

## ASSOCIATION BETWEEN HYPOTHYROIDISM AND PRIMARY OPEN ANGLE GLAUCOMA

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### Abstract

**Background:** To study the association between hypothyroidism and primary open angle glaucoma. **Materials and Methods:** A case control study was undertaken with 50 cases- GROUP A (newly diagnosed cases of hypothyroidism) and 50 controls- GROUP B (euthyroid case) and the prevalence of primary open angle glaucoma was seen in them. Criteria for diagnosis of hypothyroidism and POAG was followed. Strict adherence to inclusion and exclusion criteria was done. **Result:** In group A the mean of the right eye is  $19.59 \pm 2.01$  mmHg whereas in the left eye it is  $19.91 \pm 2.61$  mmHg. In group B the mean IOP of the right eye is  $17.96 \pm 1.43$  mmHg and  $18.55 \pm 1.96$  mmHg in the left. There is a clinical significance in both ( $p$  value  $< 0.05$ ). In group A 8 out of 50 subjects had a CD ratio of  $> 0.5$  with a mean of  $0.73 \pm 0.10$ . The other 42 subjects had a mean CDR of  $0.33 \pm 0.04$ . In group B only 2 subjects had disc changes with a mean CDR of  $0.75 \pm 0.07$  whereas the other 48 had a mean of  $0.35 \pm 0.05$ . This is statistically significant ( $p$  value 0.0031). A statistically significant association between hypothyroidism and primary open angle glaucoma ( $P$  value:  $0.04 < P < 0.05$ ) was seen in this study. **Conclusion:** The mean IOP in Group A hypothyroid patients is higher than Group B euthyroid controls. However, there is no significant difference in mean IOP between the glaucomatous patients of the respective groups. Positive family history is an important risk factor for primary open angle glaucoma (22%). Hence, more studies are advocated in more centres, with more number of patients and for a longer duration, to show the association between hypothyroidism and POAG and to investigate the clinical course of patients of hypothyroidism in whom POAG is diagnosed, and to establish the pathophysiological mechanism responsible.

## INTRODUCTION

One of the most prevalent endocrine illnesses, hypothyroidism, is defined by low thyroid hormone levels and the implications these have on numerous bodily functions.<sup>[1]</sup> The ratio of females to men is determined to be 5:1.

The ocular signs of hypothyroidism include: Chemosis, Blepharoptosis, Periorbital oedema, Progressive exophthalmos, Reduced extraocular motility.

Clinical examination, low levels of T3 and T4 and an increase of TSH<sup>[2]</sup> are used to diagnose hypothyroidism.

Glaucoma is a multifactorial optic neuropathy that can occur with or without elevated intraocular pressure and is characterised by progressive neurodegeneration of the RGC layer and their axons, injury to the optic nerve, attenuation of the retinal nerve fibre layer, and loss of visual field.<sup>[3-5]</sup>

It is a leading global cause of permanent blindness. It was predicted that 66.8 million individuals had been impacted by the year 2000. About 2% of the almost 12 million blind cases in India are caused by glaucoma.<sup>4</sup> Due to its significant prevalence in the Indian population, glaucoma was included in the VISION 2020 initiative's disease control strategy.

### Aims and Objective

1. To study prevalence of POAG in hypothyroidism
2. To measure IOP of the patients
3. To assess visual field changes using a Humphreys automated perimetry in the same patient
4. To evaluate their C:D ratio

## MATERIALS AND METHODS

A case control study with 100 patients was undertaken. For our study, a total of 50 new

consecutive primary hypothyroid patients were chosen. To compare with the hypothyroid group, a total of 50 control cases who were euthyroid according to the physician's diagnosis were chosen from patients' relatives and peers.

#### Criteria For Diagnosing Hypothyroidism

Using the patient's medical history, symptoms, and signs, hypothyroidism was clinically diagnosed. Each patient had their serum T3, T4, and TSH estimated to determine their thyroid function.

#### Criteria for Diagnosing Primary Open Angle Glaucoma

The Rotterdam study's diagnostic criteria were used to determine if the patients had primary open angle glaucoma.

Two out of the following three parameters must be fulfilled:

Taking into account diurnal variation, IOP must be  $>21\text{mmHg}$  at one instance over a 24-hour: measured by Schiøtz tonometer

Automated Perimetry, Humphrey System, Model: 720: Glaucomatous Visual Field.

Cup: Disc ratio  $>0.5$

A gonioscopically normal and open anterior chamber angle.

