of outer plexiform layer to a point at the level of Bruch's membrane.**
- **Choriocapillaries level (VDI-4): extends from the level of Bruch's membrane to 353 micrometer below it.**

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Patients and methods

The ONH was assessed in 4 levels:



(VDI-1)

(VDI-2)

(VDI-3)

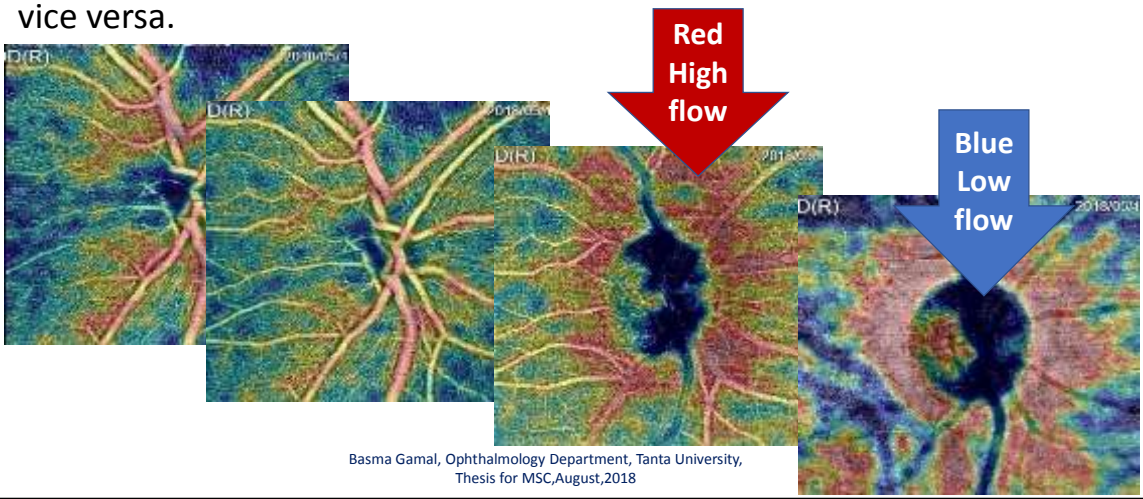
(VDI-4)

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Patients and methods

4. Density map images gave ;

- **qualitative data** ,the more flow the more hot colors will be present and vice versa.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Patients and methods

4. Density map images allowed ;

- **quantitative assessment** ,these images were processed using Image J program. The program gave us quantitative data by determining vascular density index (VDI) as percentage by taking 350 x 350 pixel images and converting it to binary images in which any flow has threshold could be detected as white color and those of very low or no flow could be detected as dark color.

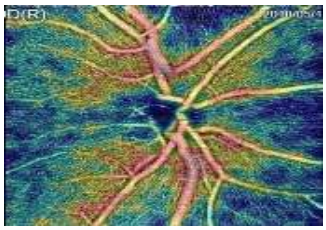
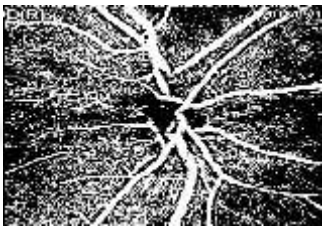


Image J program



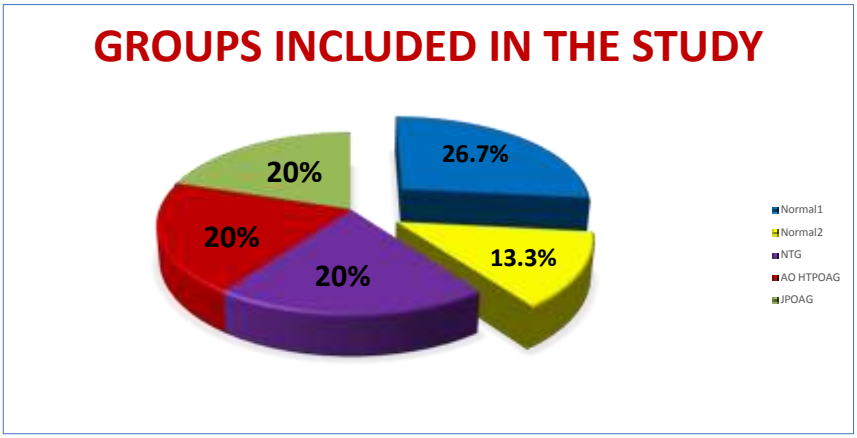
VDI

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

Results

The study had 5 groups



Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

Demographic Data:

General: **No significant differences** regarding the age and gender distribution.

Type of Participants		Normal control 1	NTG	AO HTPOAG	Test of sig.	P Value
Number		20 eyes	15 eyes	15 eyes	t= -0.047	0.962
Age (years)	Mean ± SD	55.5±11.79	52.80±13.197	58.53±11.42		
	Median	53.00	57.00	59.00		
	Range	35-75	35-70	41-76		
Sex	Male	9 (45%)	8 (53.3%)	9 (60%)	x^2= 0.654	0.419
	Female	11 (55%)	7 (46.7%)	6 (40%)		

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

Type of Participants		Normal control 2	JPOAG	Test of sig.	P Value
Number		10 eyes	15 eyes	t= 0.037	0.971
Age (years)	Mean ± SD	26.80±7.8	26.67±9.492		
	Median	27.00	28.00		
	Range	14-40	13-38		
Sex	Male	6 (60%)	8 (53.3%)	c2= 1.326	0.250
	Female	4 (40%)	7 (46.7%)		

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

OCTA

After processing of density map images for the 4 groups we could measure VDI of the 4 levels of segmentation and the average was calculated then all are tabulated and compared.

Measurements of vascular density in normal control (1) subjects.

