

---

*Original Article*PREVALENCE OF GLAUCOMA AMONG OPHTHALMOLOGY CLINIC  
PATIENTS AT SOHAG UNIVERSITY HOSPITALAbd El-Basit, A.<sup>1</sup>, Ismail, A.<sup>2(\*)</sup>, Farouk, M.<sup>2</sup> & El Saman, I.<sup>2</sup><sup>1</sup>Ophthalmology dept., Sohag Teaching Hospital, Sohag, Egypt <sup>2</sup>Ophthalmology dept., Faculty of  
Medicine, Sohag, Univ., Sohag, Egypt.\*E-mail: [eslamsaad@med.sohag.edu.eg](mailto:eslamsaad@med.sohag.edu.eg)

Received: 12/8/2023

Accepted: 21/11/2023

Doi: 10.21608/ejco.2024.334202

**Abstract**

**Purpose:** To assess the prevalence of glaucoma and its types by clinical ophthalmic evaluation of all patients attending the ophthalmology clinic at Sohag University Hospital. **Design:** A cross sectional observational study. **Patients and methods:** One-hundred patients underwent full history taking regarding duration of glaucoma diagnosis, treatment regimen and systemic diseases history and full ophthalmic examination including uncorrected and best-corrected visual acuity (UCVA, BCVA), Intraocular pressure (IOP) using Goldmann applanation tonometry (GAT), Automated refraction (AR), Pupil reaction assessment, Angel grading using Van Herick's technique and a standardized ophthalmic examination using slit lamp biomicroscopy for full anterior segment examination, fundus and optic disc examination with 78D aspheric condensing lens. **Results:** Among 7500 participants, there were 100 patients diagnosed with glaucoma. 51% of cases were females and 49% males and the mean age was 54.3 years (SD  $\pm$ 15.3 years). The crude prevalence of glaucoma was 1.3%. Primary open angle glaucoma was found in 0.76%, primary angle-closure glaucoma in 0.33 %, secondary glaucoma was 0.10% of cases, congenital glaucoma 0.06%, normotensive glaucoma 0.04% and ocular hypertension was 0.02%. **Conclusion:** Our study found a higher prevalence of glaucoma mainly primary open-angle glaucoma. Age and increased intraocular pressure were significant risk factors of glaucoma. Therefore, increasing public awareness about these risk factors for prevention and early detection of cases is essential and calling for additional observational studies for better understanding of factors.

**Keywords:** Refractive errors, Anterior chamber depth, Keratometry, White to white**1. Introduction**

Glaucoma is a common visual disorder whose frequency among people of the world has not been analysed comprehensively. Open angle glaucoma (OAG) is a slowly progressive atrophy of the optic nerve, characterised by loss of peripheral visual function and an excavated appearance of the optic disc by ophthalmoscopy [1]. The

glaucomas are a group of optic neuropathies characterized by progressive degeneration of retinal ganglion cells. These are central nervous system neurons that have their cell bodies in the inner retina and axons in the optic nerve. Degeneration of these nerves results in cupping, a characteristic appearance of the optic disc and visual

loss [2]. The biological basis of glaucoma is poorly understood and the factors contributing to its progression have not been fully characterized [3]. Glaucoma suspects were defined as those having glaucomatous optic neuropathy, or suspicious-appearing optic discs based on stereophotograph review by two experienced graders, or ocular hypertension (intraocular pressure (IOP) >21 mmHg at baseline without evidence of repeatable glaucomatous visual field defect (VFD) at baseline. It is found that the rate of RNFL loss over time may be a useful tool to help identify patients who are at risk for developing VF loss [4]. Glaucoma affects more than 70 million people worldwide with approximately 10% being bilaterally blind [5], making it the leading cause of irreversible blindness in the world. Glaucoma can remain asymptomatic until it is severe, resulting in a high likelihood that the number of affected individuals is much higher than the number known to have it [6,7]. Population-level surveys suggest that only 10% to 50% of

## 2. Patients and Methods

### 2.1. Methods

This is a cross sectional observational study. All patients attending Ophthalmology outpatient clinic at Sohag University Hospital

