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Clinical features of patients who were diagnosed with glaucoma incidentally

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Abstract

Glaucoma usually does not show any symptoms and may not be noticed until it reaches the advanced stage. In our study, demographic and clinical findings of patients who were diagnosed with glaucoma incidentally and were not aware of their disease and any symptoms are presented. Our study group consisted of people who did not have any symptoms and only wanted to receive an eye health report. Additional tests (visual field examination, retinal nerve fiber layer (RNFL) analysis, central corneal thickness etc.) for the diagnosis of glaucoma were planned for all participants over the age of 18 with suspected glaucoma (intraocular pressure >21 mmHg, optic nerve changes (cup/disc (c/d) ratio of 0.6 and above, c/d asymmetry greater than 0.2 between optic discs, peripapillary atrophy, optic disc hemorrhage etc.) in routine examinations. The diagnosis and classification of glaucoma was defined according to the International Society for Geographical and Epidemiological Ophthalmology Classification. Glaucoma was diagnosed in 51 eyes of 35 out of 1024 patients, including 24 male patients and 11 female patients. The mean age of the patients was 62.31 ± 12.392 years. There was 14 patients in primary open-angle glaucoma, 10 patients in pseudoexfoliation glaucoma, 6 patients in normotensive glaucoma, 1 patient with chronic angle-closure glaucoma, 1 patient with pigmentary glaucoma, 1 patient with angle-recession glaucoma, 1 patient with steroid-related glaucoma, and 1 patient with vitreoretinal surgery-related glaucoma. The mean visual acuity (VA) was 0.6 and above in all types except the patient who had the vitrectomy surgery. Primary open-angle glaucoma was the most common in incidentally diagnosed glaucoma patients. The presence of a high VA before symptoms develop in patients with glaucoma indicates the importance of early diagnosis in the prognosis of the disease.

Keywords: Early diagnosis, glaucoma, retinal nerve fiber layer, visual field, vision loss

Introduction

Glaucoma is a degenerative optic neuropathy that might cause visual field defects and vision loss due to progressive damage of the optic nerve [1-4]. It is the second most common cause of irreversible blindness in the world, and it is shown to be one of the preventable causes of blindness if diagnosed early [5]. Signs and symptoms of the disease vary according to the glaucoma type. Acute angle closure is a severe clinical condition and may manifest itself with severe eye pain and headache, visual impairment, conjunctival hyperemia, nausea and vomiting. On the other hand, open-angle glaucoma usually does not show any symptoms and may not be noticed until the advanced glaucoma.

Binocular vision may be preserved since visual field losses are usually not in the same part of the areas of the two eyes [6]. Thus, people with open-angle glaucoma usually do not report any complaints, and most of them are unaware of their disease [7]. Approximately 30% of the patients have advanced glaucoma in at least one eye at the time of diagnosis [8]. Generally, individuals who have regular eye checks can be diagnosed early. Limited access to health centers and inadequate knowledge of risk factors make early diagnosis difficult [9]. It is obvious that disease screening programs needs to be increased in order to reduce the burden of blindness due to glaucoma.

The aim of the study is to examine the clinical characteristics of

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patients who applied to get a Health Board Report without any eye complaints and were diagnosed glaucoma incidentally.

Material and Methods

This prospective and descriptive study was carried out by the ophthalmology department of Nigde Omer Halisdemir University School of Medicine. The protocol for this study was approved by the local ethics committee (No: 2022/114) and the study complies with the Declaration of Helsinki. All participants were informed about the study and written consent was obtained before the study.

Our study group consisted of people who did not have any symptoms and only wanted to receive an eye health report for situations such as getting a driver's license, starting a job, etc. All patients aged 18 years and over who applied to the health board, except for those with exclusion criteria, were included in the study. Special tests for the diagnosis of glaucoma were planned for all participants over the age of 18 with suspected glaucoma in routine examinations (elevated intraocular pressure (IOP) ($>21\text{mmHg}$) and/or optic nerve changes (cup/disc (c/d) ratio of 0.6 and above or neuroretinal rim thinning or notching, c/d asymmetry greater than 0.2 between both optic discs, peripapillary atrophy, optic disc hemorrhage and collaterals). The diagnosis of normotensive glaucoma (NTG) was made by the presence of glaucomatous visual field defects, open angles and IOP levels less than 22mm Hg , and glaucomatous optic nerve head injury [10]. The criteria of our study were determined as follows.

Inclusion criteria

- Be 18 years or older.
- Not having received any previous treatment for glaucoma.
- Not having been diagnosed with glaucoma prior to our examination.

Exclusion criteria

- Be under the age of 18.
- Having diseases that may affect the visual field such as multiple sclerosis, intracranial mass.