NormaL1	VDI-1	VDI-2	VDI-3	VDI-4	Average VDI
Mean ± S. D	58.57±2.676	64.18±2.922	47.16±4.037	26.12±4.612	49.43±1.746
Median	58.285	63.466	47.076	26.007	49.051
Range	55.13-67.44	60.36-69.81	48.26-58.79	19.2-37.69	45.32-53.81

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

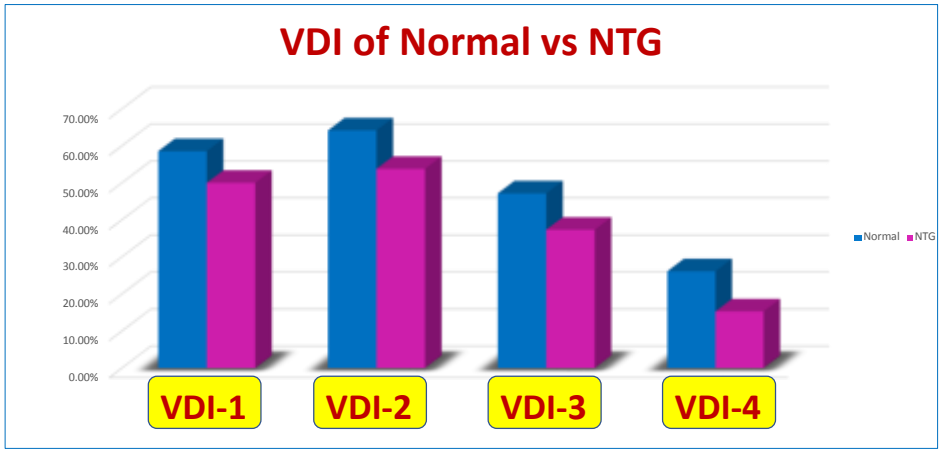
In NTG group there was **statistically significant difference at all levels**.

Measurements of VDI in NTG patients and comparison with normal subjects.

NTG	VDI-1	VDI-2	VDI-3	VDI-4	Average VDI
Mean ± S. D	50.00±9.715	53.79±13.99	37.34±12.19	15.295±2.695	39.11±8.225
Median	52.234	53.784	38.072	14.178	41.635
Range	26.06-60.20	9.07-66.69	10.27-55.64	12.05-19.49	14.4-47.11
Mean Difference	8.573	10.392	9.819	10.82	9.9
T test	3.325	2.830	2.999	8.091	4.585
P value	0.004*	0.013*	0.008*	<0.001*	<0.001*

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results



vascular density in normal subjects and NTG patients

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

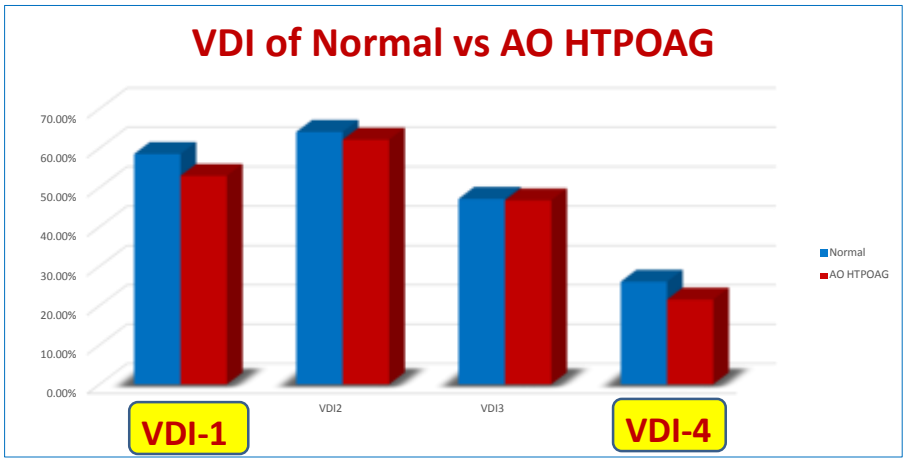
In AO HTPOAG there was **only significant difference in VDI-1 and VDI-4.**

Measurements of VDI in AO HTPOAG patients comparison with normal subjects.

AO HTPOAG	VDI-1	VDI-2	VDI-3	VDI-4	Average VDI
Mean ± S. D	53.01±5.919	62.19±6.84	46.79±7.079	21.58±4.972	45.892±3.954
Median	53.305	62.664	49.45	20.7	45.4
Range	44.41-59.57	49.99-69.7	32.23-53.62	12.45-28.21	38.95-52.18
Mean Difference	5.567	1.986	0.365	4.538	3.114
T test	3.394	1.055	0.179	2.786	2.849
P value	**0.003***	0.305	0.859	**0.009***	**0.011***

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results



Vascular density in normal subjects and AO HTPOAG patients.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

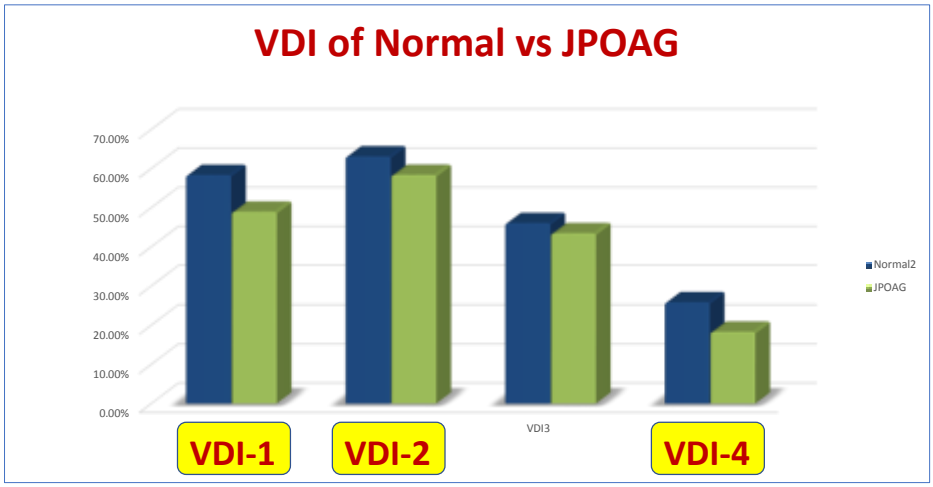
In JPOAG group there was **statistically significant difference in all levels except in outer retina level**

Measurements of VDI in JPOAG patients and comparison with age matched normals.