#### 2.1.1. Methodology

All patients who fulfilled the inclusion criteria underwent: **1)** History taking regarding if previously diagnosed or not, duration and time of diagnosis, treated or not and type of treatment. **2)** Full ophthalmic examination including: uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA). \*) Intraocular pressure (IOP) was measured by Goldman applanation (GAT) tonometry using standard methods and recorded to the nearest 1 mmHg. Tonometers were checked for calibration daily according to the manufacturer's recommendation. Eyes with

people with glaucoma are aware they have it [6-10]. Glaucomas can be classified into 2 broad categories: open-angle glaucoma and angle-closure glaucoma. In the United States, more than 80% of cases are open-angle glaucoma; however, angle-closure glaucoma is responsible for a disproportionate number of patients with severe vision loss [11,12]. Both open-angle and angle-closure glaucoma can be primary diseases. Secondary glaucoma can result from trauma, certain medications such as corticosteroids, inflammation, tumor, or conditions such as pigment dispersion or pseudoexfoliation [13]. **Risk factors:** Age, race, type and degree of refractive error, systemic hyper- and hypotension, vasospasm, migraine, pigmentary dispersion syndrome, pseudoexfoliation syndrome, obstructive sleep apnea syndrome, diabetes, medication interactions and side effects and intracranial pressure elevations and fluctuations, smoking, and symptoms in addition to genetics and family history of the disease [14].

between September 2019 and September 2020 were included.

significant corneal surface pathology, phthisis or participants unable to fixate were excluded. Automated refraction (AR), assessment of pupil reaction for relative afferent pupillary defect (RAPD) and angle grading using Van Herick's technique were done to differentiate between open angle and narrow anterior chamber angles by measuring limbal chamber depth. Participants underwent a standardized ophthalmic examination using slit-lamp biomicroscopy for full anterior segment examination and, fundus and optic disc examination with 78D aspheric condensing lens for dilated

stereoscopic disc assessment in details.  
 \*) Glaucoma was defined according to International Society for Geographical and Epidemiologic Ophthalmology (ISGEO) criteria and categorised by clinical subty-

**2.2. Statistical analysis**

Data was analyzed using SPSS version 20 (Statistical Software package version 26). Descriptive analysis was performed, Kolmogorov-Smirnov was used for test of normality. Quantitative data was represented as mean, standard deviation, median and range. Qualitative Data are reported as frequencies and percentages. Chi-square

test was used for categorical data. One way ANOVA test was used for parametric continuous data. Kruskal-Wallis test was used for non-parametric continuous data. Graphs were produced by using Excel or SPSS version20. P value was considered significant if it was less than 0.05.

**3. Results**

**3.1. Glaucoma prevalence**

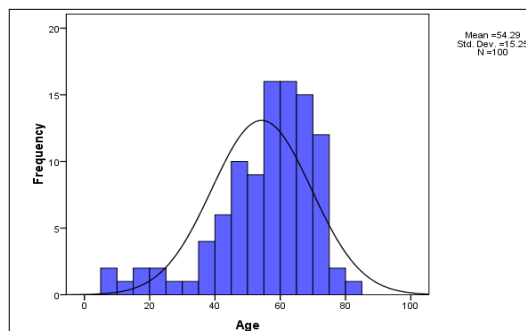
Among 7500 patients attended the ophthalmology clinic at Sohag University Hospital within 125 work days, there were 100 patients diagnosed with glaucoma. The crude prevalence of glaucoma was 1.3%, primary open angle glaucoma was

found in 0.76% and primary angle closure glaucoma in 0.33 %. Secondary glaucoma accounted for 0.10% of the cases, congenital glaucoma 0.06%, normotensive glaucoma 0.4% and ocular hypertension was 0.02%.

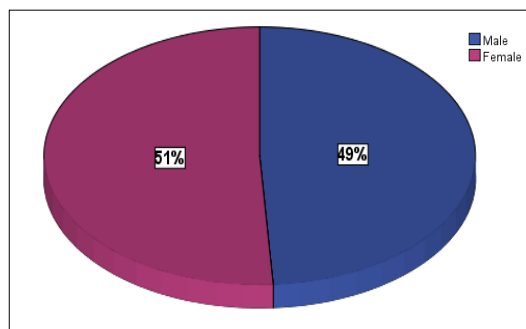
**3.2. Demographic data:**

This study was carried on 100 patients completed the full ophthalmic examination (51% female and 49% male) and the mean

age was 54.3 years (Standard deviation (SD) ±15.3 years) as shown in figs. (1,2).



**Figure 1:** Age distribution



**Figure 2:** Gender distribution

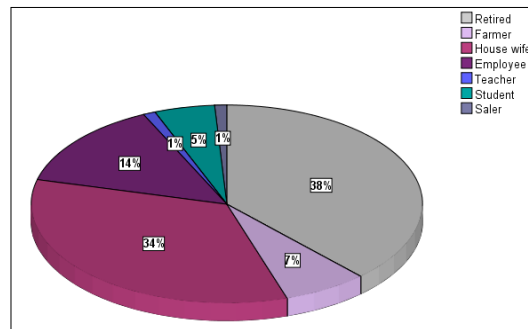
### 3.3. Personal history of studied patients

Fifty-five percent of participants were living in north areas of Sohag government and 45% were living in south areas. Twenty-five percent of participants were smokers and only one patient was ex-smoker. Most of patients were retired (38%) and hou-

sewives (34%). However, the others were employee (14%), farmer (7%), student (5%), teacher (1%) and sales (1%). These data are summarized in tab. (1) & figs. (3, 4 & 5).

