The Frequency and Causes of Blindness in a Rural Region of Central Anatolia of Turkey

Enver Mirza[1], Gunsu Deniz Mirza[2], Refik Oltulu[2], Mehmet Okka[2], Ahmet Ozkagnici[2]

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ORCID IDs of the authors:
E.M. 0000-0002-8847-5726
G.D.M. 0000-0002-3073-1213
R.O. 0000-0003-2447-6524

[1]Department of Ophthalmology, University of Health Sciences, Konya Training and Research Hospital, Konya, Turkey
[2]Department of Ophthalmology, Necmettin Erbakan University, Meram School of Medicine, Konya, Turkey

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Correspondence to: Enver Mirza
E-mail: envermirza@gmail.com

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ABSTRACT

Objective: This study aimed to evaluate the frequency and primary causes of blindness in adults aged 18 years and more in Sarıkaya rural region of Yozgat, Turkey, to contribute to the epidemiologic information about blindness in our country.

Materials and Methods: Patients who were examined between October 2016 and March 2017 in Sarıkaya State Hospital, Clinic of Ophthalmology, were prospectively investigated. Demographic and ophthalmic examination data, presented visual acuities (VA), primary causes of blindness, and monocular blindness were recorded. Blindness was defined as presented visual acuities (VA) definition of World Health Organization criteria.

Results: A total of 3423 participants, aged 18-96 years, were examined. Among them, 1887 participants (55%) were female and 1536 (45%) were male. The frequency of blindness was 1.5% (95% CI: 1.1%-2.0%); and cataract was the primary cause of blindness (42%). Age-related macular degeneration (21%) and uncorrected refractive error (13%) were the next main causes of blindness. The frequency of monocular blindness was 4% (95% CI: 3.8%-5.2%), and cataract (27%) followed by phthisis bulbi/evisceration (13%) and glaucoma (12%) were the leading causes of monocular blindness.

Conclusion: In this rural region of Central Anatolia, the primary cause of blindness and monocular blindness was an unoperated cataract. The patterns of age-specific causes of blindness are variable, but most of them are avoidable or treatable. Thus, awareness should be increased in societies, and people should be prevented from blindness with health-care programs in rural regions of developing countries.

Keywords: Blindness, frequency, prevalence, cataract, Turkey

Introduction

The sense of sight is the most important sense for education, teaching, understanding, processing information, acquiring new knowledge, skills, and of course for life. Hence, blindness is a very unpleasant and difficult situation because it prevents people from having their own way of life and limits access to personal education, especially in younger ages.

Worldwide, approximately 1 of 200 people are blind (about 36 million) [1]. In Europe, there are 3000 blind people per million in population; and the most frequent causes of blindness are cataract, uncorrected refractive error, glaucoma, and age-related macular degeneration (AMD) [1].

Turkey is a developing country in Europe where approximately 78 million people live; and the population is mostly made of young generation. The rates of eye diseases increase with the increase in the elderly population [2]. Therefore, preventing blindness should be a priority national goal for countries like Turkey in the upcoming years.

Thoroughly, blindness is not a personal issue. It is a major social problem in all countries, and it affects the national economy. Because blindness also affects millions of people, often family members and close relatives who accompany the blind people; and consequently, it prevents economic productivity [3]. In analyze of the data in 2011 for all disabled people and their relatives, $2.9 billion was spent and 8.4% of this allowance was used for ophthalmologic reasons in

Turkey [4]. The burden of blindness costs too much for societies, and thus it is important to investigate and eliminate the causes of blindness.

This study aimed to evaluate the frequency and primary causes of blindness in a rural region of Central Anatolia. We hope it will be a representative example for countries like Turkey.

Materials and Methods

This prospective study received the district governorship support. People from Sarıkaya and the neighborhood region were invited to the Sarıkaya State Hospital by the district municipality with a public announcement to have a routine eye examination by the ophthalmologist (EM). The participants aged 18 years and more who were examined in Sarıkaya State Hospital between October 2016 and March 2017 were included in this prospective study. The Medical, Surgical and Drug Investigations Ethical Committee of Necmettin Erbakan University, Meram School of Medicine approved the study, and all participants gave informed consent according to the Declaration of Helsinki. All participants were asked where they live, and those not living in Sarıkaya region were excluded from the study. Visual acuity (VA) was evaluated according to the education level. VA was obtained with the Snellen charts in literate participants and with a reduced logMAR tumbling-E chart in illiterate participants. All participants underwent automated refraction (ACCUREF-K 9003D, Shinnippon, Japan). Intraocular pressure (IOP) was measured by Goldmann applanation tonometry. Slit-lamp biomicroscopic and dilated funduscopic examinations were performed. The examination and demographic data of the participants were recorded only once. Using the blindness definition of World Health Organization criteria, blindness was defined as presenting VA less than 20/400 in the better eye or visual field loss of <10° from the central fixation; but in this study, visual field test could not be performed because of the absence of device. Monocular blindness was defined as presenting VA less than 20/400 in worse eye and higher than 20/400 in the better eye.

