PREVALENCE OF BLINDNESS IN PEOPLE OVER 40 YEARS IN THE VOLTA REGION OF GHANA

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SUMMARY

In 2001, we conducted a population-based cluster survey of the prevalence of blindness and glaucoma in three districts of the Volta region of Ghana, West Africa. A secondary purpose was to assess the presenting visual acuities of individuals who had undergone extracapsular cataract extraction with an intraocular lens implant (ECCE/IOL) and intracapsular cataract extraction (ICCE). The target population consisted of 2400 adults, aged 40 years and older, of whom, 2298 (95.7%) were examined. The prevalence of moderate to severe bilateral blindness was found to be 4.4 %. The main causes of blindness were cataract and glaucoma (53.9% and 20.6%, respectively). Eighty-one percent of the blind had preventable or treatable causes. Nine percent of the population ≥40 years needed cataract surgery in one or both eyes for vision ≤6/18. The corrected prevalence of glaucoma in one or both eyes was 7.5%. There were 51 individuals who had undergone cataract surgery, all of whom had been operated in Ghana. Those who had ECCE/IOL surgery had a presenting visual acuity of 20/60 or better in 65% of eyes while those who had ICCE surgery achieved this level in only 30% of eyes [p=0.02].

Keywords: Africa, blindness, cataract, extracapsular cataract surgery, glaucoma

INTRODUCTION

There has been only one population-based survey of blindness in Ghana.[1] That study was done by non-ophthalmologists in the Brong Ahafo region of Ghana in 1991. In that study, the prevalence of blindness (<6/120 in better eye) among those 30 years and older was 1.7%. In mid-2001, we undertook a population-based study of three districts in the mid-Volta region of Ghana. The main purpose of the study was to assess the prevalence and causes of blindness. Secondary purposes were to assess the prevalence of glaucoma and the visual acuity outcomes of extracapsular cataract surgery with an intraocular lens implant (ECCE/IOL) and intracapsular cataract surgery (ICCE).

METHOD

Three ophthalmologists, 2 optometrists and 10 eye nurses participated in the field work. The country of Ghana is divided into 10 regions. This study evaluated the middle part of the Volta region which comprises three 'mountainous', ecologically similar and ethnically homogeneous districts: Ho, Hohoe and Kpando (figure 1). The sampling framework was chosen on the basis of the 1990 census, the most recent available. Population growth was extrapolated to the year 2000, yielding an estimated population of 480,000. When it was released, the 2000 census enumerated 494,000 individuals.

In the Brong Ahafo region of Ghana, among those 30 years and older, the prevalence of blindness (<6/120 in the better eye) was 1.7%.[1] We chose to study those 40 years and older and to use the American standard for bilateral blindness of ≤6/60 in the better eye.[2,3,4] Based upon an anticipated prevalence of blindness of 4.0 ± 1.0%, a power of 0.95 (95%) and a design effect of 1.5, we calculated a needed sample size of 2150 people. Our target population included 2400 individuals.

The Ho Regional Department of Health selected 12 population clusters from the three districts in locations felt to be representative. At each cluster, houses were selected by starting at a central point and choosing every third house going in four directions. A census of each house was taken by a Ministry of Health representative to enumerate individuals aged 40 and older until 200 eligible

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individuals per cluster were identified. All houses had house numbers which were used to identify them. Household members were identified by name, age, sex and occupation, and they were informed that a team would be coming to check their eyes.

Our intent was that all patients with vision < 6/18 in either eye should be refracted and examined by an ophthalmologist. The principal investigator (JPG) had worked extensively with the other two ophthalmologists (FKA and SF) as well as one eye nurse and all were trained to the same standard. Prior to beginning this study, a two-day training session was held to review the testing questionnaire, the definition of terms, the procedures and the logistics. Finally, a one-day pilot study was done at a cluster that was not part of the study.

Five vision categories were defined following the modification of Pokharel et al[3]: (1) normal or near normal vision, ≥ 6/18 in both eyes; (2) visual impairment, < 6/18 to ≥ 6/60 in better eye; ≥ 6/60 in worse eye; (3) unilateral blindness, < 6/60 in worse eye, ≥ 6/60 in better eye; (4) moderate bilateral blindness, < 6/60 in worse eye, ≤ 6/60 to ≥ 6/120 in better eye; and (5) severe bilateral blindness, counting fingers at less than 3 meters in both eyes (< 6/120).[2,3,4] It should be noted that our category 5 is the same as the WHO standard of blindness (<6/120 vision in the better eye).[1,6,7,8,9,10] By using this classification, our results would assess both the American standard for blindness (category 4) as well as for the WHO standard (category 5).