**Table 1:** Summary statistics of personal history of studied patients (no=100 patients)

Variable	Summary statistic
<b>Residence</b>	
▪ Sohag	34 (34%)
▪ Akhmim	7 (7%)
▪ El Monshah	11 (11%)
▪ El Maragha	6 (6%)
▪ Tahta	7 (7%)
▪ Tema	4 (4%)
▪ Sakolta	4 (4%)
▪ Girga	9 (9%)
▪ Dar elsalam	7 (7%)
▪ Qena	2 (2%)
▪ El ossirat	2 (2%)
▪ Guhainaa	4 (4%)
▪ El Wadi El gedid	1 (1%)
▪ Nag Hammady	1 (1%)
▪ Luxor	1 (1%)
<b>Residence</b>	
▪ North	55 (55%)
▪ South	45 (45%)
<b>Special Habits</b>	
▪ No	74 (74%)
▪ Smoker	25 (25%)
▪ X smoker	1 (1%)



**Figure 3:** Occupation distribution of studied patients

### 3.4. Glaucoma history of studied patients

Sixty percent of participants self-reported a history of glaucoma and the remaining 40% didn't report a history of glaucoma. Forty-four of participants were on medical treatment and 56% were not on medical

treatment. 19% gave history of glaucoma operation and 81% don't. These data of co-existing medical problems were summarized in tab. (2).

**Table 2:** Summary statistics of glaucoma history of studied patients (no=100 patients)

Variable	Summary statistic
<b>Diagnosed</b>	
▪ Yes	60 (60%)
▪ Not	40 (40%)
<b>Medical treatment</b>	
▪ No medical treatment	44 (44%)
▪ On medical treatment	56 (56%)
<b>Operated</b>	
▪ Not operated	81 (81%)
▪ Operated	19 (19%)
<b>Systemic diseases</b>	
▪ No	59 (59%)
▪ Hypertension	20 (20%)
▪ D.M	14 (14%)
▪ Both hypertension and D.M	4 (4%)
▪ Thyrotoxicosis	1 (1%)
▪ Autoimmune diseases	1 (1%)
▪ Cardiac diseases	1 (1%)

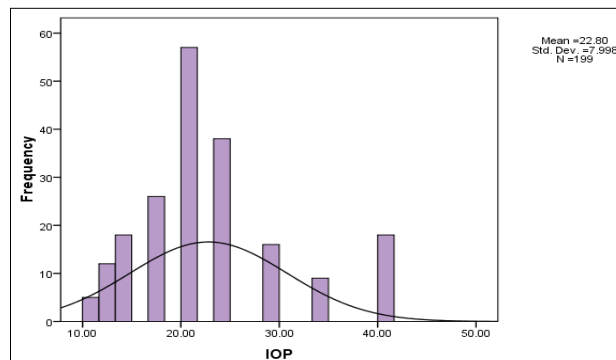
### 3.5. Summary statistics of examination of studied patients (no=200 eyes)

According to WHO criteria and within total 200 examined eyes, there were 8 right eyes and 7 left eyes with glaucoma totally blind, 20 right eyes and 18 left eyes with glaucoma that were blind, 12 right eyes and 13 left eyes were severe visually impaired, 30 right eyes and 34

left eyes were mild to moderate visually impaired and the remaining 30 right eyes and 28 left eyes didn't have visual impairment. Other glaucoma related findings of the 200 eyes with glaucoma were illustrated as shown in tab. (3) and fig. (4).

