Prevalence of Visual Impairment and Blindness in Butajira Town, Central Ethiopia

Investigators

Kirubel Tesfaye, MD, Ophthalmology Resident, AAU, CHS, SoM, Department of Ophthalmology

Mulugeta Demissie, MD, Assistant Professor of Ophthalmology, Cornea and Anterior Segment Surgeon, AAU, CHS, SoM, Department of Ophthalmology

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Acronyms

AMD - Age Related Macular Degeneration

CBHI - Community Based Health Insurance

CO - Corneal Opacity

DM - Diabetes Melitus

ICD - International Classification of Diseases

IOP - Intraocular Pressure

SNNPR - Southern Nation Nationalities and Peoples' Region

SPSS -Statistical Package for the Social Sciences

VA - Visual Acuity

VI - Visual Impairment

WHO - World Health Organization

Abstract

Title – Prevalence of Visual Impairment and Blindness in Butajira town, Central Ethiopia

Investigators 1. Kirubel Tesfaye, MD, Ophthalmology Resident

2. Mulugeta Demissie, MD, Assistant Professor of Ophthalmology

Background – WHO defines visual impairment as visual acuity of less than 6/18 and blindness when visual acuity is less than 3/60. In 2020 it was estimated that there are 43.3 million people blind and 553 million had some degree of visual impairment. The number of people affected by blindness is estimated to rise to 61.0 million by the year 2050. From the causes of VI and blindness, an estimated 50% are either preventable or treatable. In Ethiopia the pooled prevalence of blindness was found to be 1.18% with regional variations and the highest rate reported in SNNPR with a prevalence of 1.9%.

Objective – The main objective of the study was to assess the prevalence of visual impairment and blindness in those who are aged 40 and above in Butajira town, Central Ethiopia

Methodology - Community based cross-sectional study on the prevalence of visual impairment and blindness in Butajira town. Any individual aged 40 and above available within the selected household was included in the study. Systematic sampling was used to select each household. A semi-structured questionnaire was administered and then ocular examination done for those with visual acuity less than 6/18.

Results - A total of 251 participants were enrolled in the study. The prevalence of visual impairment(6/18≥3/60) was found to be 16.8% and that of blindness was 3.6%. The major cause of visual impairment was found to be cataract at 45.2% followed by refractive error(41.4%), trachomatous CO(4.8%), Glaucoma(4.8%) and other(2.4%). Whereas the major cause of blindness was found to be glaucoma(33.33%) followed by trachomatous CO and cataract both at 22.2%. Using bivariate correlation, education level and reported history of reduction of vision were the only variables found to be correlated to visual Impairment and blindness and were statistically significant at p=0.015.

Conclusion - This study showed the prevalence of visual impairment and blindness to be high in Butajira town. Although the small sample size might make it difficult for extrapolation but has shown the continued need for ophthalmic service as cataract and refractive error are still the leading causes of visual impairment. It also showed glaucoma as the major cause of blindness which indicates further screening with IOP and disc evaluation is needed for the detection.

Introduction

Background

Visual impairment(VI) and Blindness continues to be of public health importance throughout the world and especially in third world countries. In 2020 it was estimated that there are 43.3 million people fulfilling the definition of blindness: visual acuity of less than 3/60, while 553 million had some degree of visual impairment. The number of people affected with blindness is estimated to rise to 61.0 million by the year 2050.(1) WHO estimates that half of the world's visual impairment is either avoidable or unaddressed. The majority of the visual impairment being found in low and middle income countries.(2)

In 2020 it was estimated that 18.1 million people within the working age group were blind globally, whereas 142 million had either moderate or severe visual impairment. It was also shown that the global relative reduction of employment for people with visual impairment and blindness was 30.2%. The economic productivity loss being estimated at 411 Billion USD in 2020.(3) VI and blindness has also been shown to negatively affect quality of life.(4,5)

Globally between 1990 and 2020 the age standardized prevalence of blindness of those above 50 years of age decreased by about 28.5%. However the number of people who were blind increased by 50.6% indicating that the services being delivered are not meeting the population growth.(1) Due to the growing and aging population the challenges in trying to eliminate blindness are ever-growing.(6)

Recent global meta-analysis have shown that the commonest causes of moderate and severe visual impairment were refractive error followed by cataract and age related macular degeneration thirdly. Whereas the leading cause of blindness was cataract.(7)

