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Original article.

Presenting features of primary open angle glaucoma at initial diagnosis at Government Medical College Baramulla - a hospital based study.

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Running Title:

Presenting features of primary open angle glaucoma at initial diagnosis in a hospital based study.

ABSTRACT

Title: Presenting features of primary open angle glaucoma at initial diagnosis at Government Medical College Baramulla - a hospital based study.

Aim:

To study clinical presentation of primary open angle glaucoma at initial diagnosis.

Methods:

The study was conducted on patients of above 40 years of age attending OPD to screen the patients for primary open angle glaucoma.

Results:

The prevalence of glaucoma in the study is 1%. The mean age in our study is 58.1 years. 20.9% and >50% of the studied cases showed RAPD in the right and left eye, respectively. CDR 0.5-0.8 was present in 70% of right eyes and 42.9% of left eyes whereas Glaucomatous Optic Atrophy was present in 16.8% in right eyes and 27.8 left eyes, respectively. Mean IOP was 22.9mmHg and 27.8mmHg in right and left eye, respectively. 13.8% of the patients had IOP greater than 30mmHg in the right eye at presentation. 19.9% of the study subjects had mild visual fields changes in right eye. 20.4% had moderate and 10.2 % had severe visual fields changes in right eye whereas 6.6% had moderate visual field changes in left eye and 55.6% had severe changes. There was a statistically significant correlation of BCVA which decreased with increasing CD ratio, increasing IOP and progressively increasing visual field defects.

Conclusion:

Most of the patients presented late in the disease stage and 39.8% had glaucomatous optic atrophy in left eye and 16.8% in right eye at the first visit to OPD indicating lack of awareness about the disease especially in rural areas. The nature of primary open angle glaucoma is that it evades detection until final stages of the disease is reached. A health service response is required to prevent blindness from glaucoma. Early detection of the cases offers the best potential in preventing blindness from glaucoma. Screening in high risk populations should complement periodic ocular examination by an Ophthalmologist.

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Introduction:

Primary open angle glaucoma is an etiologically heterogeneous group of diseases characterized by damage to the optic nerve, resulting in peripheral visual loss that can progress to involve the fovea and central vision. This review focuses on primary open angle glaucoma (POAG), since it accounts for the vast majority of the disease burden and its etiology remains unknown.[1]

Glaucoma describes a group of ocular disorders of multi factorial etiology united by a clinically characteristic optic neuropathy with potentially progressive, clinically visible changes at the optic nerve head (ONH). Glaucoma is the second most prevalent condition after cataract known to cause blindness worldwide. [2,3] While good data on the prevalence of glaucoma are now available, adequate information on the incidence of POAG is not available. Statistical models population survival rates [4] as well as longitudinal studies that were not population-based [5,6,7] have been used to estimate incidence rates for various populations, primarily white residents of the United States. Such studies indicate that, even in study populations enriched with subjects who are considered high risk for the development of glaucomatous optic nerve damage, the incidence of new cases is quite low, in the range 1/1000 to 1/100 per year [5,6,7] Several population based studies over the last decade have thrown light on the prevalence of glaucoma in India. Noteworthy among them are Vellore Eye Study (Prevalence 4.1%), Andhra Pradesh Eye study (Prevalence 2.0%), Chennai Glaucoma Study (Prevalence 3.5%), West Bengal Glaucoma Study (Prevalence 2.7%)[11].

Primary Open Angle Glaucoma (POAG) tends to progress slowly and patients are often asymptomatic until the disease reaches an advanced stage. Injury due to glaucoma is largely irreversible, so early detection and prevention is of vital importance. It has been reported that Circum-papillary Retinal Nerve Fiber Layer thickness begins to decrease during the early stages of glaucoma. [8] Damage to Retinal Nerve Fiber Layer and optic disc has been shown to precede functional loss by about 5 years. Thus, imaging enables early detection of the disease and treatment initiation. Early treatment of glaucoma has been shown to reduce the incidence of Visual Field loss. Examination of the optic nerve head and its surrounding Retinal Nerve Fiber Layer is considered essential in both detecting and monitoring glaucoma [9]. It has been long recognized that focal rim loss, particularly in the vertical poles of the disc is characteristic of glaucoma. The neuro retinal rim area reflect the number of ganglion cells axons paying through the Optic disc and out performs the C/D ratio into correlation with visual function.[10]

Aims and Objectives:

To study clinical presentation of primary open angle glaucoma at initial diagnosis

Materials and methods:

After obtaining the ethical clearance from the Institution Ethical Committee, the descriptive hospital based study was conducted on patients of above 40 years of age attending