**Table 3:** Summary statistics of examination of studied patients (no=100 patients)

Variable	Summary statistic	Variable	Summary statistic
<b>A. Uncorrected VA</b>		<b>D. IOP</b>	
No projection of light	15 (7.5%)	Mean ± SD	22.8±8
Hand motion (bad projection)	11 (5.5%)	Median (range)	20.6 (10.2-41.5)
Hand motion (good projection)	10 (5%)	<b>E. Anterior Segment</b>	
Counting finger 25	3 (1.5%)	Normal	163 (81.5%)
Counting finger 50	1 (0.5%)	Abnormal (diseased)	37 (18.5%)
1/60	17 (8.5%)	<b>F. Angel Grading</b>	
2/60	14 (7%)	Degree 0	1 (0.5%)
3/60	24 (12%)	Degree I]	41 (20.5%)
4/60	1 (0.5%)	Degree 2	13 (6.5%)
5/60	4 (2%)	Degree 3	42 (21%)
6/60	33 (16.5%)	Degree 4	98 (49%)
6/36	23 (11.5%)	Can't be assessed	5 (2.5%)
6/24	21 (10.5%)	<b>G. Pupil</b>	
6/18	10 (5%)	Rounded regular reactive pupil	81 (40.5%)
6/12	8 (4%)	Sluggish reaction (RAPD)	66 (33%)
6/9	4 (2%)	Irregular dilated irreactive pupil	48 (24%)
6/6	1(0.3%)	Can't be assessed	5 (2.5%)
<b>B. Best corrected VA</b>		<b>H. Optic Disc Color</b>	
No projection of light	15 (7.5%)	Normal	77 (38.5%)
Hand motion (bad projection)	11 (5.5%)	Pale (optic atrophy)	77 (38.5%)
Hand motion (good projection)	9 (4.5%)	Hyperemic	1 (0.5%)
Counting finger 10	3 (1.5%)	No cup (silicon F.)	1 (0.5%)
Counting finger 25	1 (0.5%)	Couldn't be assessed	44 (22%)
Counting finger 50	1 (0.5%)	<b>I. Neuroretinal Rim</b>	
1/60	6 (3%)	Normal	78 (39%)
2/60	7 (3.5%)	Thin	78 (39%)
3/60	20 (10%)	Couldn't be assessed	44 (22%)
5/60	5 (2.5%)	<b>J. Notching</b>	
6/60	20 (10%)	Absent	118 (59%)
6/36	26 (13%)	Present	38 (19%)
6/24	18 (9%)	Couldn't be assessed	44 (22%)
6/18	23 (11.5%)	<b>K. Flame Shaped Hemorrhage</b>	
6/12	24 (12%)	Absent	147 (73.5%)
6/9	9 (4.5%)	Present	9 (4.5%)
6/6	2 (1%)	Couldn't be assessed	44 (22%)
<b>C. Refraction</b>		<b>L. Peripapillary Atrophy</b>	
Ref.1		Absent	109 (54.5%)
Mean ± SD	-0.97±4.04	Present	47 (23.5%)
Median (range)	0 (-14-11)	Couldn't be assessed	44 (22%)
Ref.2		<b>M. Cup/disc ratio</b>	
- Couldn't be assessed	44 (22%)	Mean ±SD	0.62 ±0.19
- Myope	96 (48%)	Median (range)	0.65 (0.3-0.9)
-Hypermetrope	60 (30%)		



**Figure 4:** IOP measurements of the studied patients

### 3.6. Glaucoma sub-types of studied patients

Of the 100 participants who clinically diagnosed as glaucoma patients, there were fifty-seven percent were diagnosed

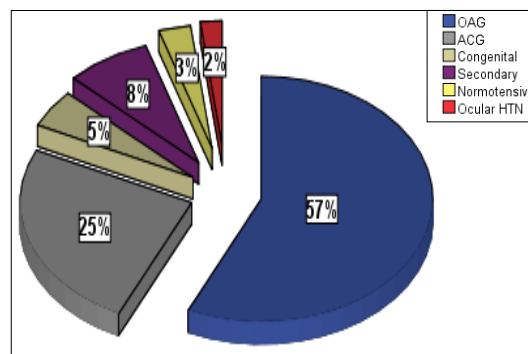
with primary open angle glaucoma POAG, twenty-five percent of participants were diagnosed with primary angel closure gla-

ucoma PACG, five percent of participants were diagnosed with primary congenital glaucoma PCC, eight percent of participants were diagnosed with secondary glaucoma, three percent of participants were

diagnosed with normotensive glaucoma and two percent of participants were with ocular hypertension as shown in tab. (4) and fig..

**Table 4:** Summary statistics of glaucoma sub-types of studied patients (no=200 eyes)

Variable	Summary statistic
<b>Type of glaucoma</b>	
▪ OAG	114 (57%)
▪ ACG	50 (25%)
▪ Congenital	10 (5%)
▪ Secondary	16 (8%)
▪ Normotensive	6 (3%)
▪ Ocular HTN	4 (2%)



