

Correlation of Primary Open Angle Glaucoma and Other Systemic and Vascular Diseases

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Abstract: Primary open angle glaucoma is the second most common cause of blindness can be associated with systemic and vascular disease especially hypertension affects ocular blood flow and optic nerve perfusion. **Aim:** Correlation of primary open angle glaucoma with systemic disease, hypertension and other vascular disease. **Methods:** In 100 patients we have carried out basic demographic data (age, gender, residence) and general ophthalmic anterior as well as posterior segment examination with detail glaucoma work up including applanation tonometry, funduscopy, gonioscopy, pachymetry, perimetry, and HRT. Then repeat examination was carried out after 1 week, 1 month, 3 months, 6 months, and after 1 year. Patients having vascular disease were referred to physician for complete medical check up. **Study design:** Study carried out in routine O.P.D patients diagnosed of glaucoma. **Results:** Out of 100 patients majority were male patients and the rest were female patients. 63% were male and 27% were female patients. 72% were suffering from HTN and 7% suffering from DM. **Conclusion:** There is a major correlation of POAG with hypertension, DM being the second most. Both ways patients of HTN and DM and patients above 40 yrs of age should be screened for glaucoma and all patients of glaucoma should undergo routine medical examination.

Keywords: Intraocular pressure, hypertension, open angle glaucoma, ocular perfusion pressure

1. Introduction

Glaucoma is one of the major cause of blindness in developing countries, most of the time Open angle glaucoma is asymptomatic characterized by open angles, increased intraocular pressure with significant RNFL loss, disc changes, visual field loss. There is progressive loss of retinal ganglion cells besides the mechanical effects of raised IOP on the optic nerve head (ONH) several vascular factors leads to hypo-perfusion of ONH and play important role in pathogenesis in progression of primary open angle glaucoma (POAG). There are two theories: (1) vascular (2) ischemic.

There are many risk factors for POAG. Elevated intra ocular pressure is considered the most important risk factor. Number of vascular factor has been identified as risk factor and lead to hypo-perfusion of optic nerve head and play an important role in pathogenesis and progression of POAG. Elevated BP is associated with increased IOP leading to increase risk of glaucoma but excessive lowering of BP may cause a drop in ocular perfusion pressure and subsequent ischemic injury.

2. Material and Methods

This study was carried out in glaucoma patients visiting our hospital to find correlation of primary open angle glaucoma with HTN, DM, IHD and hypothyroidism. This study was done in 100 patients visiting our O.P.D during one year period. Routine ophthalmic detailed history and both general and systemic, family history, personal history, history of ocular disease, history of medication, history of surgery was taken. Detail eye examination both eye visual acuity, torch light examination, refraction, slit lamp examination for

anterior segment (conjunctiva, cornea, anterior chamber depth, iris colour and pattern, pupil, lens) IOP was taken with applanation tonometer, CCT taken with pachymeter, gonioscopy was done, fundus examination after pupillary dilatation was done to see the size, shape, colour of the disc, cup disc ratio, vascular changes, and detailed retinal evaluation. Patients were followed up after 10 days after starting of first drug, 1 month, 3 months, 6 months after 1 year. Perimetry was done at 1st visit, 6 month, and one year.

HRT was done every 6 months and repeated after 1 year. Patients were referred to physician for complete medical evaluation.

Criteria for diagnosis:

- Intra ocular pressure b/n 21 – 40 mm Hg, and more.
- Indirect gonioscopy showing all the structures, ciliary body, iris root, trabecular meshwork, schwalbe's line, or any 3 structures.
- Fundus/disc examination: with direct ophthalmoscopy, 78D and indirect ophthalmoscope was done:- RNFL defect/loss, abnormal disc/cup/rim, cup: disc ratio difference of more than 2 between two eyes and bilateral asymmetry, notching, nasalisation of vessels, lamellar dot signs, optic atrophy
- Vascular changes: Bayonetting, Baring of circumlinear vessel, overpass

Perimetry was done with octopus perimeter on 1st visit, repeated every 3rd, 6th month and 1 year.