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outpatient Department of Ophthalmology, Govt. Medical College and Hospital Baramulla in order to screen the patients for primary open angle glaucoma. The study was conducted over a period of 18 months from (Jan 2021-July 2022). The sample size for screening the patients was calculated to be 19600 taking 2%prevalence with allowable error of 10% CI=90% using the formula 4 pq/l2. A total of 19,600 patients aged more than 40 years were screened for symptoms suggestive of POAG as pain, redness, watering, low vision, headaches, colored halos and photophobia. 196 patients with symptoms suggestive of POAG were further evaluated by way of detailed history and comprehensive eye examination. Detailed history and comprehensive eye examination formed the cornerstone of diagnosing the patients.

Visual Acuity was done at six meters distance with Snellen chart. E-chart used for illiterate people. Examination of the eye in diffuse light with torch was done to detect any gross abnormalities of anterior segment Detailed slit lamp examination was done in every patient, and all the findings were recorded in a systemic manner.

Slit Lamp Examination also included, fundus examination with +78D lens for evaluation of the optic disc and retinal nerve fibre layer. Goldmann applanation tonometry was used to measure IOP Indirect gonioscopy was done using a Goldmann three mirror gonio-lens in conjunction with a slit lamp. The angles were graded as open angle, narrow angle and closed angle using shaffers grading.

Automated perimetry by Humphery field analyser Model 750i series (HFA-2) was done in patients using the SITA (Swedish Interactive Threshold Algorithm) standard. Central (30-2) threshold strategy was used.

Inclusion Criteria

- Age > 40 years.
- Anterior chamber angle open.
- First time presentation with glaucoma.
- Reliable automated perimetry.
- No previous surgical intervention for glaucoma.
- Not using any antiglaucoma medication in the past.
- Informed consent

Exclusion Criteria

- High myopia, spherical error >6D, cylindrical error >2.5D.
- History of refractive or vitreo-retinal surgeries, and neurological diseases.
- Cloudy ocular media that interferes with fundus examination
- Angle closure glaucoma.

Statistical Methods

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and pie diagrams. Chi-square test was employed to determine the association of BCVA with cup disc ratio, intra ocular pressure and visual field analysis. A P-value value of less than 0.05 was considered statistically significant.

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Results:

Total number of patients who attended OPD with age more than 40 years for screening were 19600, in which 196 patients were first time glaucomatous. The prevalence of glaucoma in our study is 1%.

Table 1: Age distribution of study subjects

Age (years)	Frequency	Percentage
41-50	57	29.1
51-60	69	35.2
61-70	55	28.1
> 70	15	7.7
Total	196	100
Mean±SD (Range)=58.1±9.53 (41-80)		

The mean age in our study was 58.1 and the majority of the patients were in the age group of 51 -60 years. 60.2% of patients were males in the study and 39.8% were females.

Table 2: Occupation of study subjects

Occupation	Frequency	Percentage
Skilled	52	26.5
Unskilled	144	73.5
Total	196	100

73.5% of our study subjects were unskilled occupation wise majority of them being farmers and labourers. Among all the subjects, 63.3% of the study cases presented with blurring of vision.13.3% presented with headache, 9.7% had watering, 7.1% had irritation, whereas 3.6% had burning sensation and 3.1% had itching respectively.

Table 3: Best corrected visual acuity (BCVA) of study subjects

BCVA		Frequency	Percentage
Right Eye	6/6-6/12	149	76.0
	6/18-6/24	13	6.6
	6/36-6/60	34	17.3
Left Eye	6/6-6/12	136	69.4
	6/18-6/24	20	10.2
	6/36-6/60	40	20.4

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Analysis of the visual acuity of the study eyes showed that in right eyes most patients (38.8%) had visual acuity of 6/6 to 6/12 at presentation and in left eyes most patients (40.3%) had visual acuity of 6/18 to 6/24 at presentation. Visual acuity of left eye showed that the visual acuity was 6/18 -6/24 in > 50% of cases at presentation. BCVA of 6/6 -6/12 was achieved in approximately in 70% of patients in both the eyes.

Table 4: Anterior segment of study subjects.

Anterior Segment		Frequency	Percentage
Right Eye	RAPD	41	20.9
	WNL	155	79.1
Left Eye	RAPD	116	59.2
	WNL	80	40.8

20.9% of the studied cases showed RAPD in the right eye and anterior segment of the studied cases showed > 50% of RAPD in left eye.