**Figure 5:** Type of glaucoma in studied patients

#### 4. Discussion

Glaucoma is the second leading cause of blindness after cataracts and the leading cause of irreversible blindness in the world. In 2013, it has been estimated 89 that 64.3 million people were affected by glaucoma globally, increasing to 76.0 million in 2020 and 111.8 million in 2040. The global estimated bilaterally blindness from glaucoma was projected to increase from 8.4 million in 2010 to 11.1 million by 2020 [15]. The World Health Organization (WHO) recommended its member countries combat the public health problem of glaucoma through a program approach. Additionally, World Glaucoma Week (WGW) is conducted every year for 1 week during March to provide more emphasis on awareness of glaucoma. To plan the strategies, it is of the highest significance that the prevalence, distribution, various subtypes in a region, and risk factors of glaucoma are identified [16]. In the current

study we found that from a total of 7500 patients attended to ophthalmology clinic at Sohag University Hospital within 125 work days, there were 100 patients diagnosed with glaucoma. The crude prevalence of glaucoma was 1.3%. Primary open angle glaucoma was found in 0.76% and primary angle closure glaucoma in 0.33%. Secondary glaucoma accounted for 0.10% of the cases. Congenital glaucoma was 0.06%, normotensive glaucoma was 0.04% and ocular hypertension was 0.02%. The prevalence of glaucoma in our study is correlated with other studies conducted by Hohn, R., et al. in Gutenberg Health Study was 1.44% [17], McCann, P., et al. in the Northern Ireland (NICOLA) study was 2.83% [18], Al-Mansouri, F. A., et al. in Qatar 1.73% [19], Hashemi, H., et al. In Shahroud, Iran was 1.92% [20], Keel, S., et al. in non-Indigenous Australians was 1.5% [21], Gupta, P., et al. in the US

civilian, was 2.1% [22] and Thapa, S. S., et al. in Nepal was 1.9% [23]. The prevalence of glaucoma in our study is lower compared to other studies conducted by Chan, M. P. Y., et al. Glaucoma and intraocular pressure in EPIC-90 Norfolk Eye Study (4%) [24], Pakravan, M., et al. central Iran: the Yazd eye study was 4.4% [25], Kyari, F., et al. in Nigeria was 5.02 % [26] and Baskaran, M., et al. in an Urban Chinese Population: 4.0% [27]. The lower prevalence of glaucoma in our study might be due to sample size, nature of participants, and age of participants which tend to overestimate the magnitude. Regional/racial variations in prevalence have been attributed to genetic and possible environmental differences. In the present study we found that there were 51% female and 49% male. The mean age was 54.3 years (Standard deviation (SD),  $\pm 15.3$  years). Prevalence of glaucoma regarding age groups revealed that <30 years: 8% (0.1% of total participants), 30-39 years: 5 % (0.06%), 40-49 years: 16% (16%), 50-59 years: 24% (0.32%), 60-69 years: 32% (0.42%), >70 years: 15% (0.2%). Wubet et al. showed that 150(59%) of them were males. The mean ( $\pm$ SD) age of the participants was found to be 63 ( $\pm 12.54$ ) years [28]. Lee et al. in Hong Kong, China, the presenting age of the 100 cases of phacomorphic glaucoma was  $73.8 \pm 10.6$  years, which is a little higher than the patients in our research. Female gender was a risk factor for PACG (OR: 3.226 [95% confidence interval (CI): 2.602–4.001]) [29]. In Al-Mansouri et al. study, the age-adjusted prevalence of glaucoma was higher in males compared with females [19]. However, it was not a statistically significant risk factor for glaucoma among participants. Similar observations were made in a meta-analysis covering studies on POAG by Rudnicka et al. [30]. In contrast, Cedrone et al. found higher rates of glaucoma in females [31]. The proportion percentage of PACG was smaller in our study than the proportion of 91 POAG in

Qatar. The former is known to be more common in females. This could be the reason for higher risk of glaucoma in male compared to female. Bentum et al. showed that the adult male population had a slightly higher number of patients (241) presenting with the disease than their female counterpart (206). However, the prevalence of glaucoma in the adult female population (9.52%) was higher than their male counterparts (8.77%) even though the difference in prevalence was not statistically relevant ( $p=0.0918$ ) [32]. In de Voogd et al. study, there was a trend towards increased risk for OAG in males [33]; however, this difference did not reach statistical significance, possibly due to small sample sizes. Also, in a study by Iqbal et al. to determine the age and sex distribution as well as types of glaucoma in hospitalized children and adults at Khyber Institute of Ophthalmic Medical Sciences, Hayatabad Medical Complex, Peshawar, glaucoma was more common in males in both groups [34]. Sex appears to be a controversial issue associated with an increased risk of glaucoma. The adult male population has a higher chance of being affected with the disease but generally the female population has a higher prevalence of glaucoma since women have increased longevity compared to men. In our study we found that 100 patients are 55% percent of participants living in north areas of Sohag government and others living in south areas. Twenty-five percent of participants are smokers and only one patient is ex-smoker. Most of patients are retired (38%) and housewives (34%). However, the others are employee (14%), farmer (7%), student (5%), teacher (1%) and saler (1%). Wubet et al. reported that concerning occupational status, 39 (15.6%) of farmers had glaucoma and 91 (30.6%) had no glaucoma [28]. In the current study we found that 60% of participants were self-reported history of glaucoma and 44% weren't self-reported history of glaucoma. 44% of participants are on