Cataract was defined as a lens opacity consistent with 20/60 or worse vision. Glaucoma was defined as any two of the following: (1) intraocular pressure (IOP) greater than 21 mm by applanation tonometry; (2) cup/disc ratio > 0.4; and (3) visual field loss consistent with glaucoma. Visual field testing was done using a confrontation method by asking the patients to count fingers in all quadrants followed by hand comparison across the vertical meridian. Gross loss of nasal field in the presence of advanced disc damage was considered diagnostic for glaucoma. Those with a high IOP or an abnormal disc and normal confrontation fields (glaucoma suspects) were referred to our base hospital for a free examination including Octopus 1-2-3 visual field testing (Interzeag, Bern, Switzerland) using tendency oriented perimetry (TOP strategy).

On the first day of each survey, examinations were performed at a central location. On days 2 and 3, teams went house to house. Trained eye nurses used a Snellen E chart in areas which were not in direct sunlight. Vision was tested without correction, with correction and, when the visual acuity was less than 6/18, with a pinhole. The presenting visual acuity was with the usual correction if the individual had spectacles. The eye examination consisted of an external examination, eversion of one upper eyelid, penlight examination of the pupils, cornea and lens, and direct ophthalmoscopy of the disc and macula. A retinoscope was used to assess media opacity and a dilated fundus examination with indirect ophthalmoscopy was done when vision was <6/18 and the cause was not obvious. Intra-ocular pressure was measured in all patients with a Schiotz tonometer by eye nurses and/or with a Perkins applanation tonometer by ophthalmologists. All eyes which were suspicious for glaucoma had applanation tensions.

This study was done between April and September 2001. Data was recorded on modified WHO eye survey forms and was checked periodically for quality by the principal investigator. In cases where a visual acuity was not entered, that individual's data was not entered. In order to assess the actual prevalence of glaucoma, a second smaller study was done in February 2002. The records of all glaucoma suspects ≥ 40 years at our base hospital with at least one Octopus visual field test were examined. An Octopus 1-2-3 machine had been installed in November 2000. We excluded cases of secondary glaucoma and used all available data. At the end of the study, all data were entered into Microsoft Excel. SPSS (SPSS Corp., Chicago, IL) was used to calculate chi-square values. Values for 95% confidence intervals and the test of two proportions were calculated manually. A "p" value of less than 0.05 was considered statistically significant.

RESULTS

A total of 2400 adults were enumerated and 2298 (95.8%) were examined. The demographics are shown in Table 1. There were 1951 individuals (84.9%) who were examined by an ophthalmologist and 347 (15.1%) who were seen by an eye nurse. The target and sample populations were 60.5% and 59.9% female, respectively. Similarly, the year 2000 census found the female: male ratio for those over 40 years to be 54.4%:45.6%. Table 2 shows the number and types of eye operations in the sample population.

Table 1 Age and sex distribution of adults in Volta regional eye survey in Ghana, 2001.

Age (years)	Male (%)	Female (%)	Total (%)
40-49	363 (39.4)	558 (40.6)	921 (40.1)
50-59	192 (20.8)	295 (21.4)	487 (21.2)
60-69	190 (20.6)	269 (19.5)	459 (20.0)
70-79	124 (13.5)	164 (11.9)	288 (12.5)
80 and over	53 (5.7)	90 (6.5)	143 (6.2)
Total	**922 (100)**	**1376 (100)**	**2298 (100)**

Table 2 Prior eye surgery among 2298 adults in the Volta region of Ghana in 2001.

Eye surgery	Number of operated eyes (%)
Intracapsular cataract extraction	31 (36%)
ECCE/IOL	20 (23%)
Glaucoma surgery	9 (10%)
Pterygium	8 (9%)
Couching	7 (8%)
Evisceration	1 (1%)
Unknown	10 (12%)
Total	**86 (100%)**

Table 3 lists the prevalence of visual impairment and blindness by age and sex using the presenting visual acuity. The prevalence of moderate to severe bilateral blindness was 4.4% (C.I.=3.6 – 5.2%) while that for severe bilateral blindness was 2.8% (C.I.=2.1 – 3.5%). There was no significant difference in the prevalence of blindness among the three districts (Chi-square=4.6; p=0.10). There was a trend towards a higher prevalence of blindness among males compared to females (3.6% vs. 2.3%, respectively) but this difference was not statistically significant (Chi-square=2.785; p= 0.06).

Table 4 lists the causes of blindness for those individuals categorized as having either moderate or severe bilateral blindness. Cataract was the most common cause for those with either unilateral blindness or visual impairment, (N= 81 of 165 and 110 of 308 individuals, respectively)[49.1% and 35%].

Table 4 Diagnoses for 102 individuals with moderate to severe bilateral blindness in the Volta region of Ghana, 2001.

Diagnosis	Number of individuals (N=102)	%
Cataract	55	53.9
Glaucoma	21	20.6
Uncorrected aphakia	10	9.8
Retinal disorders	9	8.8
Optic atrophy	9	8.8
Refractive error	7	6.9
Iatrogenic	4	3.9

Diagnoses add up to more than 102 because some individuals had more than one cause in each eye.