JPOAG	VDI-1	VDI-2	VDI-3	VDI-4	Average VDI
Mean ± S. D	48.92±8.09	58.33±4 .5	43.41±10.77	18.26±3.851	42.23±4.71
Median	52.234	60.120	46.82	17.874	42.518
Range	30.82-59.78	49.5-63.9	24.22-55.92	12.92-27.69	30.96-47.89
Mean Difference	9.389	4.747	2.618	7.547	6.076
T test	4.317	3.427	0.867	5.836	4.673
P value	0.001*	0.002*	0.397	<0.001*	<0.001*

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

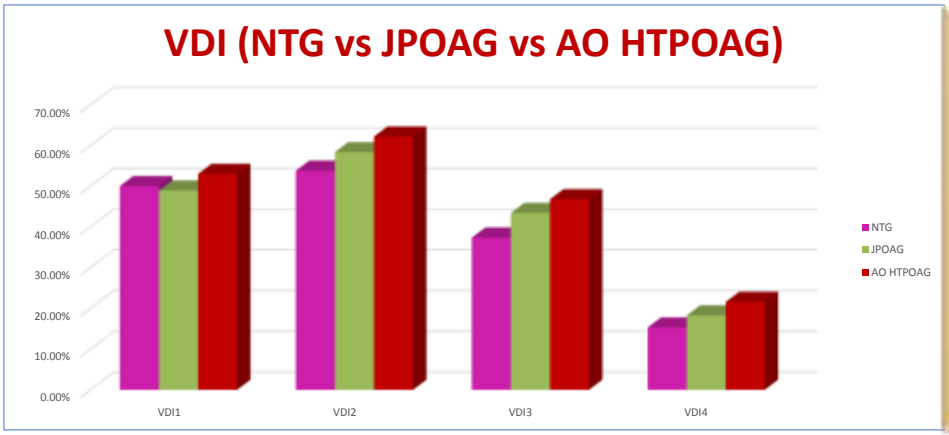
Results



Vascular density in normal subjects and JPOAG patients

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results



VDI values in descending order

- **AO HPOAG**
- **JPOAG**
- **NTG**

Ischemia in reverse

Comparison between vascular density in the 3 types of glaucoma.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

In this study, many correlations had been done between VDI and

- **BCVA**
- **CCT**
- **IOP**
- **OPP**
- **C/D raio, RA**
- **VF (MD , PSD)**
- **RNFLT**
- **GCLT**

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

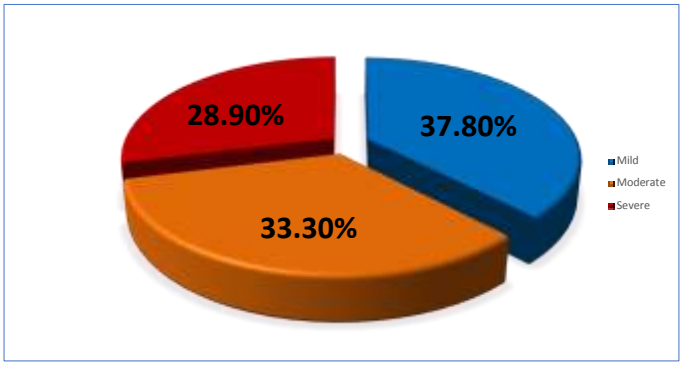
According to Severity

Based on severity of glaucomatous damage according to GSS:

glaucoma patients (45eyes)

are divided into:

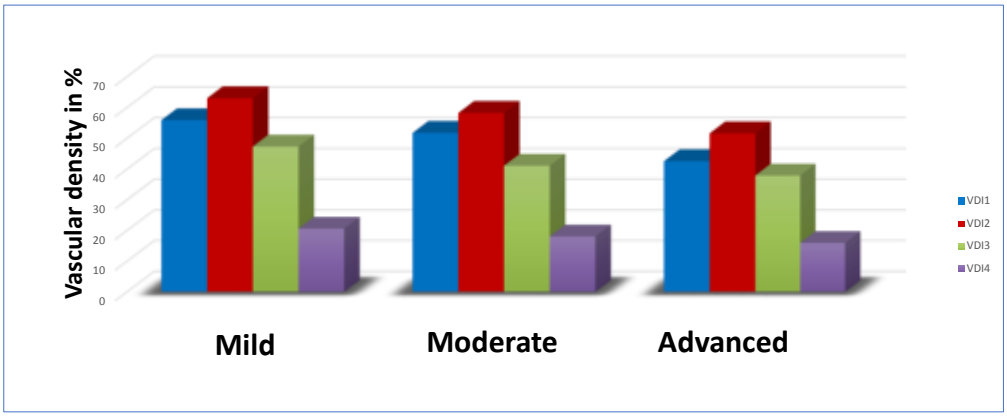
- **Mild : 17 eyes (37.8%).**
- **Moderate : 15 eyes (33.3%).**
- **Advanced : 13 eyes (28.9%).**



Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Results

By comparing means of VDI measurements in different levels in the 3 stages we found that **there was decrease in VDI measurements with increase the stage of severity.**



Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Case presentation

Case1

Normal control 1

50 years old healthy female.