There were an estimated 75 million blind people in Africa by 2020.(8)2 In Sub-Saharan Africa the pooled prevalence estimate of blindness was found to be 10%, where west and east Africa had the highest numbers.(9) In Ethiopian context the pooled prevalence of blindness was found to be 1.18% with regional variations and the highest rate reported in Southern Nation Nationalities and Peoples' Region (SNNPR) with a prevalence of 1.9%.(10) Prior to this pooled prevalence the national prevalence of blindness in Ethiopia was 1.6% and that of low vision was 3.7%. Out of the causes 91% of low vision and 87% of blindness were either treatable or preventable.(11)

As the world population is growing the number of people with visual impairment and blindness is on the rise. The burden falls largely on low and middle income countries where 90% of the blind are believed to live.(12) Reports from Africa show that due to the effect of COVID 19 pandemic school health programmes and also outreach programmes targeting eye health had been suspended, presumably leading to added burden of visual impairment and blindness.(13)

Remarkably, over 85% of the causes of visual impairment and blindness worldwide are either preventable or treatable.(11) This statistic underscores the urgent need for ongoing assessment to identify changes in the causes and to evaluate the effectiveness of implemented strategies. With proper identification of the causes we can have targeted interventions that can create change.

The last national survey done in Ethiopia to assess blindness and visual impairment was more than 15 years back and to our knowledge there is no published paper studying the prevalence of visual impairment and blindness in Butajira town. This study assessed the prevalence of visual impairment and blindness and by doing so identified the different causes of visual impairment and blindness. This study

thus will be helpful to provide updated information in order to plan eye care service strategies in the study area.

Objective of the Study

General Objective

The general objective of this study was to determine the prevalence of visual impairment and blindness in those above the age of 40 years in Butajira town, Central Ethiopia

Specific Objective

- To identify the causes of visual impairment
- To identify the causes of blindness
- To assess the factors associated with visual impairment and blindness

Method and Subjects

Study Design and Period

Community based cross-sectional study on the prevalence of visual impairment and blindness in Butajira town, Gurage zone, Central Ethiopia was done from August 1 - August 31,2024

Study Area

The study was conducted in Butajira town located in Gurage zone, which is located 120 km south-southwest of Addis Ababa, the capital of Ethiopia. With an estimated population of 77,483 for the year 2023, Butajira town has 5 kebeles and an estimated 15,813 households. There is an estimated household occupancy of 5 residents per house.

Sample Size and Sample Procedure

Sample size was calculated using a single population proportion formula, and prevalence was taken as 1.6%(11) for blindness and 3.7%(11) for visual impairment. Sample size was calculated for both visual impairment and blindness and the larger sample size was taken (251)

$$n = \frac{(Z_{\alpha/2})^2 P(1-P)}{d^2}$$

Visual Impairment	**Blindness**
Z – 95% CI – 1.96,	Z – 95% CI – 1.96,
P(Proportion) – 3.7%,	P(Proportion) – 1.6%
d(Margin of Error) – 3%	d(Margin of Error) – 3%
Design Effect – 1.5	Design Effect - 1.5
10% Non- Response rate	10% Non-Response Rate
Sample Size - 251	Sample Size - 111

The sample size was distributed to the 5 kebeles proportionally. The first house was selected in each kebele by convenience sampling and then every seventh house was selected until the sample size for

the kebele was met. All available individuals above the age of 40 years within the household were examined if eligible.

Sample size from each kebele = $\frac{\text{total sample size} * \text{total population in each kebele}}{\text{total population of the town}}$

Kebele 1 = 251*14803/77483 = 48

Kebele 2 = 251*14092/77483 = 46

Kebele 3 = 251*15501/77483 = 50

Kebele 4 = 251*16890/77483 = 55

Kebele 5 = 251*16197/77483 = 52

Eligibility Criteria

Inclusion Criteria

Any individual above the age of 40 years available within the selected household

Exclusion Criteria

- Relocated resident of less than 6 month
- People with mental disabilities who are uncooperative for evaluation