Glaucoma alone was the only anomaly that could account for the visual field defect

The following patients were excluded from the study:

1. Cases less than 20 years of age.
2. Cases of congenital glaucoma.
3. Cases with secondary glaucoma.
4. Cases with narrow angle glaucoma.
5. Acute ocular infection or inflammation, ocular surgery, trauma or corneal defect that prevents recording of IOP
6. Diseases affecting retinal function & causing acute loss of vision

## RESULTS

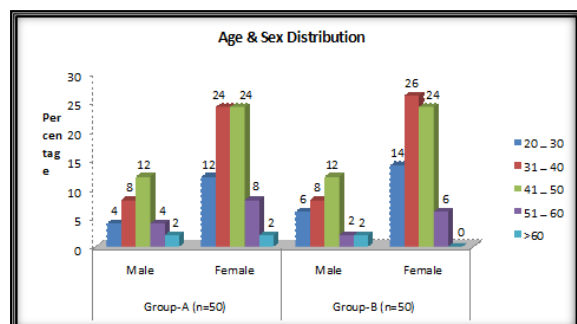


Figure 1: Age & Sex Distribution

In the present study, there is no statistical significance between the age and sex distribution in both the groups.

[Table 2] In the present study, 11 (22%) out of 50 subjects in group A had a family history on POAG whereas only 2 (4%) out of 50 subjects had a positive family history in group B. This was statistically significant with a p value of 0.007.

[Table 3] shows the mean IOP in both the groups. In group A the mean of the right eye is  $19.59\pm 2.01\text{mmHg}$  whereas in the left eye it is  $19.91\pm 2.61\text{mmHg}$ . In group B the mean IOP of the right eye is  $17.96\pm 1.43\text{mmHg}$  and  $18.55\pm 1.96\text{mmHg}$  in the left. There is a clinical significance in both (p value  $< 0.05$ ).

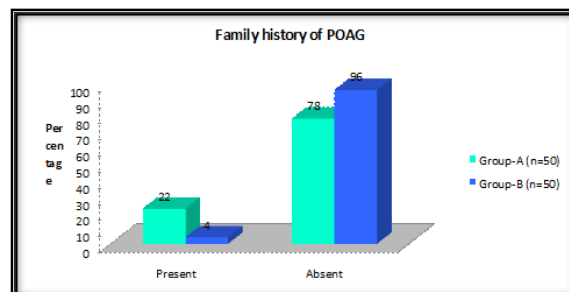


Figure 2: Family history of POAG

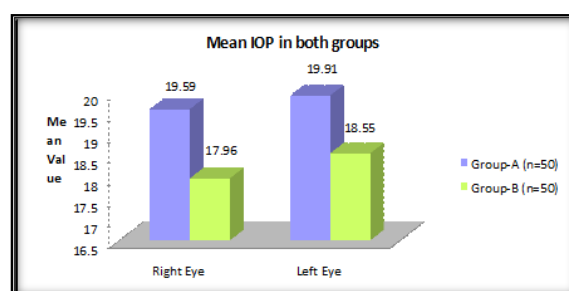


Figure 3: Mean IOP in both groups

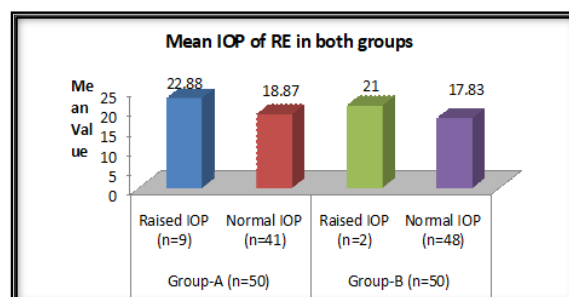
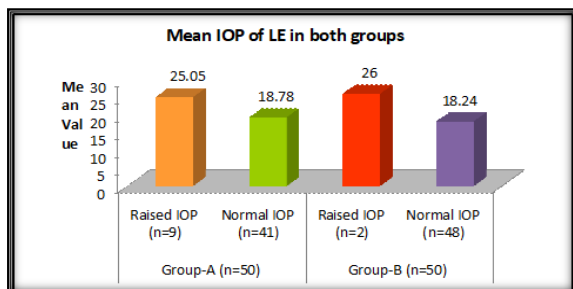