3. Results

In our study 10% male had f/H/O open angle glaucoma. 5 % female had F/H/O open angle glaucoma. 59% male had

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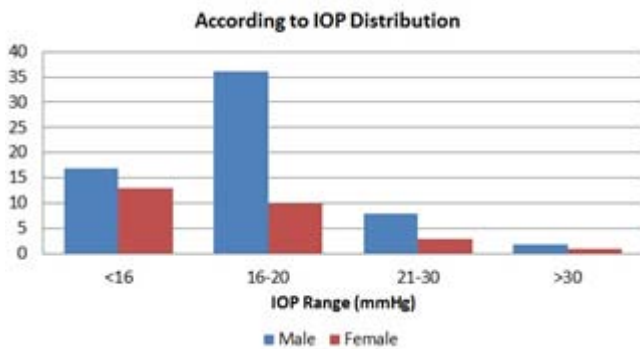
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grade III angle. 26% female had grade III angle. 41% male had grade IV angle. 86% female had grade IV angle. 8% male and 2% female were operated for AGS. Out of all 49 male were suffering from HTN, 23 female were suffering from HTN. 6 male and 1 female had DM, 2 male and 1 female had hypothyroidism. Some detected of HTN and DM after coming to our OPD.

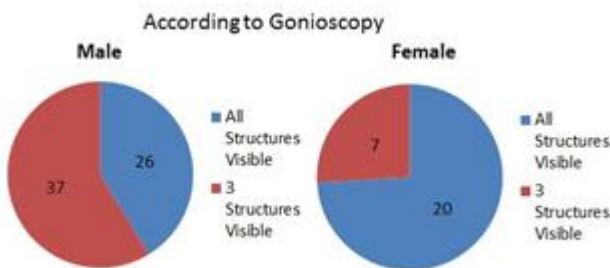
(1) According to IOP distribution:

IOP range (mmHg)	Male	Female
<16	17	13
16-20	36	10
21-30	08	03
>30	02	01



(2) According to Gonioscopy:

Structures visible	Male	Female
All structures visible	26	20
3 structures visible	37	07



(3) According to CCT:

µm	Male	Female
555	2	1
515-535	20	13
485-455	38	11
445	3	2

(4) According to RNFL loss

Type of defect	Male	Female
Striation loss	13	09
Wedge defect	20	07
Total RNFL loss	30	11

(5) According to disc evaluation:

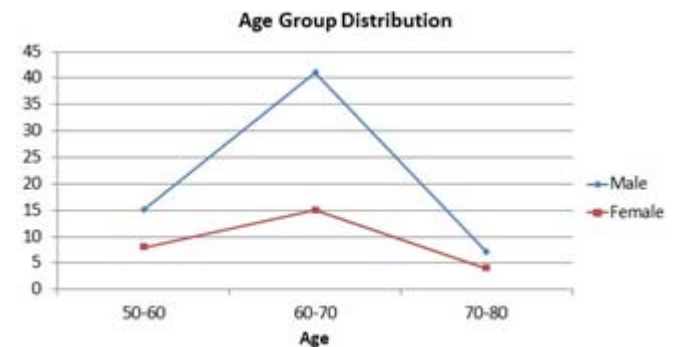
CD ratio	Male	Female
0.4-0.6	20	09
0.6-0.8	41	17
0.9	02	01

(6) According to DDLS scale:

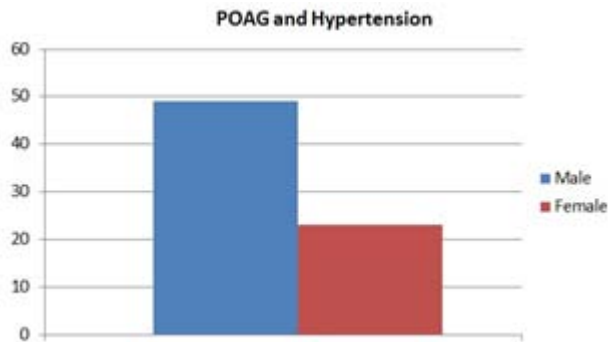
Scale	Male	Female
0a	13	06
0b	07	03
4	29	11
5	12	06
6	02	01

4. Discussion

Glaucoma is one of the major causes of visual impairment in developing countries. 67million individuals worldwide have glaucoma. It is linked to various vascular and endocrinal disorders. It is slowly progressive and asymptomatic. POAG accounts for 70% of all over cases. Socio-demographic variables include age, sex, occupation, and level of education. HTN affects blood flow & disc perfusion. Most of the patients were above 40 yrs (52-80 yrs) of age. The major age group was between 60-70yrs of age and having systemic problem like HTN (most common), DM, IHD, Hypothyroidism. In our study patients of POAG major patients were suffering from HTN almost 72% .Table no.2 showing IOP distribution states that major patients were controlled with medical line of treatment, 10 patients had to undergo anti glaucoma surgery. Most of the patients were having cup/disc ratio between 0.6-0.8 (male:41 female:17). Many epidemiological studies have investigated the relationship between OAG and diabetes mellitus and some of them provide evidence for a positive association. DM causes sclerosis of trabecular meshwork, which impedes the outflow of aqueous humour and then leads to elevated IOP and OAG. DM affects small vessels supplying optic nerve. In our study major correlation was with HTN. Out of all 100 patients 72 patients were suffering from HTN. 7 patients were suffering from DM. Out of 100 patients 2 male and 1 female was suffering from hypothyroidism, this shows association of primary open angle glaucoma with it.