Detailed history and medical records of patients with suspected glaucoma were questioned. Detailed ophthalmological examinations including refractive error, best corrected visual acuity (BCVA) according to Snellen chart, pachymetry measurement, IOP measurement with goldmann applanation tonometry, eye movements, light reflexes, relative afferent pupillary defect (RAPD), anterior and posterior segment examination with a slit lamp, and iridocorneal angle assessment using a three-mirror Goldmann lens were performed. The Humphrey 30-2 SITA Standard program (Zeiss Humphrey Systems, Dublin, CA, USA) was used for the perimetry. Reliability criteria were a fixation loss of $<20\%$ and false-positive errors of $<15\%$. Otherwise, the visual field test was repeated. Retinal nerve fiber layer (RNFL)

analysis (Cirrus HD-OCT, Carl Zeiss Meditec Inc., Dublin, CA, USA) were used for optic nerve pathologies in patients. Images with a signal quality of 6 and above in the optic nerve analysis were used. The diagnosis of glaucoma was defined according to the International Society for Geographical and Epidemiological Ophthalmology Classification (ISGEO) [10].

Demographic information of the patients diagnosed with glaucoma such as age, gender, family history, medications used, comorbidities (Hypertension (HT), Diabetes mellitus (DM), Migraine) were questioned and recorded. BCVA, IOP, central corneal thickness, vertical cup/disc ratios, and RNFL thicknesses of the patients were recorded. Glaucoma patients were classified according to the ISGEO criteria [10].

Statistical analysis was done using the Statistical Package for Social Science (SPSS) by IBM, version 25. Descriptive data were analyzed using mean and percentage as appropriate.

Results

Glaucoma was diagnosed in 51 eyes of 35 out of 1024 patients examined, including 24 male patients and 11 female patients. The incidence of incidental glaucoma in our study group was found to be 3.4%. The mean age of the patients with glaucoma was 62.31 ± 12.392 years. Glaucoma was detected in one eye of 19 (3 females and 16 males) patients and in both eyes of 16 patients (8 females and 8 males). The eye most severely affected in terms of visual field mean deviation was used for presenting the glaucoma data in patients diagnosed with glaucoma in both eyes. Primary open-angle glaucoma (POAG) was diagnosed in both eyes of 8 patients; pseudoexfoliation glaucoma (PEG) was diagnosed in both eyes of 2 patients; and NTG was diagnosed in both eyes of 6 patients.

POAG was detected in 14 patients (4 females and 10 males), and it was the most common type of glaucoma. PEG was detected in 10 patients (2 females and 8 males) and NTG was detected in 6 patients (4 females 2 males). In our study, other than these 3 types of glaucoma, there was 1 patient with chronic angle-closure glaucoma, 1 patient with pigmentary glaucoma, 1 patient with angle-recession glaucoma, 1 patient with steroid-related glaucoma, and 1 patient with vitreoretinal surgery-related glaucoma (Table 1).

Patients' medical history and demographics data were given in Table 1 and clinical characteristics of the patients were given in Table 2. While there was male gender dominance in POAG and PEG patients, female patients were the majority in NTG. The highest mean age was in PEG. The highest rate of diabetes coexistence was found in POAG, with a rate of 42.9% (in POAG patients). The presence of HT was again in POAG, with the highest rate of 57.1% (in POAG patients). A family history of glaucoma was most common in NTG (Table 1). POAG patients had the highest IOP. The highest cup/disc ratio and RNFL thinning were detected in NTG. The mean BCVA was 0.6 and above in all types except the patient who had a vitrectomy (Table 2).

Table 1. Medical history and demographics of newly diagnosed glaucoma patients

Diagnosis	Number of patients	Sex (f/m)	Mean age	Side (right/left)	Diabetes mellitus	Hypertension	Migraine	Family history
Primary open-angle glaucoma	14	4/10	58.84±11.1	12/2	6 (42.9%)	8 (57.1%)	-	6 (42.9%)
Pseudoexfoliation syndrome	10	2/8	66±6.99	4/6	2 (20%)	2 (20%)	-	2 (20%)
Normal-tension glaucoma	6	4/2	63.6±21.02	4/2	2 (33.3%)	2 (33.3%)	2 (33.3%)	3 (50%)
Chronic angle-closure glaucoma	1	0/1	50	0/1	-	-	-	-
Pigmentary glaucoma	1	0/1	58	1/0	1	-	-	-
Angle-recession glaucoma	1	0/1	45	0/1	-	-	-	-
Steroid-induced glaucoma	1	0/1	50	0/1	-	1	-	-
Glaucoma associated with vitreoretinal surgery	1	1/0	65	0/1	-	1	-	-