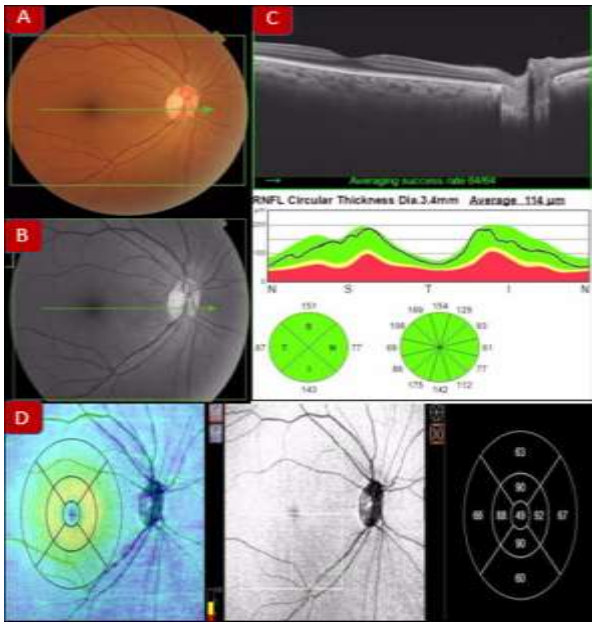
A. Colored photo: **normal** RA **1.85 mm²**, CD ratio of **0.31**, CV **0.07 mm³**.

C. OCT B scan with RNFLT map. RNFLT within the **normal** range in all four quadrants with average **114 um**.

D. MGCLT map showing within **normal** thickness detected by color coding, with 3mm average thickness **90 um**.

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case presentation



Case presentation

Superficial papillary level: normal dense peripapillary capillary plexus. **(VDI-1)57.85%.**

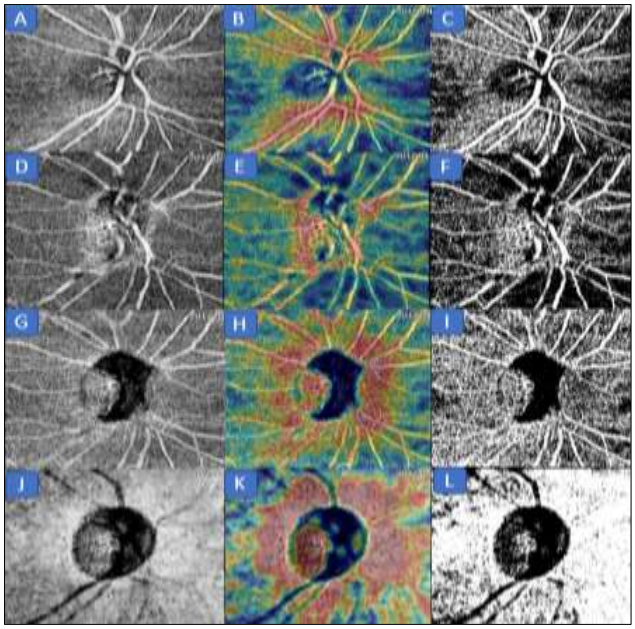
Deep papillary level: normal dense peripapillary capillary plexus with **(VDI-2)67.54%.**

Outer retina level:

(VDI-3) 49.36%.

Choriocapilaries level:

(VDI-4)27.32%.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case 2

Moderate NTG

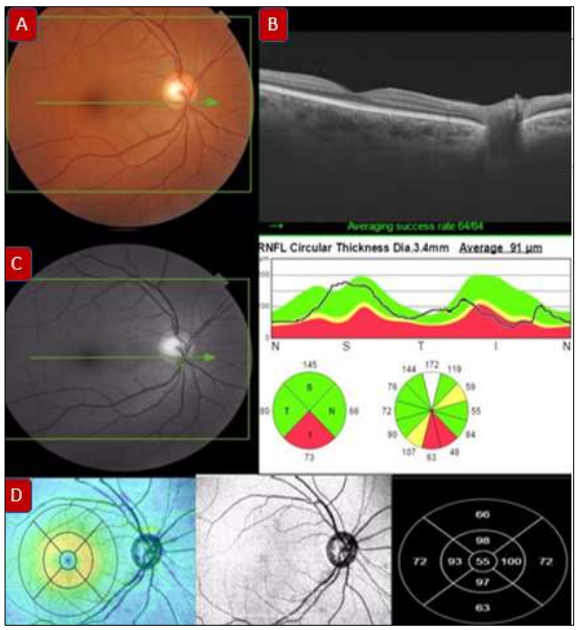
Case presentation

60 years old NTG female patient .

A. Colored photo : RA **1.47mm²**,CD ratio of **0.62** and CV **0.33mm³**.

C. OCT B scan , RNFLT map RNFLT show **thinning in inferior quadrant** with average **91 um**.

D. macular GCL map with 3mm average thickness **97 um**.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case presentation

Superficial papillary level: attenuated PPCP (infero-temporal).

(VDI-1) 50.82%.