medical treatment and 56% are not on medical treatment. 19% gave history of glaucoma operation and 81% don't. 59% of participants don't have any systemic disease, 20% are systemic hypertensive, 14% are diabetic, 4% are diabetic hypertensive, 1% has thyrotoxicosis, 1% has autoimmune disease and 1% is cardiac disease. Wubet et al. stated that among glaucoma cases, 35(13.5%) had some form of chronic illness. Accordingly, 16 (6.3%), 8(3.2%), and 8(3.2%) of patients had hypertension, diabetes mellitus, and cardiac illness respectively. Sixteen (6.2%) patients with glaucoma had also a positive family history of glaucoma. Five patients were having a refractive error with astigmatism. Twenty-six (10.3%) patients with glaucoma were smokers [28]. Al-Mansouri et al. showed that more than half of the patients had sought treatment for glaucoma. Three-fourth of those treated were using local eye drops at the time of the survey and the other 6% underwent previous surgery. Coverage of glaucoma treatment rather than the rate of glaucoma surgery could be a better indicator to monitor the glaucoma control program [19]. In the present study we found that according to WHO criteria and within total 200 examined eyes, there are 8 right eyes and 7 left eyes with glaucoma totally blind, 20 right eyes and 18 left eyes with glaucoma that are blind, 12 right eyes and 13 left eyes are severe visually impaired, 30 right eyes and 34 left eyes are mild to moderate visually impaired and the remaining 30 right eyes and 28 left eyes don't have visual impairment according to WHO criteria [35]. Other glaucoma related findings of the 200 eyes with glaucoma, ninety-six (48%) eyes are myopes, however; sixty (30%) eyes are hypermetropes and others (22%) can't be assessed. With mean refraction of totally examined eyes was  $-0.97 \pm 4.04$ . The mean values and standard deviations of IOP of examined eyes are  $22.8 \pm 8$  mm Hg. The anterior Segment examination shows 163 (81.5%) eyes are

normal however; 37 (18.5%) eyes show different abnormalities. Anterior chamber angle examination using van-Heerick grading technique for examined eyes; one (0.5%) eye is grade 0, forty-one (20.5%) eyes are grade 1, thirteen (6.5%) eyes are grade 2, forty-two (21%) eyes are grade 3, ninety-eight (49%) eyes are grade 4 and five (2.5%) eyes can't be assessed. The pupil reaction of examined eyes is reactive to light in eighty-one (40.5%) eyes, sluggish in sixty-six (33%) eyes, dilated non-reactive in forty-eight (24%) eyes and five (2.5%) eyes can't be assessed. The optic disc examination shows seventy-seven (38.5%) eyes are normal, pale (optic atrophy) in also seventy-seven (38.5%) eyes, however hyperemic in only one (0.5%) eye and no cup (silicon F.) in one eye. Forty-four (22%) eyes can't be assessed. Neuro-retinal rim examination is thin in seventy-eight (39%) eyes, normal in seventy-eight (39%) eyes, however can't be assessed in forty-four (22%) eyes. Notching examination is observed absent in 118 (59%) eyes and present in 38 (19%) eyes; however, can't be assessed in forty-four (22%) eyes. Flame Shaped hemorrhage is observed absent in 147 (73.5%) eyes and present in nine (4.5%) eyes; however, can't be assessed in forty-four (22%) eyes. Peripapillary atrophy is observed absent in 109 (54.5%) eyes and present in forty-seven (23.5%) eyes; however, it can't be assessed in forty-four (22%) eyes. Al-Mansouri et al. [19] reported that glaucoma in Qatar was significantly associated with myopia. Scientists have shown a strong association of moderate to severe myopia to POAG. Axial myopia has also been associated with glaucoma. Unfortunately, we did not study the relationship between the magnitude of myopia and glaucoma. Our findings regarding glaucoma sub-types of studied patients revealed that of the 100 participants who attended clinical examination are fifty-seven percent of participants are diagnosed with POAG, twenty-five percent



of participants are diagnosed with PACG, five percent of participants are diagnosed with PCC, eight percent of participants are diagnosed with secondary glaucoma, three percent of 94 participants are diagnosed with normotensive glaucoma and two percent of participants with ocular hypertension. In agreement with our results, Wubet et al. showed that among the overall prevalence of glaucoma identified in the study, the most common type was primary open angle glaucoma followed by closed-angle glaucoma which was 32(48%), and 21(32%), respectively while 13 (19.7%) of them had secondary glaucoma [28]. Khandelwal et al. illustrated that the distribution of glaucoma by subtype in the current study indicated that the majority of cases have primary open angle glau-