Data Collection

Ethical clearance was taken from the department of ophthalmology at Addis Ababa University research and publication committee and Butajira health bureau. After informed verbal consent was taken, a semi-structured questionnaire was administered by the principal investigator and supporting data collectors which included socio-demographic questions on age, sex, occupation and educational level. A brief history was then asked to enquire duration of reduction of vision if there is any, prior trauma, history of family ocular illness, history of ophthalmic evaluation and ocular surgery. Ocular examination of both eyes was carried out one eye at a time using Snellen E chart using the peek acuity application (Peek Vision Ltd) for visual acuity and vision was tested at 2 meters initially and if the patient couldn't see the largest target presented, vision was tested again at 1 meters and if again no response light perception was checked. The above steps were in accordance with the peek acuity application. All individuals with VA of less than 6/18 underwent pin hole examination and the best improved line was documented. Torch light and 2x magnifying loupe was used for ocular and adnexal examination. IOP was measured using tonopen. Dilated lenticular and fundus evaluation with Tropicamide 1% was done for all patients with VA of less than 6/18 and no improvement with pinhole and no anterior segment findings to validate the vision. All treatable cases were referred to the nearest eye care unit with the help of the health extension workers.

Data Quality and Control

All the collected data was reviewed and checked for completeness by the principal investigator and entered into the data analysis software SPSS Version 26.0

Data Processing and Analysis

Data was cleaned, entered, coded and analyzed using SPSS Version 26.0. The data was subjected to statistical evaluation using bivariate correlation as well as multinomial and ordinal regression. P value <0.05 was considered statistically significant.

Operational Definition

WHO visual acuity classification was used by using the presenting VA of the better eye(14)

- VA ≥ 6/18 – No visual Impairment
- VA 6/18 ≤ 6/60 – Moderate Visual Impairment
- 6/60 ≤ 3/60 – Severe Visual Impairment
- VA < 3/60 – Blindness

Refractive Error – When at least one line improvement in visual acuity is noted with pinhole

Corneal blindness or visual impairment was ascribed to trachoma if patients had corneal opacity plus misdirected lashes or history of surgery for misdirected lashes. All others were considered as non-trachomatous corneal opacity.(11)

Cataract – any lenticular opacity seen after dilation.

Glaucoma - Intraocular pressure above 21.00 mmhg plus optic disc pallor

Ocular trauma – self reported previous history of any trauma involving the eye

Results

A total of 251 participants were enrolled in the study with 92% response rate. 46.6% of our study participants were in the 40-55 age group with a mean age of 57 years(Range 40-95)(See Table 1). Majority of the participants were females (67.3%). Among the study participants only 6% had a diploma or higher education, while the majority were illiterate(42.6%). Primary and secondary school education accounted for 27.5% and 11.6% respectively, while 12.4% of the study participants could read and write. 56.6% of the study participants were unemployed while 43.4% had some form of employment(Table 1).

68.5% of our study participants had a reported history of reduction of vision. From this study participants 72.7% had a history of ophthalmic evaluation. 17.1% had some form of surgery where intraocular surgery compromised the highest proportion at 58.1%, whereas 39.5% had eyelid/eyelash surgery and 2.3% had both. History of trauma and family history of ocular illness was reported in 8% and 21.5% of study participants respectively(See Table 2). 58.2% had community based health insurance(CBHI). 26.7% of our study participants had hypertension while 8.4% had a history of DM.

Table 1. Demographic Characteristics

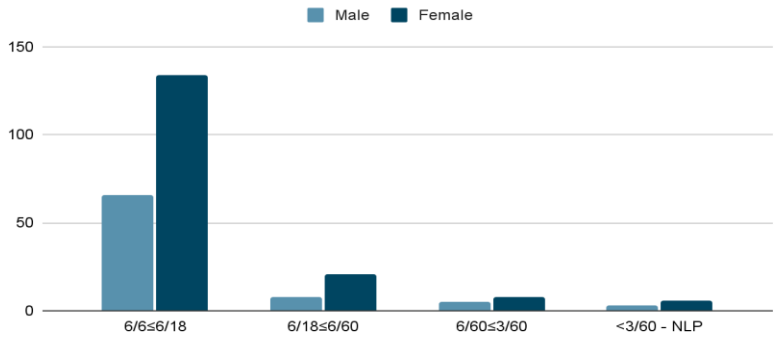
		Frequency (n)	Percentage
Age	**40 - 55**	**117**	**46.6%**
	56 - 65	**72**	**28.7%**
	66 - 75	**53**	**21.1%**
	76+	**9**	**3.6%**
Gender	**Male**	**82**	**32.7%**
	Female	**169**	**67.3%**
Education Level	**Diploma or higher**	**16**	**6.0%**
	Secondary School	**29**	**11.6%**
	Primary School	**69**	**27.5%**
	Literate	**31**	**12.4%**
	Illiterate	**107**	**42.6%**
Occupation	**Farmer**	**14**	**5.6%**
	Government Employee	**14**	**5.6%**
	Private Employee	**29**	**11.6%**
	Self-Employed	**52**	**20.7%**
	Unemployed	**142**	**56.6%**
CBHI	**Yes**	**146**	**58.2%**