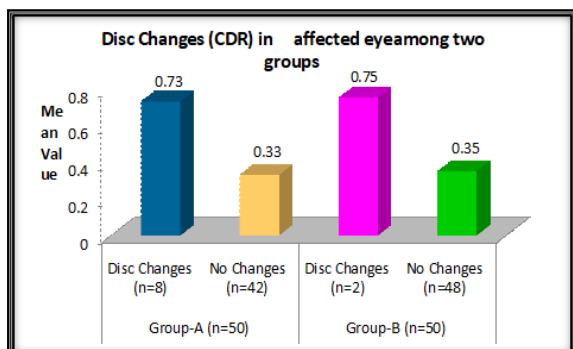
Figure 4: Mean IOP of RE in both groups

[Figure 4] shows the mean IOP in right eye of both the groups. In group A, there is an increase of IOP in 9 subjects with a mean of  $22.88\pm 1.61\text{mmHg}$ . There were 41 cases with IOP in the normal range with mean being  $18.87\pm 1.21\text{mmHg}$ . In group B, 2 out of 50 subjects had an elevated IOP with a mean of  $21\text{mmHg}$ . The other 48 subjects had IOP within normal ranges and the mean was  $17.83\pm 1.31\text{mmHg}$ . This shows a clinical significance with a p value of 0.041.



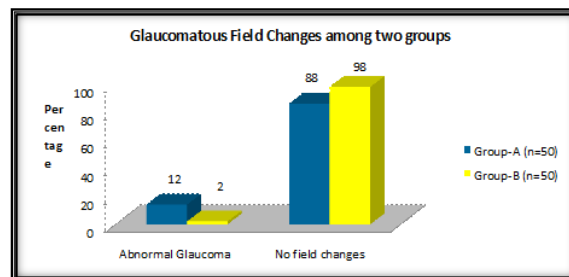
**Figure 5: Mean IOP of LE in both groups**

[Figure 5] shows the mean IOP in left eye of both the groups. In group A, there is an increase of IOP in 9 subjects with a mean of  $25.02 \pm 1.52$  mmHg. There were 41 cases with IOP in the normal range with mean being  $18.78 \pm 0.88$  mmHg. In group B, 2 out of 50 subjects had an elevated IOP with a mean of  $26 \pm 0.98$  mmHg. The other 48 subjects had IOP within normal ranges and the mean was  $18.24 \pm 1.24$  mmHg. This shows a clinical significance with a p value of 0.039.



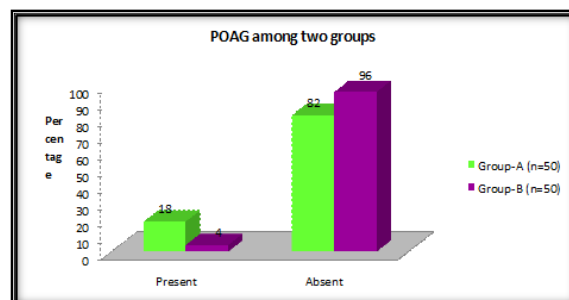
**Figure 6: Disc Changes (CDR) in affected eye among two groups**

[Table 6] In group A 8 out of 50 subjects had a CD ratio of  $>0.5$  with a mean of  $0.73 \pm 0.10$ . The other 42 subjects had a mean CDR of  $0.33 \pm 0.04$ . In group B only 2 subjects had disc changes with a mean CDR of  $0.75 \pm 0.07$  whereas the other 48 had a mean of  $0.35 \pm 0.05$ . This is statistically significant (p value 0.0031)



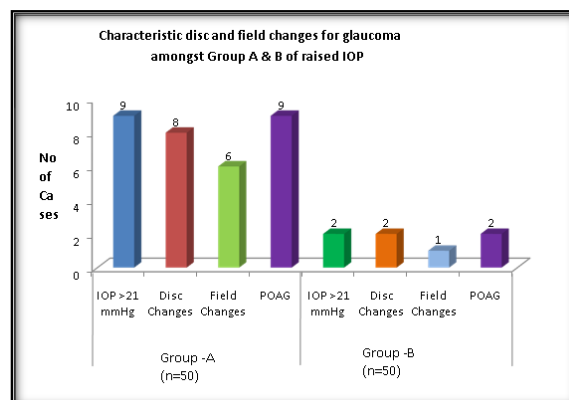
**Figure 7: Glaucomatous Field Changes among two groups**

Cases with elevated IOP and distinctive disc changes were further analysed by Automated Perimetry. According to Anderson's criteria<sup>5</sup>, the Glaucoma Hemifield Test was assessed to confirm cases of glaucoma.



**Figure 8: POAG among two groups**

As per our diagnostic criteria laid down in Materials and Methods, 9 cases had Primary Open Angle Glaucoma (POAG) in Group A and 2 in Group B. This shows a statistical significance with a p value of 0.025.