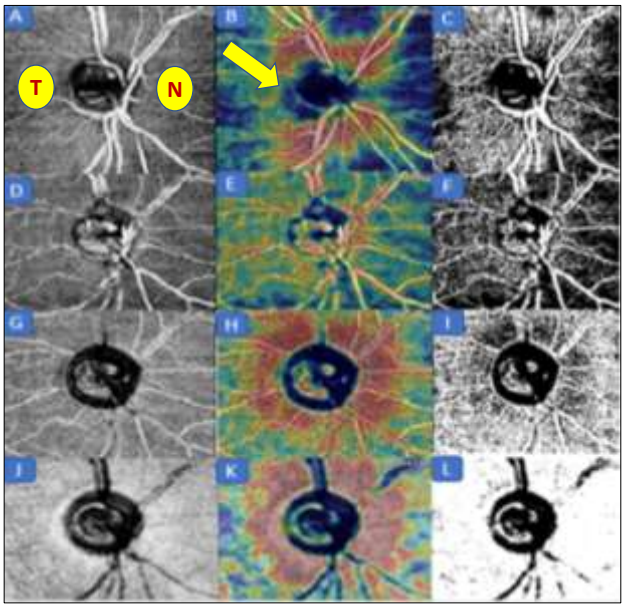
Deep papillary level: (VDI-2) 62.76%.

Outer retina level:

(VDI-3) 44.34%.

Choriocapilaries level:

(VDI-4) 15.875%.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case presentation

Case 3

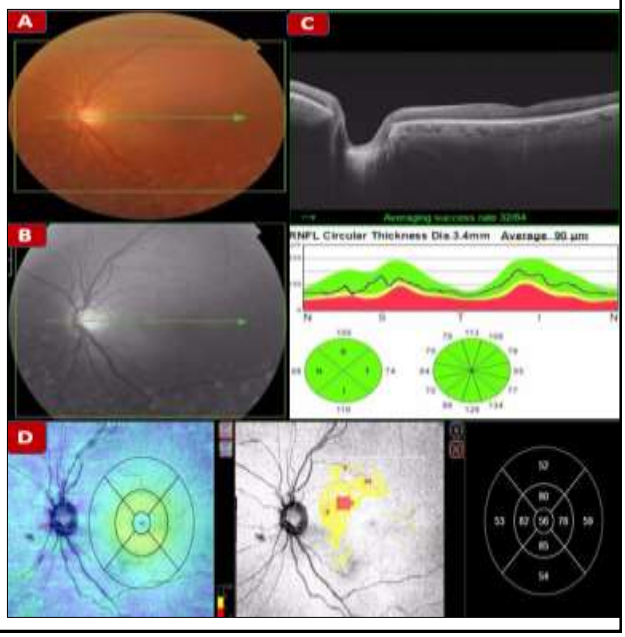
Mild AO HTPOAG

50 years old AO HTPOAG male patient . Visual field showed mild glaucomatous field changes with MD -3.29 and PSD +2.92.

A. Colored photo shows a RA **1.51mm²**, with CD ratio of **0.67** and CV **0.46 mm³**

C. OCT B scan with RNFLT map. RNFLT still normal thickness in all 4 quadrant with average **90 um**.

D. macular GCL map hot colors represent thinning with average 3mm thickness **81.75 um**.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

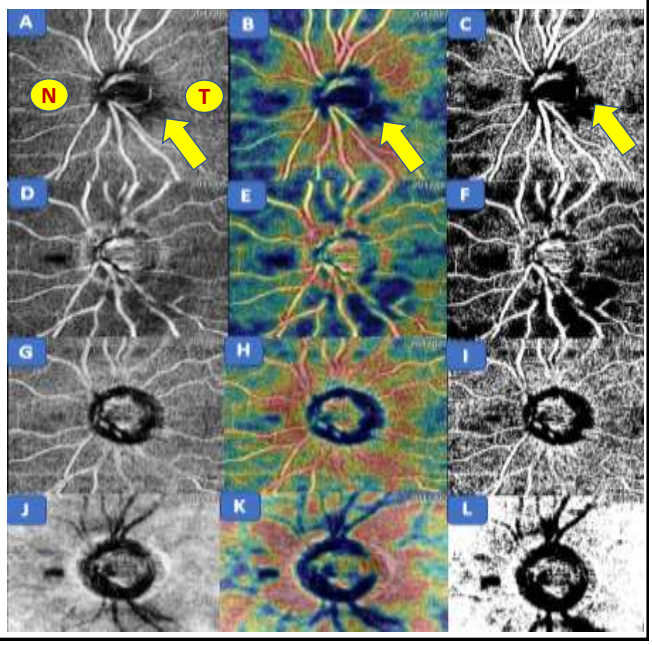
Case presentation

superficial papillary level: diffuse capillary drop out of peripapillary capillary plexus all over OD marked inferotemporal. (**VDI-1) 55.89%.**

Deep papillary level: multiple areas with capillary dropout **(VDI-2) 60.69%.**

Outer retina level: (VDI-3) 45.69%.

choriocapilaries level: (VDI-4) 25.482%.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case 4

Severe AO HTPOAG

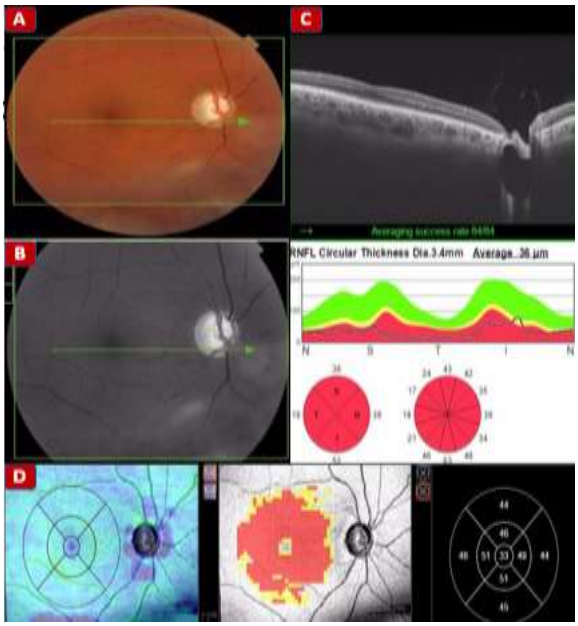
Case presentation

46 years old AO HTPOAG male patient .