	No	**105**	**41.8%**

Table 2. Ocular and Systemic History

		Frequency(n)	**Percentage**
History of Surgery	**Yes**	**43**	**17.1%**
	No	**208**	**82.9%**
History of ophthalmic Evaluation	**Yes**	**166**	**66.1%**
	No	**85**	**33.9%**
History of Trauma	**Yes**	**20**	**8.0%**
	No	**231**	**92.0%**
Hypertension	**Yes**	**67**	**26.7%**
	No	**184**	**73.3%**
Diabetes	**Yes**	**21**	**8.4%**
	No	**230**	**91.6%**

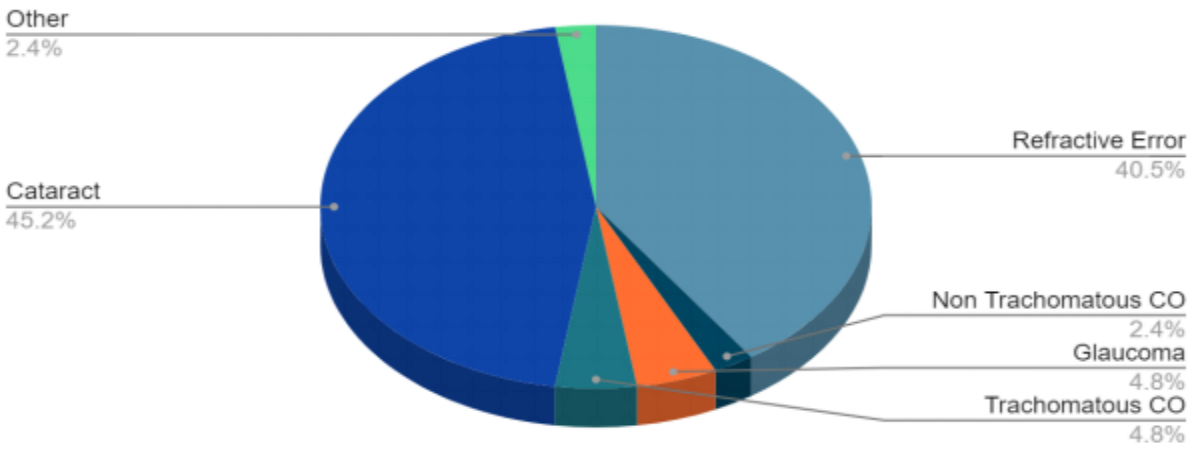
Fig 2. Visual Acuity Breakdown by Gender Based on Frequency (n)



refractive error only 34.5% had a history of spectacle use.

The total prevalence of visual impairment in our study was 16.8% which was constituted of moderate visual impairment as 11.6%(n=29)(95% CI; 8.6%,14.6%) and severe visual impairment as 5.2%(n=13)(95% CI 2.2%,8.2%) (See Fig 2). The major cause was found to be cataract (45.2%). Other causes were refractive error (40.5%), trachomatous CO (4.8%), Glaucoma (4.8%), Non-Trachomatous CO (2.4%) and Other(2.4%)(See Fig. 3). Of those who had

Fig 3. Causes of Visual Impairment



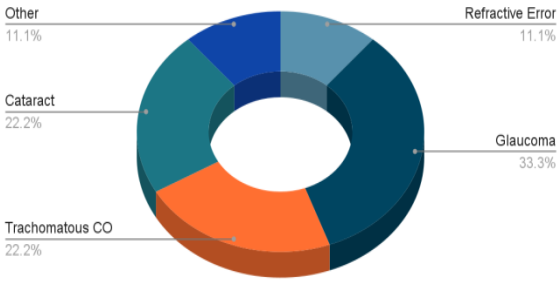
The prevalence of blindness was found to be 3.6%(n=9)(95% CI 0.6%,6.6%). The major cause was found to be glaucoma at 33.33%(n=3). Trachomatous CO and cataract were both at 22.2% (n=2). Refractive error was seen in 11.1%(n=1) and another believed to be AMD was seen in 1 case(11.1%). (See Fig. 4)