Table 5: Cup disc ratio observed in study subjects

CD Ratio	Right Eye		Left Eye	
	No.	%age	No.	%age
Normal	24	12.2	34	17.3
Cupping (0.5-0.8)	139	70.9	84	42.9
Glucamatous optic atrophy	33	16.8	78	39.8
Total	196	100	196	100

In right eye 70% of the subjects had CDR between 0.5-0.8 whereas 16.8% had glaucomatous optic atrophy. In the left eye 42.9% of the subjects had CDR between 0.5-0.8 whereas 39.8% had glaucomatous optic atrophy.

Table 6: Intra ocular pressure observed in the studied subjects

IOP (mmHg)	Right Eye		Left Eye	
	No.	%age	No.	%age
≤ 20	108	55.1	67	34.2
21-30	48	24.5	58	29.6
31-40	27	13.8	27	13.8
> 40	13	6.6	44	22.4
Mean±SD	22.9±8.64		27.8±10.35	

The Mean IOP in right eye was 22.9mmHg and Mean IOP in left eye was 27.8mmHg. 13.8%

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of the patients had IOP greater than 30mmHg in the right eye at presentation.

Table 7: Showing visual field analysis of study subjects

Visual Field Analysis		Frequency	Percentage
Right Eye	WNL	97	49.5
	Mild	39	19.9
	Moderate	40	20.4
	Severe	20	10.2
Left Eye	WNL	74	37.8
	Mild	0	0.0
	Moderate	13	6.6
	Severe	109	55.6

49.5% of the study subjects had visual fields within normal limits in the right eye, however 19.9% of the study subjects had mild visual fields changes in right eye. 20.4% had moderate visual fields changes in right eye and 6.6 in left eye. 10.2% had severe visual fields changes in right eye and 55.6% in left eye.

Table 8: Correlation of BCVA with cup disc ratio in study eyes

CDR	BCVA			Total
	6/6-6/12	6/18-6/24	6/36-6/60	
Normal	51	7	0	58
Cupping(0.5-0.8)	190	6	27	223
Glaucomatous optic atrophy	44	20	47	111
Total	285	33	74	392
Chi-square=93.82; df=4; P-value<0.001*				

The study eyes showed that with normal CDR 51 eyes had BCVA of 6/6-6/12 and 7 eyes with 6/18 to 6/24. The study eyes showed that with CDR (0.5-0.8) 190 eyes had BCVA of 6/6 to 6/12, 6 eyes had BCVA OF 6/18 to 6/24 and 27 had 6/36 to 6/60. In the eyes with glaucomatous optic atrophy 44 eyes had BCVA OF 6/6 to 6/12, 20 eyes with 6/18 to 6/24 and 47 eyes with 6/36 to 6/60. This showed that there is a statistically strong correlation between the two.

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Table 9: Correlation of BCVA with intra ocular (IOP) in study eyes.

IOP (mmHg)	BCVA			Total
	6/6-6/12	6/18-6/24	6/36-6/60	
≤ 20	168	7	0	175
21-30	72	20	14	106
31-40	7	0	47	54
> 40	38	6	13	57
Total	285	33	74	392
Chi-square=231.04; df=6; P-value<0.001*				

168 eyes had a BCVA OF 6/6 to 6/12 and 7 eyes with 6/18 to 6/24 when IOP was 20mmHg. 72 eyes had a BCVA OF 6/6 to 6/12, 20 eyes had 6/18 to 6/24 and 14 eyes had 6/36 to 6/60 when IOP was between 21-30mmHg. 7 eyes had BCVA OF 6/6 to 6/12 and 47 eyes had 6/36 to 6/60 when IOP was between 31-40mmHg. 38 eyes had BCVA OF 6/6 to 6/12, 6 eyes had 6/18 to 6/24 and 13 eyes had 6/36 to 6/60 when IOP was > 40mmHg.

Table 10: Correlation of BCVA with visual field analysis (VFA) in study eyes

VFA	BCVA			Total
	6/6-6/12	6/18-6/24	6/36-6/60	
WNL	164	7	0	171
Mild	26	6	7	39
Moderate	32	14	7	53
Severe	63	6	60	129
Total	285	33	74	392
Chi-square=138.07; df=6; P-value <0.001*				

With normal visual fields 164 eyes had BCVA of 6/6 to 6/12 and 7 eyes had 6/18 to 6/24. 26 eyes had BCVA of 6/6 to 6/12, 6 eyes had 6/18 to 6/24 and 7 eyes 6/36 to 6/60 with mild visual fields changes. 32 eyes had 6/6 to 6/12, 14 eyes had 6/18 to 6/24 and 7 eyes had 6/36 to 6/60 with moderate visual fields changes. 63 eyes had BCVA of 6/6 to 6/12, 6 eyes had 6/18 to 6/24 and 60 eyes had 6/36 to 6/60 with severe visual fields changes.