f/m: female/male

Table 2. Clinical characteristics of newly diagnosed glaucoma patients

Diagnosis	BCVA (Mean±SD) Range (min.-max.)	IOP (mmHg) (Mean±SD)	Mean central corneal thickness (Mean±SD)	Vertical c/d ratio (Mean±SD)	RNFL thickness (Mean±SD)
Primary open-angle glaucoma	0.78±0.18 (0.5-1.0)	37.29±7.53	533.86±23.08	0.6±0.16	71.71±13.78
Pseudoexfoliation syndrome	0.9±0.1 (0.7-1.0)	27.2±4.96	550.8±13.55	0.48±0.12	70.6±17.4
Normal-tension glaucoma	0.63±0.05 (0.6-0.7)	14±1.7	509±19.2	0.86±0.05	53.3±9.3
Chronic angle-closure glaucoma	1.0	25	571	0.4	97
Pigmentary glaucoma	1.0	28	539	0.5	100
Angle-recession glaucoma	1.0	25	539	0.4	99
Steroid-induced glaucoma	1.0	24	571	0.4	97
Glaucoma associated with vitreoretinal surgery	0.4	23	539	0.5	80

BCVA: Best corrected visual acuity IOP: Intraocular pressure SD: standard deviation c/d:cup/disc RNFL: retinal nerve fiber layer

Discussion

Glaucoma is the common definition for a group of chronic optic neuropathies characterized by irreversible retinal ganglion cell damage and visual field defects [11]. It is considered that at least half of glaucoma cases go undiagnosed, even in developed countries where social awareness programs on glaucoma are implemented [12]. In our study, clinical and demographic information of the incidentally diagnosed glaucoma patients who did not have any complaints about the disease was presented.

The majority of our patients were classified into three main glaucoma types. The most common type of glaucoma was found to be POAG. This was followed by PEG and NTG.

Prevalence and types of glaucoma varied according to ethnicity and geographical region, and while closed-angle glaucoma was common in Asia, Western-centered studies reported that POAG was more common [13]. Overall, POAG has been reported to be the most common form of glaucoma worldwide [11]. The incidence of POAG increases with age. In some studies, it was observed at similar rates in men and women, and in other studies, it was observed slightly more in men [10]. The number of male patients was higher in POAG in our study.

The prevalence of POAG was found to be higher in diabetic individuals than in non-diabetic individuals [14]. In our study, DM was present in 42% of POAG patients. The relationship

of HT with POAG is complex. In some studies, elevated blood pressure has been associated with the development of POAG, but some studies have not found this association. HT may protect the optic nerve from ischemia, but it may increase the IOP by increasing aqueous humor production. In our study, more than %50s of POAG patients had HT. Although there is no obvious inheritance, family history is a well-known risk factor. The risk of developing glaucoma in siblings of patients with POAG is 3.7 times higher [15]. In our study, family history was found to be %42 in POAG in patients.

In our study, it was reported that PEG, which is the second most common glaucoma type, is more aggressive and has a worse prognosis compared to POAG [16,17]. In our study, IOP and c/d rates of patients with PEG were lower than patients with POAG, and RNFL thicknesses were found to be similar. This may probably be explained by the early diagnosis of patients with PEG. Family history has been reported as a risk factor in PEG [18]. In our study, %20s patients with PEG have a family history of glaucoma.

NTG patients are usually 10 years older than other glaucoma patients, and most of them are in the 7th and 8th decades at the time of diagnosis. It has been reported that it is generally bilateral and more common in the female gender [19]. All six of our patients with NTG were diagnosed with NTG in both eyes. It is considered that the role of vascular pathologies is especially prominent in NTG [20]. In our study, DM was present in 2 patients and HT in 2 patients. In our study, 2 patients with NTG had migraine, and migraine was not detected in other types of glaucoma. Family history was found to be %50 in NTG patients, and this rate is the highest among 3 types of glaucoma.

In our study, no types of glaucoma other than POAG, NTG, PEG, chronic angle-closure glaucoma, pigmentary glaucoma, angle-recession glaucoma, steroid-related glaucoma, and vitreoretinal surgery-related glaucoma were encountered. The absence of glaucoma types that such as angle-closure glaucoma, inflammation-related glaucoma, retinal detachment-related glaucoma, hyphema-related glaucoma, and malignant glaucoma may be due to the fact that they generally have symptomatic findings.

The mean VA of the patients in our study was observed to be 0.5 and above, except for the patient who underwent vitreoretinal surgery. This indicates that the patients were diagnosed early, before their symptoms developed, and shows how valuable early diagnosis is for prognosis.

The most important limitation of our study is the small number of patients, and therefore the percentages may not fully reflect reality. It can only give an idea for the differences between the types of glaucoma.

Conclusion

As a result, POAG was the most common in incidentally diagnosed glaucoma patients. The presence of a high VA before symptoms develop in patients with glaucoma indicates the

importance of early diagnosis in the prognosis of the disease. Vision loss can be prevented by early diagnosis and treatment thanks to screening programs.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

Permission for the study, dated 8/12/2022 and numbered 2022/114, was obtained from the Local Ethics Committee.

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