From our study participants who had either visual impairment or blindness (n=51): 41.2% had cataract, refractive error was seen in 35%, glaucoma was seen in 9.8% with mean IOP of 36.7±8.31 mm hg while trachomatous and non-trachomatous corneal opacity accounted for 7.8% and 2% respectively. The remaining 3.9% (n=1) was labeled as other. (See Table 3)

Table 3. Causes of Visual Impairment and Blindness

	Frequency	Percent
Refractive Error	18	35.3
Cataract	21	41.2
Glaucoma	5	9.8
Trachomatous CO	4	7.8
Non-Trachomatous CO	1	2.0
Other	2	3.9
Total	51	100.0

Fig 4. Causes of Blindness



Using bivariate correlation, education level(p=0.015), occupation(p=0.032) and reported history of reduction of vision(p=0.015) was found to be correlated to visual Impairment and blindness and was statistically significant. While history of ophthalmic evaluation or surgery ,history of spectacle use, history of trauma, history of hypertension, family history of trauma and CBHI had no correlation. Secondary level education was associated with better visual acuity(p=0.028).

Subanalysis showed that male sex and DM patients (AOR 2.735, AOR 1.131 respectively) were more likely to have visual impairment but this finding was not statistically significant. The odds of blindness was 5.88 more likely if study participants had family history of ocular illness than those who didn't(AOR 5.884 95% CI; 1.154-30.008).

Table 4. Correlation to Visual Impairment and Blindness

	p value		p value
Age	**<0.001**	History of Ophthalmic Evaluation	0.660
Sex	0.806	History of Trauma	0.293
	p value		**p value**
Occupation	**0.032**	History of Spectacle	0.170
Education	**0.010**	Family History	0.293
CBHI	0.230	History of Surgery	0.117
Diabetes	0.714	Hypertension	0.550

Discussion

This study was conducted to see the prevalence of visual impairment and blindness in Butajira town, Central Ethiopia and found the prevalence of visual impairment to be 16.8%. These results were comparable to results seen in Debrebirhan town 16.8%(15), Gurage Zone 12.1%(16) and St. Paul hospital 10.3%(17). Our findings of 16.8% were higher than those seen in Gish Abay town(6.7%)(18), Cameroon 3.3%(19) and Iran 6.81%(20). The higher results seen in our study as compared to Gish Abay town and Iran is most likely due to our age cutoff of 40 years, as both studies included all subjects above 18 years of age. Higher results were seen in southern Ethiopia(36.95%)(21), Ghana 28.2%(23), South Sudan 39.9%(24), India 22%(25) and Pakistan 26.7%(26). The lower results seen in our study as compared to the Sudan study can be explained by the better ophthalmic service in our study area as compared to the post conflict setting reported in the study. The lower prevalence seen in our study compared to the Southern Ethiopia study can be explained by the selection of the worst eye VA as compared to the better eye in our study and Indian study can be explained by the urban setup of our study while the later

study had a rural setting. The higher prevalence seen in the Pakistan study can be explained by the 6/12 visual acuity cut point as compared to the 6/18 cut point in our study.

The prevalence of blindness was found to be 3.6% which is similar to results seen in Nigeria 4.2%(27), Ghana 3.7%(23), Pakistan 3.4%(26). The results were lower than studies done in Gurage zone 7.9%(16), Debremarkos 11.2%(22), South Sudan(24). The lower prevalence as compared to the community study in Gurage zone can be explained by the actively functioning ophthalmic center found in Butajira town. Our results were much smaller than the South Sudan study which showed 22.9% in those above the age of 50 years. The higher cut of older age might be the reason for this higher number.

In this study cataract was the leading cause of visual impairment followed by refractive error which was also seen in other studies out of Gurage zone, Debremarkos and Cameroon(16,19,22). While the leading cause of blindness was Glaucoma followed by Cataract and Trachomatous CO, this finding was also seen in other studies(St Paul(17), Cameroon(19)). The higher prevalence of glaucoma in our study could be due to the utilization and measurement of intraocular pressure for study participants with visual acuity <6/18, in addition there is better access to cataract surgery in the study area where there is an active secondary eye care unit. Although cataract has been shown as the major cause in other studies in Ethiopia and South Sudan (11,24).