Table 11: Correlation of intra ocular pressure with cup disc ratio in study eyes

CDR	IOP (mmHg)				Total
	≤ 20	21-30	31-40	> 40	
Normal	52	6	0	0	58
Cupping (0.5-0.8)	123	54	14	32	223

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Glaucomatous optic atrophy	0	46	40	25	111
Total	175	106	54	57	392
Chi-square=166.87; df=6; P-value<0.001*					

52 eyes with normal CDR had IOP of < 20mmHg, 6 eyes with normal CDR had IOP of 21-30mmHg. 123 eyes with CDR (0.5-0.8) had IOP of < 20mmHg, 54 eyes with CDR (0.50. 8) had 21-30mmHg, 14 eyes with 31-40 mmHg and 32 eyes with >40mmHg. 46 eyes with glaucomatous optic atrophy had IOP of 21-30mmHg, 40 eyes with IOP OF 31-40 mmHg and 25 eyes had > 40 mmHg.

As is evident from the table cupping is seen even at low IOP whereas glaucomatous optic atrophy is also seen at relatively low IOP even though the correlation is found to be statistically significant.

Table 12: Correlation of intra ocular pressure with visual field analysis (VFA) in study eyes.

VFA	**IOP (mmHg)**				**Total**
	≤ 20	**21-30**	**31-40**	**> 40**	
WNL	163	6	1	1	171
Mild	12	14	0	13	39
Moderate	0	47	6	0	53
Severe	0	39	47	43	129
Total	175	106	54	57	392
Chi-square=439.10; df=9; P-value<0.001*					

With normal visual fields 163 eyes had IOP <20mmHg, 6 eyes had IOP between 21-30mmHg, 1 eye with 31-40mmHg and 1 with >40mmHg. With mild visual fields changes 12 eyes had IOP <20mmHg, 14 eyes with 21-30mmHg, and 13 eyes with >40mmHg. With moderate visual fields changes 47 eyes had IOP of 21- 30mmHg and 6 eyes with 31-40mmHg. With severe visual fields changes 39 eyes had IOP of 21-30mmHg, 47 had 31-40 mmHg and 43 had >40mmHg.

Discussion:

Data from population-based surveys (PBS) indicate that glaucoma is the second leading cause of blindness, accounting for 8% of blindness among the 39 million people who are blind world-wide.[12] In Africa, glaucoma accounts for 15% of blindness and it is the region with the highest prevalence of blindness relative to other regions world-wide[13]. In 2006[14], the number of individuals estimated to be bilaterally blind from glaucoma was projected to increase from 8.4 million in 2010 to 11.1 million by 2020.[15] However, the numbers who are blind is just the tip of the iceberg as there are many more individuals with

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glaucoma who are at risk of blindness. The Africa region also has the highest incidence and prevalence of glaucoma[14]. The prevalence of glaucoma is similar among the Caucasian populations of Europe[15], USA[16,17] and Australia[18,19] being less than the prevalence in Latinos in the USA[20] and people of Asian origin.[21-28] The black populations of the Caribbean,[29,30] Africa[31,32,33,34] and USA5 have the highest prevalence of open-angle glaucoma (OAG).[35,36,37] Furthermore, there appear to be differences in the prevalence of glaucoma in different black populations in the Caribbean islands and within Africa,[38] which may be attributed to genetic diversity as well as environmental and socio-economic factors.[39,40]

In our study, 196 patients were studied in which 69 (35.2%) belonged to 51-60 years followed by 57 (29.1%) who were 41-50 years of age. There were only 15 (7.7%) patients aged >70 years of age. The mean of patients was 58.1±9.53 in our study. Out of a total of 196 patients, 118 (60.2%) were males while as 78 (39.8%) were females. There were 170 (86.7%) patients belonging to rural areas while as only 26 (13.3%) were from urban areas. As far as occupation is concerned, majority of our patients were unskilled i.e. 144 (73.5%) while as there were 52 (26.5%) skilled patients in our study. When comorbidity of our patients was checked, majority i.e. 59 (30.1%) had hypertension, 46 (23.5%) had diabetes, 19 (9.7%) were hypothyroid. 13 (6.6%) patients had gout, 12 (6.1%) patients had hypertension and diabetes, 7 (3.6%) had diabetes and gout. There were 33 (16.8%) patients who had no comorbidity. Thus it is clear that comorbid condition as diabetes, hypertension form a frequent accompaniment of the POAG. On presentation, 124 (63.3%) of the study patients had blurring of vision, followed by headache in 26 (13.3%), watering was seen in 19 (9.7%), 14 (7.1%) had irritation, 7 (3.6%) had blurring sensation, whereas 6 (3.1%) had itching. Visual acuity of the total studied cases showed right eye visual acuity 6/6 -6/12 in >50% of cases at presentation. Visual acuity of left eye showed that the visual acuity was 6/18-6/24 in > 50% of cases at presentation.