ma (POAG) [36]. In study of Singaporean Chinese conducted by Baskaran et al. POAG comprised 47% of glaucoma cases [27]. Globally, POAG is projected to comprise three-fourths of all glaucoma cases by 2020. A study of West African adults conducted by Budenz et al. reported that POAG comprised of 95% of all glaucoma cases [10]. The proportion of POAG found in the current study is lower than West African adults but much higher than the Far East Asian population. Non-compliance to the medical treatment among Saudi glaucoma patients was 31%. This was lower than that noted in Oman; a neighboring gulf country, but was within range of 5–80% as noted in a review by Olthoff et al. [37]

## 5. Study limitation factors

Corona virus pandemic led to shortening the duration of the study to 6 months due to closure of outpatient clinic since April 2020.

## 6. Conclusion

*In this study we found a higher prevalence of glaucoma, which is primarily a disease of the elderly. Primary open-angle glaucoma has the highest prevalence among other subtypes of glaucoma. Age and increased intraocular pressure were noticed as important risks for glaucoma in this study. Therefore, increasing patients' awareness about those risk factors for the prevention and early diagnosis of cases is critical. Additionally, this study calls for additional observational studies for a better understanding of factors at play*

## References

1. Quigley, H. Number of people with glaucoma worldwide. *British Journal of Ophthalmology*, 1996; 80 (5): 389-393.
2. Weinreb, R. & Khaw, P. Primary open-angle glaucoma. *Lancet*, 2004; 363 (9422): 1711-1720.
3. Nickells, R., Howell, G., Soto. I., et al. Under pressure: Cellular and molecular responses during glaucoma, a common neurodegeneration with axonopathy. *Annu Rev Neurosci*, 2012; 35: 153-179.
4. Miki, A., Medeiros, F., Weinreb, R., et al., Rates of retinal nerve Fiber layer thinning in glaucoma suspect eyes. *Ophthalmology*. 2014; 121 (7): 1350-1358.
5. Quigley, H. & Broman, A. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol*. 2006; 90 (3): 262-267.
6. Leite, M., Sakata, L. & Medeiros, F. Managing glaucoma in developing countries. *Arq Bras Oftalmol*. 2011; 74 (2): 83-84.
7. Rotchford, A., Kirwan, J., Muller, M., et al., Temba glaucoma study: A population-based cross-sectional survey in urban South Africa. *Ophthalmology*. 2003; 110 (2): 376-382.
8. Hennis, A., Suh-Yuh, W., Nemesure, B., et al., Awareness of incident open-angle glaucoma in a population study: The Barbados Eye Studies. *Ophthalmology*. 2007; 114 (10): 1816-1821.