A. Colored photo : RA **0.29mm²**, CD ratio of **0.99** and CV **1.55mm³**.

C. OCT B scan with RNFLT map. RNFLT show **diffuse thinning in all quadrants** with average **36 um**.

D. MGCL map shows hot color (red) representing **diffuse thinning** with average 3mm thickness **49.25 um**.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

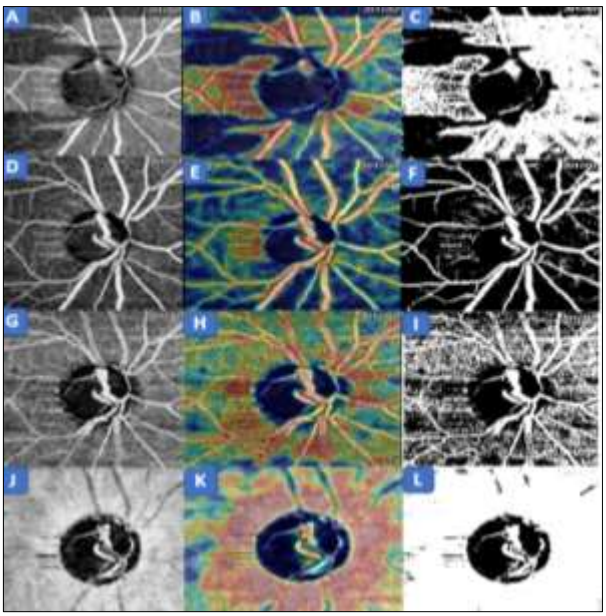
Case presentation

Superficial papillary level: large areas with capillary drop out with cold blue color representing decreased vascular density i.e. ischemia. **(VDI-1) 44.41%.**

Deep papillary level: Diffuse capillary dropout i.e. ischemia. **(VDI-2) 49.99%.**

Outer retina level: with **(VDI-3) 48.95%.**

Choriocapilaries level: with **(VDI-4) 12.45%.**



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case 5

Normal control 2

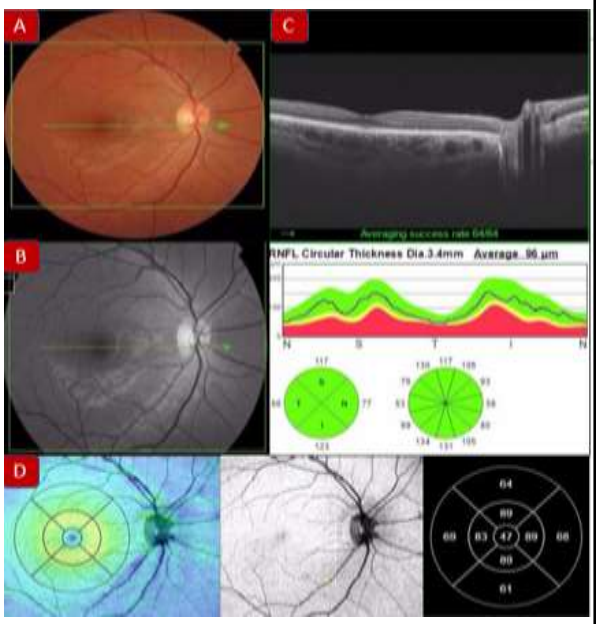
Case presentation

27 years old healthy female .

A. Colored photo : normal RA **1.65mm²**, CD ratio of **0.3**, and CV **0.06mm³**.

C. OCT B scan with RNFLT map. RNFLT is within the normal range in all four quadrants with average **96 um**.

D. MGCL map shows within normal thickness with average 3mm thickness **87.50 um**.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case presentation

Superficial papillary level: normal dense micro vascular network.

(VDI-1) 59.67%.

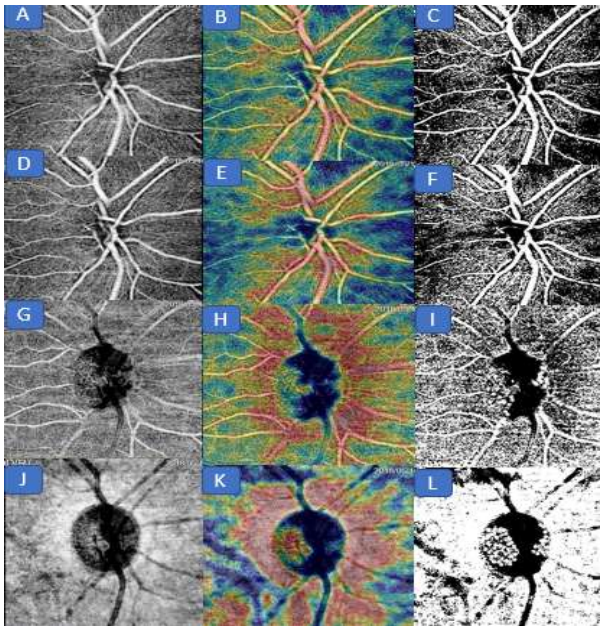
Deep papillary level: normal dense micro vascular network.

(VDI-2) 63.55%.