Statistical Analysis

The statistical analyses of this study were performed with The Statistical Package for the Social Sciences (SPSS) 22.0 package program (IBM Corp.; Armonk, NY, USA). Numerical data were reported as mean±standard deviation (min, max) in independent samples tests. We used the chi-square test in the analysis of categorical data and one-way ANOVA test in continuous data analysis.

Results

A total of 3423 participants were examined. Among them, 1887 (55.1%) participants were female and 1536 (44.9%) were male. The age of participants ranged between 18 and 96 years, and the mean age of participants was 49.91±17.67 years (Table 1).

We identified 52 blind participants. The mean age of blind participants was 73.79±16.85 years, and the frequency of blindness was 1.5% (95% CI: 1.1%-2.0%). Among the blind participants, 28 (53.8%) were female and 24 (46.2%) were male. The frequency of blind female was 1.5% (95% CI: 1.0%-2.1%) and of blind male was 1.6% (95% CI: 1.0%-2.3%, Table 2). In blind participants, there were no significant differences in gender (p=0.945).

Cataract (42%), AMD (21%), uncorrected refractive error (13%), glaucoma (6%), proliferative diabetic retinopathy (6%), optic atrophy (6%), and retinitis pigmentosa (RP, 6%, Table 3) were found to be the primary causes of blindness.

The most frequently occurring age group of blind people was the 80-89 years (n=20/52, 38%), and cataract was the primary cause of blindness in this age group. Considering the pattern of age-specific causes of blindness, cataract was the main reason for blindness in people aged over 60 years (Table 4). The anticipated information is that blindness was more common in uneducated people, and 56% (n=29) of blind people had never attended school.

We also identified 152 monocular blind participants. The mean age of monocular blind participants was 65.22±16.95 years, and the frequency of monocular blindness was 4% (95% CI: 3.8%-5.2%). Among monocular blind participants, 81 (53.3%) were female and 71 (46.7%) were male (Table 1). The frequency of monocular blind female was 4.3% (95% CI: 3.4%-5.3%) and male was 4.6% (95% CI: 3.6%-5.8%, Table 2).

Cataract (27%), phthisis bulbi/evisceration (13%), glaucoma (12%), AMD (11%), corneal diseases (11%), uncorrected refractive error (9%), optic atrophy (6%), retinal vein occlusion (4%), amblyopia (3%), chronic retinal detachment (2%), proliferative diabetic retinopathy (<1%), and RP (<1%) were the primary causes of monocular blindness (Table 5).

The most frequently occurring age group of monocular blind people was the 60-69 years (n=41/152, 27%), and cataract was the primary cause of blindness in this age group. Cataract remains the main reason for monocular blindness in older ages (Table 6). Considerably phthisis bulbi/evisceration was the leading cause in younger ages and more often in male (60%).

In addition, according to age, blindness and monocular blindness were significantly more common in elder participants (p=0.001, p=0.001, respectively); and the blind participants were older than monocular blind participants (p=0.002).

Discussion

Yozgat is one of the oldest settlements with an estimated 5000-year history in the middle of Central Anatolia. It has a population of 420.000 people. With a population of approximately 17,000 people in the center of the district and 16,000 people in the villages, Sarıkaya is the

Table 1. Descriptive data and frequencies

	n	Female n %	Male n %
Total	3423	1887 55.1	1536 44.9
Blindness	52	28 53.8	24 46.2
Monocular Blindness	152	81 53.3	71 46.7
		Mean±sd	Median, min, max
Age		49.91±17.67	51, 18, 96

Table 2. The frequency of blindness and monocular blindness in gender

	n	Blindness n %	Monocular Blindness n %
Female	1887	28 1.5	81 4.3
Male	1536	24 1.6	71 4.6

Table 3. The primary causes of blindness

Primary Causes of Blindness (n=52)	n	%
Cataract	22	42
AMD	11	21
Uncorrected Refractive Error	7	13
Glaucoma	3	6
Proliferative Diabetic Retinopathy	3	6
Optic Atrophy	3	6
Retinitis Pigmentosa	3	6