9. Sathyamangalam, R., Paul, P., George, R., et al., Determinants of glaucoma awareness and knowledge in urban Chennai. *Indian J Ophthalmol.* 2009; 57 (5): 355-360.
10. Budenz, D., Barton, K., Whiteside-de Vos, J., et al., Prevalence of glaucoma in an urban West African population: the Tema Eye Survey. *JAMA Ophthalmol.* 2013; 131 (5): 651-658.
11. Friedman, D., Wolfs, R., O'Colmain, B., et al., Prevalence of open-angle glaucoma among adults in the United States. *Arch Ophthalmol.* 2004; 122 (4): 532-538.
12. Day, A., Baio, G., Gazzard, G., et al., The prevalence of primary angle closure glaucoma in European derived populations: A systematic review. *Br J Ophthalmol.* 2012; 96 (9): 1162-1167.
13. Weinreb, R., Aung, T. & Medeiros F. The pathophysiology and treatment of glaucoma: A review. *JAMA.* 2014; 311(18): p. 1901-1911.
14. McMonnies, C. Glaucoma history and risk factors. *J. of Optometry.* 2017; 10 (2): 71-78.
15. Liang, Y., Jiang, J., Ou, W., et al., Effect of community screening on the demographic makeup and clinical severity of glaucoma patients receiving care in urban China. *American J. of Ophthalmology.* 2018; 195: 1-7.
16. Bhutia, K., Dhakal, S. & Bhutia, S. To find the prevalence of glaucoma in patients with diabetes mellitus attending tertiary care hospital, east Sikkim. *Indian J. of Clinical and Experimental Ophthalmology.* 2018; 4 (4): 447-449.
17. Hohn, R., Nickels, S., Schuster, A., et al., Prevalence of glaucoma in Germany: results from the Gutenberg health study. *Graefes Arch Clin Exp Ophthalmol.* 2018; 256 (9): 1695-1702.
18. McCann, P., Hogg, R., Wright, D., et al., Glaucoma in the Northern Ireland Cohort for the Longitudinal Study of Ageing (NICOLA): Cohort profile, prevalence, awareness and associations. *Br J Ophthalmol.* 2020; 104 (11): 1492-1499.
19. Al-Mansouri, F., Kanaan, A., Gamra, H., et al., Prevalence and determinants of glaucoma in citizens of Qatar aged 40 years or older: A community-based survey. *Middle East Afr J Ophthalmol.* 2011; 18 (2): 141-149.
20. Hashemi, H., Mohammadi, M., Zandvakil, N., et al., Prevalence and risk factors of glaucoma in an adult population from Shahroud. *Iran. J. Curr Ophthalmol.* 2019; 31 (4): 366-372.
21. Keel, S., Xie, J., Foreman, J., et al., Prevalence of glaucoma in the Australian National Eye Health Survey. *Br J Ophthalmol.* 2019; 103(2): 191-195.
22. Gupta, P., Zhao, D., Guallar, E., et al., Prevalence of glaucoma in the United States: The 2005-2008 National Health and Nutrition Examination Survey. *Invest Ophthalmol Vis Sci.* 2016; 57 (6): 2905-2913.
23. Thapa, S., Paudyal, I., Khanal, S., et al. A population-based survey of the prevalence and types of glaucoma in Nepal: The Bhaktapur Glaucoma Study. *Ophthalmology.* 2012; 119 (4): 759-764.
24. Chan, M., Broadway, D., Khawaja, A., et al., Glaucoma and intraocular pressure in EPIC-Norfolk Eye Study: cross sectional study. *BMJ.* 2017; 358: doi: 10.1136/bmj.j3889.
25. Pakravan, M., Yazdani, S., Javadi, M-A., et al., A population-based survey of the prevalence and types of glaucoma in central Iran: The Yazd eye study. *Ophthalmology.* 2013; 120 (10): 197719-84.
26. Kyari, F., Entekume, G., Rabi, M., et al., A Population-based survey of the prevalence and types of glaucoma in Nigeria: Results from the Nigeria National Blindness and Visual Imp-

- airment Survey. *BMC Ophthalmol.* 2015; 15: 176.
27. Baskaran, M., Foo, R., Cheng, C-Y., et al. The prevalence and types of glaucoma in an urban Chinese population: The Singapore Chinese eye study. *JAMA Ophthalmol.* 2015; 133 (8): 874-880.
  28. Wubet, G. & Assefa, A. Glaucoma and its predictors among adult patients attending ophthalmic outpatient department: A hospital-based study, North West Ethiopia. *BMC Ophthalmology.* 2021; 21 (1) p. 19.
  29. Lee, J., Lai, J., Yick, D., et al. Retrospective case series on the long-term visual and intraocular pressure outcomes of phacomorphic glaucoma. *Eye.* 2010; 24 (11): 1675-1680.
  30. Rudnicka, A., Mt-Isa, S., Owen, Ch., et al. Variations in primary open-angle glaucoma prevalence by age, gender, and race: A Bayesian meta-analysis. *Investigative Ophthalmology & Visual Science.* 2006; 47 (10): 4254-4261.
  31. Cedrone, C., Mancino, R., Cerulli, A., et al. Epidemiology of primary glaucoma: Prevalence, incidence, and blinding effects. *Progress in Brain Research.* 2008; 173: 3-14.
  32. Bentum, O., Boateng, T. & Arkaa, O. Prevalence of glaucoma in an eye clinic in Ghana. *Russian Open Medical J.* 2013; 2(3): 0310.
  33. de Voogd, S., Ikram, M., Wolfs, R., et al., Incidence of open-angle glaucoma in a general elderly population: The Rotterdam Study. *Ophthalmology.* 2005; 112 (9): 1487-1493.
  34. Iqbal, S., Khan Z., Shah S., et al. Types and presentation of glaucoma. *J. of Postgraduate Medical Institute,* 2008; 22 (4): 324-332
  35. WHO criteria of visual impairment. <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>. (10/10/2023)
  36. Khandelwal, RE., Raje, D. & Khandelwal, RA. Clinical profile and burden of primary glaucoma in rural camp patients attending a tertiary care center in India. *J. of Clinical Ophthalmology and Research,* 2019; 7(2): 55-60.
  37. Olthoff, C., Schouten, J., de Borne, B., et al., Noncompliance with ocular hypotensive treatment in patients with glaucoma or ocular hypertension: an evidence-based review. *Ophthalmology,* 2005; 112 (6): 953-961.