Tidake P et al (2017)[40] conducted a study on 100 eyes of fifty patients. In their study mean age of the fifty patients was 54.22 ± 13.28 years, out of which, 54% were females and 46% were males. At presentation, 34% had blurring of vision and 16% had eye pain or photophobia.

According to Vijaya et al. in 2014[41], baseline age was a risk factor. In reference to the 40–49 years' age group, the incidence increased from 2.3 (95% CI, 1.4–3.7) for 50–59 years' age group to 3.5 (95% CI, 2.2–5.7) for 60–69 years' age group ($P < 0.001$). In the Beaver Dam Eye Study by Klein et al.,[42] the prevalence increased with age from 0.9% in people aged 43–54 years to 4.7% in people aged 75 years or older. According to Sun et al.[43] in 2012, on multivariate analysis, age and IOP were regarded as significant independent risk factors.

A study was conducted by Zhao Y (2015)[45] in which a total of 1458 patients (984 right eyes and 981 left eyes) were enrolled. Their mean age was 56.73 ± 18.13 years (range: 1–93 years). Seven hundred forty- two (50.89%) patients were males while 716 (49.11%) were females, giving male to female ratio of 1.04:1. The mean ages of male and female were 53.21 ± 18.91 years and 60.37 ± 16.51 years, respectively ($P < 0.001$). Of them, 850 (58.30%) patients came from rural areas and the remaining 608 (41.70%) lived in cities.

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In this study, they observed that almost half of patients with POAG had hypertension. Other studies have shown differing results, Díaz et al. (2010)[44] in a study conducted in Cuba, found 62% of occurrence of hypertension; Zhao et al. (2015),[45] found 9.17% in patients in China. In a study conducted in the city of Santa Maria, in the south part of Brazil, Rossi AG et al. (2012)[46] found 48.2%, a very close percentile to the findings of this investigation.

Among the participants, 17.9% declared themselves diabetics. However, it is referenced in the literature that approximately 50% of people with diabetes are unaware of the fact that they are carriers of this disease.[47] A systematic review and meta-analysis of case-control and cohort studies conducted by Zhou et al., (2014)[48] emphasized a significant association between diabetes and increased risk of developing primary open-angle glaucoma. In my study out of 196 patients who were diagnosed as POAG percentage of eye presented with mild, moderate or severe glaucomatous damage was 17.6%, 24% and 58.45 respectively. From the cross tables it is evident that CD ratio and visual fields changes can be affected even with low levels of IOP.

There are various risk factors of glaucoma such as old age >40 years, race (African, American), family history, elevated IOP, myopia, increased CD ratio, disc haemorrages, thin central corneal thickness, low ocular perfusion pressure, blood pressure, type 2 DM, migraine, OCPs, smoking, obesity, alcohol etc[49,50,51,52] Intraocular pressure is one of the most important risk factor for development of glaucoma, relying only on IOP for glaucoma work up is not the right choice, as the cup-disc changes and visual fields changes can be seen early even in those having normal IOP .

Conclusion:

In the OPD based study , majority of our study patients presented to OPD with the complain of blurring of vision. In our study we found most of the patients presented late in the disease stage 39.8% had glaucomatous optic atrophy in left eye and 16.8% in right eye at the first visit to our OPD indicating lack of awareness about to diseases especially in rural areas. The nature of primary open angle glaucoma is that it evades detection until final stages of the disease is reached. It also unrelenting and takes advantages of any delays or insufficiencies in the treatment. A health service response is required to prevent blindness from glaucoma. Primary and secondary level of prevention should be the priorities in glaucoma management due to the irreversible nature of vision loss and lack of sight restoring treatment modalities. In primary and secondary level of prevention, programmes should be initiated to make people aware of the disease and its nature.

Early detection of the cases offers the best potential in preventing blindness from glaucoma. Screening in high risk populations like older adults, socioeconomically disadvantaged for undiagnosed glaucoma should complement periodic ocular examination by an ophthalmologist. Like in our study we screened all patients above 40 years attending OPD for glaucoma out of those 196 patients presented with first time glaucoma.

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