AMD: Age-related macular degeneration

Table 4. The distribution of leading cause of blindness in the age group

Age Group of Blindness	n	%	Leading Cause of Blindness in the Age Group
>90	4	8	Cataract
80-89	20	38	Cataract
70-79	14	26	Cataract
60-69	4	8	Cataract
50-59	3	6	Proliferative Diabetic Retinopathy
40-49	4	8	Uncorrected Refractive Error
30-39	2	4	Uncorrected Refractive Error
18-29	1	2	Uncorrected Refractive Error

Table 5. The primary causes of monocular blindness

Primary Causes of Monocular Blindness (n=152)	n	%
Cataract	42	27
Phthisis Bulbi or Evisceration	20	13
Glaucoma	18	12
AMD	16	11
Corneal Disease	16	11
Uncorrected Refractive Error	13	9
Optic Atrophy	10	6
Retinal Vein Occlusion	6	4
Amblyopia	5	3
Chronic Retinal Detachment	4	3
Proliferative Diabetic Retinopathy	1	<1
Retinitis Pigmentosa	1	<1

AMD: Age-related macular degeneration

fifth most crowded and rural district of Yozgat. Sarıkaya is located between two cities, in the southeast of Yozgat (about 80 km away) and in the north of Kayseri (about 120 km away, latitude: 39.493611, longitude: 35.376944). The economy is largely based on farming and animal husbandry. The vast majority of the population have low income. Until 2016, there was no ophthalmologist who had previously worked in this rural region; and ophthalmic surgery instruments or ophthalmic operation room equipment did not exist.

This study involved the rural population in this region of Central Anatolia of Turkey. In this area, we indicated that the three major causes of blindness were cataract, AMD, and uncorrected refractive error in descending order. A cataract is the clouding of the crystalline lens because of several conditions including congenital disorders, systemic diseases, trauma, and aging [5]. AMD is an acquired degeneration of the retinal pigment epithelium that affects the central vision. Uncorrected refractive error is the difficulty in seeing objects clearly because of refractive error that is untreated with corrective glasses, contact lenses, or refractive surgery [6].

Furthermore, cataract followed by phthisis bulbi/evisceration and glaucoma were identified as the primary causes of monocular blindness. Phthisis bulbi is an atrophic scarred, non-functional eye that may result from a variety of severe ocular conditions due to inflammation, trauma, or complication of an ocular surgery [7]. Evisceration is the removal of the internal tissues of the globe leaving the sclera and extraocular muscles intact by surgically due to inflammation, endophthalmitis, and neovascular glaucoma [8]. Glaucoma is an optic neuropathy due to elevated intraocular pressure that damages the optic nerve and retinal ganglion cells, and leads to progressive and irreversible vision loss [9]. Additionally, we noticed that phthisis bulbi/evisceration was more common in the study. Probably, it is correlated with working in dangerous jobs with risk of trauma; and it was more often in male (60%, n=12).

Actually, we could not evaluate the economic status of the participants of the population, but it is known that generally people with low income live in this rural region; and the reality is that eye diseases that cause blindness are usually associated with poverty [1]. The rate of blindness in developed countries is 3-4 times less than in developing countries [2]. However, most of eye diseases that cause blindness are preventable or treatable.

In developed countries like USA and most European countries, AMD is the leading cause of blindness [1, 10]. In previously reported studies across the rest of the world and rural regions in developing/developed countries, such as in Nigeria, Pakistan, Jordan, and in rural areas of Spain, Canada, China, unoperated cataract has been identified as the predominant reason of blindness [11-17]. In the Beijing Eye Study, cataract (38.5%) followed by myopic macular degeneration (15.4%), and glaucoma (7.7%) were determined as leading causes of blindness in adult Chinese [17]. Optic neuropathy (7.7%), diabetic retinopathy (7.7%), AMD (7.7%), and RP (7.7%) were the other reasons for blindness [17]. Also, in the Singapore Indian Eye Study, cataract (59.3%) was identified as the primary cause of bilateral blindness [18]. AMD (11.1%), uncorrected refractive error (7.4%), myopic macular degeneration (7.4%), glaucoma (3.7%), diabetic retinopathy (3.7%), and amblyopia (3.7%) were the other diseases that caused blindness [18]. Moreover, in the Tajimi Study, myopic macular degeneration (22.4%), glaucoma (12.2%), and trauma (12.2%) were reported as the primary causes of monocular blindness in Japanese adults [19]. In the Copenhagen City Eye Study and in the Rotterdam Study, AMD was the major cause of blindness [20, 21]. Myopic macular degeneration (14%), glaucoma (14%), RP (11%), and diabetic retinopathy (7%) were the other frequent causes of blindness in the Copenhagen City Eye Study [20]. Glaucoma (8%), cataract (6%), myopic macular degeneration (6%), and optic neuropathy (6%) were the other causes of blindness in descending order in the Rotterdam Eye Study [21]. In the Barbados Eye Study, open angle glaucoma (28%) and AMD (28%) were defined as predominant cause of blindness [22]. Retinol/choroidal diseases (15%) and optic atrophy (11%) were the other causes [22]. In addition, the prevalence of blindness ranged from 0.04% to 30% in those studies [11-17].