Systemic hypertension is a major health issue affecting more than 25% of the adult population worldwide; its prevalence is predicted to affect more than 1.5 billion individuals by 2025. Hypertension adversely affects not only the heart and kidneys, but is also associated with wide range of major eye disease, including glaucoma.



Hypertension is thought to increase the risk of the development and progression of glaucoma. Direct microvascular damage caused by hypertension could worsen blood flow to the anterior optic nerve. Auto regulation of the posterior ciliary circulation could also be impaired by hypertension. Anti hypertensive therapy could induce hypotensive episodes, especially at night, which could injure the optic nerve. Hypertension increased the risk of OAG by more than 50% after adjustment for other glaucoma risk factors such as intraocular pressure. Majority of population based study was reported as position associated or correlation between systolic blood pressure, diastolic blood pressure and intraocular pressure. There is a pulled average IOP increase of 0.26mm Hg and 0.17mm Hg associated with a 10mm Hg and 5mm Hg increase in diastolic BP with similar results seen in cross sectional and longitudinal study. This trend may be because of systemic HTN increases IOP via overproduction not impaired outflow of aqueous humour.

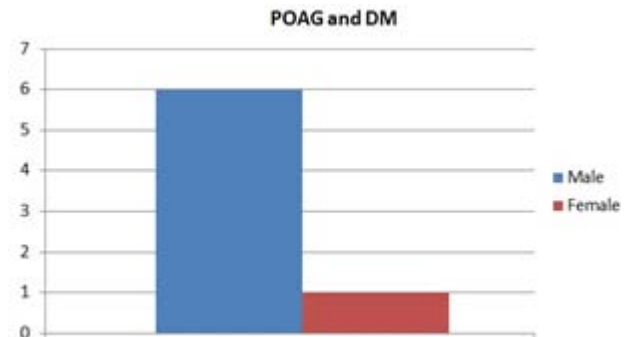
In Blue mountain eye study HTN was present in 45.7% of subjects and was significantly associated with OAG. This relation was strongest in subject with poorly controlled treated HTN. However they did not exclude nocturnal hypotensive episodes among treated subjects. HTN was also associated with ocular HTN. Which reflect influence of BP and IOP.

The Baltimore eye survey showed an age related association between BP and glaucoma in younger patients HTN showed productive effect that might improve OPP (ocular perfusion pressure). OPP can be defined as a systolic diastolic or mean OPP. The mean OPP can be calculated as $2/3^{rd}$ of the mean arterial BP-IOP. Systolic OPP is difference between systemic SBP and IOP whereas diastolic OPP (DOPP) equals the DBP-IOP. DOPP is regarded as independent risk

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factor for glaucoma. In older patient positive effect is lost and increase risk of glaucoma is seen most likely as a result of BP alteration induced by arterial HTN with disturbed oxygen and nutrition supply. Another important consideration is the relation between BP, IOP and OH. Elevated IOP is most important risk factor, so relation between BP and IOP should be considered in evaluating association between POAG and HTN.



Memarzadeh et al. showed no association between OAG and conventionally defined systemic HTN. However, the relationship was found across range of BP rather than by arbitrarily dividing definition. Elevated systolic and mean arterial BP was significantly associated with high prevalence of OAG independent of the impact of IOP. Several studies demonstrated that increase in BP is associated with an elevated IOP leading to increase risk of glaucoma. Microangiopathy can lead to increase in end organ damage including the retina and optic nerve. HTN must be treated because it is an important risk factor for Cardiovascular mortality and morbidity. Excessive BP lowering in glaucoma pt may cause drop in OPP and systemic ischemic injury

5. Conclusion

In our study it was found that of all systemic disease mostly HTN & few percentage of DM were the major disease correlating to POAG. Almost 72% were having HTN, so compound vasculature indices making optic disc vulnerable to damaged by fluctuation by intraocular pressure. Both ways patients of HTN and DM and other systemic diseases above 40 yrs should be screened for open angle glaucoma. Patients should undergo routine medical examination especially BP with all investigation

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