**Figure 9: Characteristic disc and field changes for glaucoma amongst Group A & B of raised IOP**

Findings of characteristic changes in the disc and field changes for glaucoma amongst 9 cases (Group A) and 2 cases (Group B) of raised IOP had been tabulated above.

**Table 1: Age & Sex Distribution**

Age in year	Group-A (n=50)				Group-B (n=50)			
	Male	%	Female	%	Male	%	Female	%
20 – 30	02	4.0	6	12.0	03	6.0	07	14.0
31 – 40	04	8.0	12	24.0	04	8.0	13	26.0
41 – 50	06	12.0	12	24.0	06	12.0	12	24.0
51 – 60	02	4.0	04	8.0	01	2.0	03	6.0

>60	01	2.0	01	2.0	01	2.0	00	0.0
Total	15	30.0	35	70.0	15	30.0	35	70.0
Statistical Inferences	Chi- Square Value-3.934 p Value- 0.984							

**Table 2: Family history of POAG**

Family history of POAG	Group-A (n=50)		Group-B (n=50)	
	No of cases	Percentage	No of Cases	Percentage
Present	11	22.0	02	4.0
Absent	39	78.0	48	96.0
Total	50	100	50	100
Statistical Inferences	Chi- Square value- 7.1618 p Value- 0.007**			

**Table 3: Mean IOP in both groups**

IOP	Group-A (n=50)		Group-B (n=50)		p Value
	Mean	SD	Mean	SD	
Right Eye	19.59	±2.01	17.96	±1.43	0.033*
Left Eye	19.91	±2.61	18.55	±1.96	0.044*

**Table 4: Mean IOP of RE in both groups**

Mean IOP RE	Group-A (n=50)				Group-B (n=50)			
	Raised IOP (n=9)		Normal IOP (n=41)		Raised IOP (n=2)		Normal IOP (n=48)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	22.88	±1.61	18.87	±1.21	21.00	±0.00	17.83	±1.31
P Value	<0.0001				<0.0001			
P Value	0.041*							

**Table 5: Mean IOP of LE in both groups**

Mean IOP LE	Group-A (n=50)				Group-B (n=50)			
	Raised IOP (n=9)		Normal IOP (n=41)		Raised IOP (n=2)		Normal IOP (n=48)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	25.02	±1.52	18.78	±0.88	26.00	±0.98	18.24	±1.24
P Value	<0.0001				<0.0001			
P Value	0.039*							

**Table 6: Disc Changes (CDR) in affected eye among two groups**

Disc Changes (CDR)	Group-A (n=50)				Group-B (n=50)			
	Disc Changes (n=8)		No Changes (n=42)		Disc Changes (n=2)		No Changes (n=48)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	0.73	±0.10	0.33	±0.04	0.75	±0.07	0.35	±0.05
P Value	<0.0001				<0.0001			
P Value	0.0031*							

**Table 7: Glaucomatous Field Changes among two groups**

Glaucomatous Field Changes	Group-A (n=50)		Group-B (n=50)	
	No of cases	Percentage	No of Cases	Percentage
Abnormal Field	06	12	01	2.0
No field changes	44	88	49	98.0
Total	50	18.0	50	4.0
Statistical Inferences	Chi- Square value- 3.840 p Value- 0.049*			

**Table 8: POAG among two groups**

POAG	Group-A (n=50)		Group-B (n=50)	
	No of cases	Percentage	No of Cases	Percentage
Present	9	18.0	2	4.0
Absent	41	82.0	48	96.0
Total	50	100	50	100
Statistical Inferences	Chi- Square value- 5.0051 p Value- 0.025*			

## DISCUSSION

In the present study statistical significance of association was tested by Chi Square Test for case control. The 'p' value was  $0.04 < P < 0.05$ . So, the association was statistically significant. This finding was similar to those of the studies reported by McLenachan and Davies, Smith et al, but not in

agreement with the studies of Cheng and Perkins and Gillow et al.<sup>[6-9]</sup>

The current study has shown a statistically significant association between hypothyroidism and POAG.

## CONCLUSION

1. There is a definite statistically significant association between hypothyroidism and primary open angle glaucoma ('P' value :  $0.04 < P < 0.05$ )
2. The mean IOP in Group A hypothyroid patients is higher than Group B euthyroid controls. However, there is no significant difference in mean IOP between the glaucomatous patients of the respective groups.
3. Positive family history is an important risk factor for primary open angle glaucoma (22%).
4. Hence, more studies are advocated in more centres, with more number of patients and for a longer duration, to show the association between hypothyroidism and POAG and to investigate the clinical course of patients of hypothyroidism in whom POAG is diagnosed, and to establish the pathophysiological mechanism responsible.

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