According to the study in two provinces of Turkey, Diyarbakır and Mardin, in 1996, Negrel et al. [23] reported that the prevalence of blindness was 0.4%; and cataract (50%), corneal opacity (15%), glaucoma (12%), phthisis bulbi (6%), and optic atrophy (6%) were the main causes of blindness. Trachoma was more common in those years, and this disease might cause the high rate of corneal opacity [24]. But interestingly, this study did not mention blindness due to AMD; and this might be probably because of the fact that it was difficult to have the diagnosis of AMD without a proper examination. In this study, the frequency of AMD causing blindness was 21%.

As previously mentioned, causes of blindness vary in worldwide, but unoperated cataract is still the leading cause. In 2010, one of every three blind people was blind because of unoperated cataract [25]. People with cataracts in developed countries normally may have cataract surgery when they are having difficulty doing daily activities such as reading newspaper or bus stop names and watching television; but in rural areas of developing countries, people with cata-

Table 6. The distribution of leading cause of monocular blindness in the age group

Age Group of Monocular Blindness	n	%	Leading Cause of Blindness in the Age Group
>90	3	2	Cataract
80-89	27	18	Cataract
70-79	39	25	Cataract
60-69	41	27	Cataract
50-59	18	12	Phthisis Bulbi or Evisceration
40-49	8	5	Phthisis Bulbi or Evisceration
30-39	9	6	Phthisis Bulbi or Evisceration
18-29	7	5	Corneal Diseases

racts become blind. In this study, the frequency of cataract causing blindness was 42% and monocular blindness was 27%.

The participants who were blind because of cataract in the sample of our study were mostly elderly. In general, the young population has migrated to bigger cities to earn money and look after their families who live in this rural region. Hence, the elderly population is often solitary and in need of care. Also, awareness, low literacy, poor economic situations, an absence of a person to accompany to the hospital, or history of a close relative unsuccessful eye operation, thought of being blinded after ocular surgery are the common reasons that increase the rate of blindness [26-29]. Moreover, the planning of health-care services is usually done without considering the geographical differences in developing countries could be another reason [25-29]. Significant lack of ophthalmologist, nurse, inadequate examination devices, or operating room equipment and conditions is also the reason for increasing blindness rate.

Worldwide, the average number of ophthalmologists varied according to the development level. In 23 countries, the ophthalmologists per million population are <1; and in 18 countries, the percentage is >100 [30]. The lowest percentage is in Sub-Saharan Africa. The highest numbers of ophthalmologists are in the three countries, China, USA, and Russia. Japan, Brazil, and India are the next three countries [30]. There were 28,338 ophthalmologists in China with a population of 1.4 billion people; and there were just 7 ophthalmologists in Niger where approximately 18 million people live. In 2012, there were 3550 ophthalmologists in Turkey [30]. Percentage of ophthalmologists doing active surgery is another important issue that needs to be assessed. In the Netherlands, the percentage is 40%; in Japan, 50%; and in Turkey, nearly 90% [30].

Turkey has a remarkable condition as a developing country, both in terms of the number of ophthalmologists and percentage of ophthalmologists doing active surgery. However, the high rate of blindness in our study may be because of the reasons that we discussed earlier, but we thought that education level, awareness, economic situations, and lack of ophthalmologist doing active cataract surgery previously were in the first place of this results in this rural area.

The limitations of this study were that our data only showed the rate of blindness in the rural region of Yozgat, and the sample was not randomly accessed. With this design, we could not report the prevalence of blindness. Nevertheless, this study has created a representative example for the region; and this study could be mainly useful to determine the educational and health service priorities of the institutions providing health services. It could also provide an important information infrastructure for areas where preventive health services need to be concentrated in Turkey.

In the light of the outcomes of our study, unoperated cataract was the main cause of both blindness and monocular blindness, which is correlated with increasing age but it is treatable. Thus, people who live in rural regions should be prevented from this unpleasant situation with health-care programs because blindness is not destiny.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Necmettin Erbakan University, Meram School of Medicine.

Informed Consent: Informed consent was obtained from the patients who participated in this study.

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