Outer retina level: with **(VDI-3) 47.08%.**

Choriocapilaries level: with **(VDI-4) 26.007%.**

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018



Case 6

Mild JPOAG

Case presentation

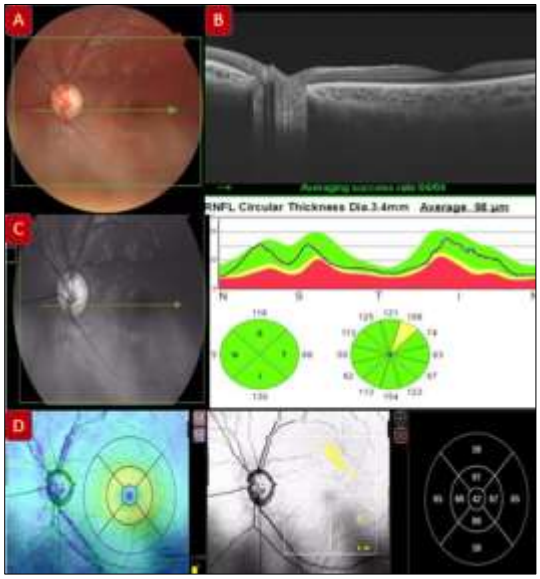
14 years old JPOAG male patient .

A. Colored photo : RA **1.45mm²**, C/D ratio of **0.68** and CV **0.58 mm³**

C. OCT B scan with RNFLT map with **mild thinning at 1 o'clock** average **98 um**.

D. MGCL map shows **scattered localized areas of thinning (yellow color)** with average 3mm thickness **88.75um**.

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018



Case presentation

Superficial papillary level: diffuse peripapillary capillary drop out.

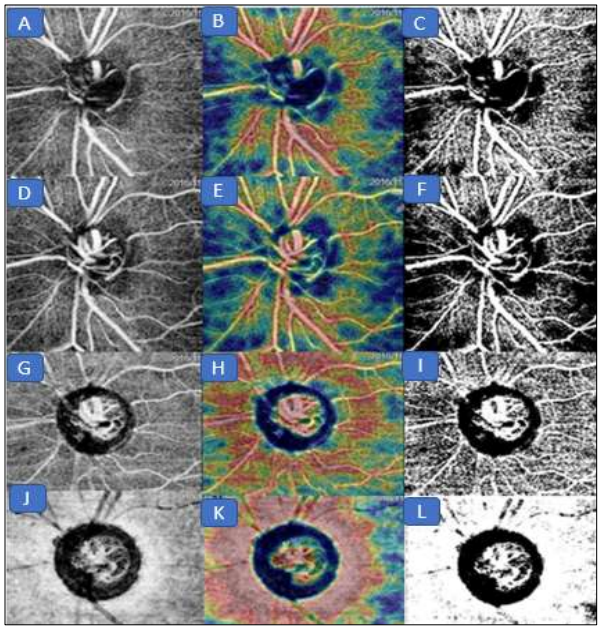
(VDI-1) 59.78%.

Deep papillary level: diffuse peripapillary capillary drop out.

(VDI-2) 63.63%.

Outer retina level: with **(VDI-3) 46.82%.**

Choriocapilaries level: with **(VDI-4) 17.52%.**



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case 7

Moderate JPOAG

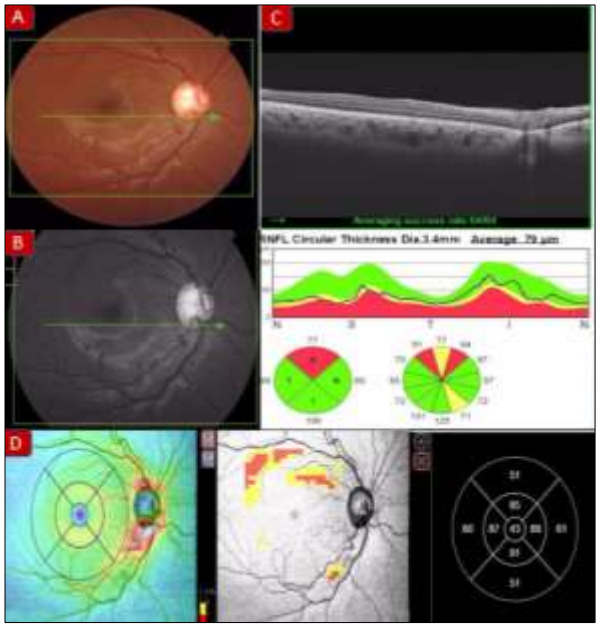
Case presentation

22 years old JPOAG male patient .

A. Colored photo : RA **0.87mm²**, C/D ratio of **0.80** and CV **0.86 mm3**

C. OCT B scan with RNFLT map. RNFLT show **thinning in superior quadrant** with average **79 um**.

D. MGCL map **hot colors (red &yellow colors) represent thinning** with average 3mm thickness **88um**.



Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018

Case presentation

Superficial papillary level: absent ONH micro vascular network and attenuated peripapillary capillary plexus.

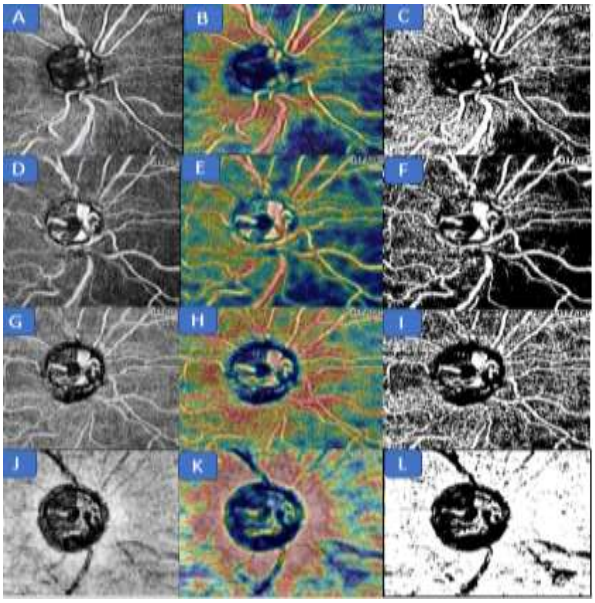
(VDI-1) 47.49%.