72.7% of the study participants had a history of ophthalmic evaluation which was significantly higher than the reports from Debrebirhan(32%)(15) which could be explained again by the actively running ophthalmic center in the town. There were comparable results seen in the Debremarkos study 67.3%(22). Education level was strongly associated with visual impairment which was also seen in other studies done in Gish Abay town, Debrebirhan town and Debremarkos(15,18,22).

In our study there was no association between visual acuity and history of trauma, history of ophthalmic surgery, CBHI as well as hypertension. This could be explained in part by the small sample size of the study,

Limitation of the study

The limitation of the study is the small sample size of 251 participants, because of this small sample size it was difficult to identify correlations. In addition the study was done in just the town of Butajira and thus might not represent the scenario in the rural parts of the town.

Conclusion

In conclusion this study showed the prevalence of visual impairment and blindness to be high in Butajira town. Although the small sample size might make it difficult for extrapolation it has shown the continued need for ophthalmic service as cataract and refractive error are still the leading causes of visual impairment. The findings also revealed that a significant proportion of participants in the refractive error group do not utilize spectacles, highlighting an unmet need for correction of refractive error. In addition we also like to emphasize the finding of glaucoma as the major cause of blindness which indicates further screening with IOP and disc evaluation is needed for the detection. We therefore recommend community based IOP screenings of those above 40. Further studies are also recommended to compare with the prevalence of visual impairment and blindness in the rural areas of Butajira.

Acknowledgment

We would like to acknowledge CBM(Christian Blind Mission) for the financial support for this study, we would also like to thank Addis Ababa University, Department of Ophthalmology and Butajira town health bureau for their unwavering support and our deepest gratitude goes to our study participants and to the people of Butajira

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Annex 1 – Information Sheet

Information Sheet

Title – Prevalence of Visual Impairment and Blindness in Gurage town

Investigators

1. Kirubel Tesfaye, MD, Ophthalmology Resident
2. Mulugeta Demissie, MD, Assistant Professor of Ophthalmology

Name of the Organization – Addis Ababa University

Purpose of the study – the purpose of this study is to determine the prevalence of visual impairment and blindness in Butajira town and identify the different causative factors.

Procedure - This questionnaire is prepared for collecting data to assess the prevalence of visual impairment and blindness from June 30 – May 31, 2024. The questionnaire is prepared by the principal investigator, Dr. Kirubel Tesfaye, a third-year ophthalmology resident. The answers to these questionnaires will be strictly confidential and will not have any identifier for the participants. You can refuse to be part of the study at any time during the evaluation and have the right to refuse to answer any questions. The evaluation will cause no harm to you.

Incentive – You will not be provided with any incentive or payment for participation in this research.

Person to Contact – This research will be reviewed by the IRB of the department of ophthalmology at AAU before initiation of the study. If you have any questions or enquiry, you can regard it to the health professional interviewing you or the principal investigator on the contact address listed below.

Contact

Kirubel Tesfaye

+251912026164

Email – Kirubelt1994@gmail.com

Annex 2 - Questionnaire

Addis Ababa University

College of Health Science

Department of Ophthalmology

Questionnaire

Participant ID _____

Section 1: Sociodemographic Data

1. Age _____
2. Sex
   - A. Male ☐
   - B. Female ☐
3. Education Level
   - A. Diploma or higher ☐
   - B. Secondary School ☐
   - C. Primary School ☐
   - D. Literate (can read and write) ☐
   - E. Illiterate ☐

4. Occupation
   - A. Farmer ☐
   - B. Government Employee ☐
   - C. Private Employee ☐
   - D. Self Employed ☐
   - E. Unemployed ☐

Section 2: History

1. Reduction of vision
   - A. Yes ☐
   - B. No ☐

   1.1 If Yes, Duration of visual reduction (months) _____

2. History of Surgery
   - A. Yes ☐
   - B. No ☐

   2.1 If Yes,
   - i. Eyelid/Eyelash Surgery ☐
   - ii. Ocular Surgery ☐

3. History of Ophthalmic Evaluation
   A. Yes ☐
   B. No ☐

4. History of Trauma
   A. Yes ☐
   B. No ☐

Section 3: Physical Examination

	OD	OS
Visual Acuity (Presenting)		
Pinhole Visual Acuity		
Eyelids		
Conjunctiva		
Cornea		
Anterior Chamber		
Pupil		
Lens		
Dilated Fundus Evaluation		