Deep papillary level: areas of capillary drop out.**(VDI-2) 60.16%.**

Outer retina level: with **(VDI-3) 49.45%.**

Choriocapilaries level: with **(VDI-4) 19.99%.**

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018



Case 8

Severe JPOAG

Case presentation

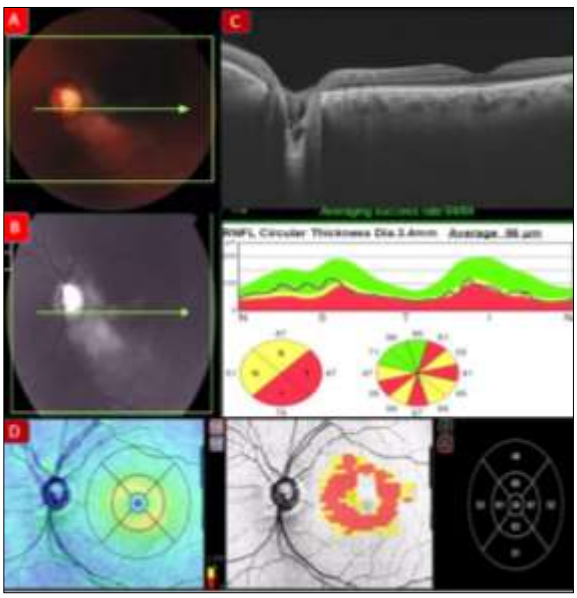
35 years old JPOAG male patient .

A. Colored photo :RA **0.77**mm^2, C/D ratio of **0.80** and CV **0.97** mm^3

C. OCT B scan with RNFLT map. RNFLT show **thinning in all quadrants** with average **66 um**.

D. MGCL map with hot colors (red &yellow colors) represent **thinning** with average 3mm thickness **67um**.

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018



Case presentation

Superficial papillary level: absent ONH micro vascular network and diffuse peripapillary capillary drop out.

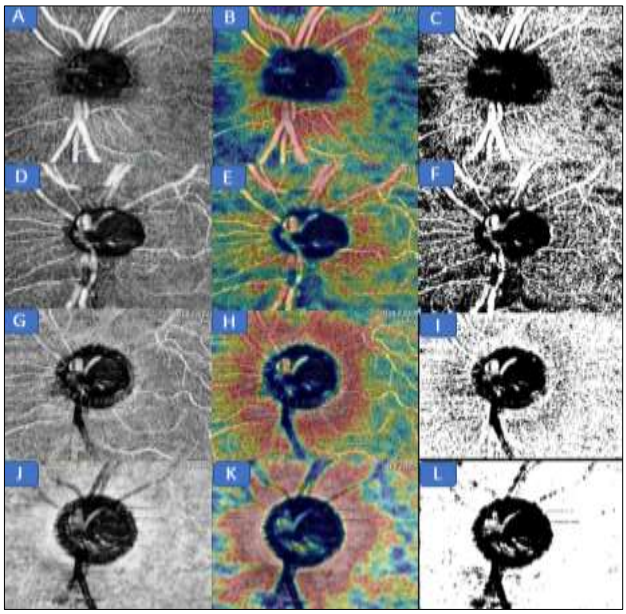
(VDI-1) 45.02% .

Deep papillary level: absent ONH micro vascular network.**(VDI-2) 63.63%.**

Outer retina level: with **(VDI-3) 24.22%.**

Choriocapilaries level: with **(VDI-4) 16.99%.**

Basma Gamal, Ophthalmology Department, Tanta University, Thesis for MSC,August,2018



Conclusion

Conclusion

In conclusion

1. glaucoma patients showed markedly reduced ONH vascular density .

- ***Quantitative assessment:*** VDI reduction was more significant in NTG followed by JPOAG and AO HTPOAG .
- ***Qualitative assessment*** the normally dense microvascular network of ONH, was attenuated with marked peripapillary capillary drop out.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Conclusion

In conclusion

2. the most affected level was choriocapilaries level. This level represents the ciliary circulation the main blood supply of ONH.

So, ischemia in glaucoma may be caused by:

- **Primary element** as detected by decreased VDI at choriocapilaries level.
- **Secondary effect** to elevated IOP (direct impact) with decrease VDI-1 that is marked in cases with high IOP .

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Conclusion

In conclusion

3. The reduction in vascular density has a strong correlation with the functional, structural glaucoma parameters and the disease severity.

3. OCTA may offer insights into the pathophysiology of glaucomatous damage.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Recommendations

Recommendations

Based on the results obtained from the study. we may recommend the following:

- Follow up longitudinal studies on large number of patients .
- Further studies on each glaucoma group separately with patients of different age, sex and race.
- Special studies should be conducted on early glaucoma and glaucoma suspect patients to detect if vascular changes have earlier presentation and its value in detection of glaucoma progression .

Recommendations

Based on the results obtained from the study. we may recommend the following:

- Further studies before starting anti-glaucomatous medications to exclude any unclear effect on vascularity.
- Further measurements of the vascularity in hemispheres or quadrants and finding the topographic relationship between it and structural glaucomatous damage might provide more information.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

Recommendations

- OCTA should not be used alone for glaucoma diagnosis and follow up but can be used as an additional tool beside visual field and conventional OCT.

Basma Gamal, Ophthalmology Department, Tanta University,
Thesis for MSC,August,2018

تم بحمد الله

Thank you!

Basma Gamal Mohamed
Ophthalmology Department
Tanta University Hospital
Thesis for MD
August, 2018