Schiotz or applanation tensions were available in 2287 (99.5%) individuals. Optic disc evaluations were available in 2217 (96.5%) individuals. The prevalence of glaucoma is seen in Table 5. Ninety-five individuals had bilateral glaucoma, (4.1%, C.I.=3.3 – 4.9) and 19 had unilateral glaucoma (0.8%, C.I.=0.5 – 1.2%), yielding a total prevalence of 5.0% (C.I.=4.1 – 5.8%). In addition, there were 252 glaucoma suspects (11.0%, C.I.=9.7 – 12.2%). All glaucoma suspects were referred for computerized visual field testing with the Octopus 1-2-3, but only 13 individuals came.

The results of the 2002 study on glaucoma at the

Table 3 Visual impairment and blindness prevalence by age and sex in the Volta region of Ghana, 2001

	Normal/near normal	Visual impairment	Unilateral blindness	Moderate bilateral blindness	Severe bilateral blindness
Age:					
40-49	869 (94.4%)	23 (2.5%)	20 (2.2%)	1 (0.1%)	8 (0.9%)
50-59	394 (80.9%)	59 (12.1%)	29 (6.0%)	1 (0.2%)	4 (0.8%)
60-69	303 (66.0%)	97 (21.1%)	45 (9.8%)	7 (1.5%)	7 (1.5%)
70-79	129 (44.8%)	83 (28.8%)	40 (13.9%)	12 (4.2%)	24 (8.3%)
80+	28 (19.5%)	46 (32.2%)	31 (21.7%)	16 (11.2%)	22 (15.4%)
Sex:					
Male	677 (73.4%)	118 (12.8%)	78 (8.5%)	16 (1.7%)	33 (3.6%)
Female	1046 (76.0%)	190 (13.8%)	87 (6.3%)	21 (1.5%)	32 (2.3%)
All	1723 (75.0%)	308 (13.4%)	165 (7.2%)	37 (1.6%)	65 (2.8%)
All (best corrected or pinhole)	1872 (81.5%)	206 (9.0%)	153 (6.7%)	22 (1.0%)	46 (2.0%)

Normal or near normal vision ≥ 6/18 in both eyes; Visual impairment < 6/18 to ≥ 6/60 in better eye, ≥ 6/60 in worse eye; Unilateral blindness, < 6/60 in worse eye, ≥ 6/60 in better eye; Moderate bilateral blindness, < 6/60 in worse eye, ≤ 6/60 to ≥ 6/120 in better eye; and Severe bilateral blindness = counting fingers < 3 meters in both eyes (< 6/120).

base hospital are shown in Table 6. This data was used to correct for all glaucoma suspects in our sample population, according to subgroup. Thus, of the 217 glaucoma suspects who had an increased cup/disc ratio, 52 should have had glaucoma and of the 35 glaucoma suspects with increased IOP, 10 should have had glaucoma. Hence, the corrected prevalence of glaucoma for our population was 176 of 2298 (7.6%, C.I. = 6.5 - 8.5%).

Table 5 Prevalence of glaucoma and glaucoma suspect among 2298 people in the Volta region of Ghana in 2001.

	Number of individuals (%) [number of eyes]
Glaucoma of both eyes	95 (4.1)
Glaucoma of one eye	19 (0.8)
Glaucoma suspect – one or both eyes	252 (11.0) [393]
-based on IOP:	35 [63]
-IOP 22 to 29mm, C/D=0 to 0.2	16 [26]
-IOP 22 to 29mm, C/D 0.3 to 0.4	9 [17]
-IOP 30 mm +, C/D = 0 to 0.2	5 [10]
-IOP 30 mm +, C/D = 0.3 to 0.4	5 [10]
-based on C/D:	217 [336]
-0.5	128 [191]
-0.6	40 [64]
-0.7	29 [48]
-0.8	9 [15]
-0.9+	11 [18]

Table 6 Visual field (VF) outcomes of 89 glaucoma suspects seen at Margaret Marquart Catholic Hospital, Volta region

	# of people	**Normal VF (%)**	**Glaucomatous VF (%)**
C/D = 0.5	13	11 (84.6)	2 (15.4)
C/D = 0.6	20	16 (80)	4 (20)
C/D = 0.7	9	7 (77.7)	2 (22.3)
C/D = 0.8	5	1 (20)	4 (80)
C/D = 0.9+	3	0 (0)	3 (100)
IOP 22 to 29mm, C/D=0.0 to 0.2	6	6 (100)	0 (0)
IOP 22 to 29mm, C/D=0.3 to 0.4	16	10 (72.5)	6 (37.5)
IOP 30 mm +, C/D=0.0 to 0.2	7	5 (71.4)	2 (28.6)
IOP 30 mm +, C/D=0.3 to 0.4	10	5 (50)	5 (50)

Fifty individuals had large cup/disc ratios in one or both eyes and normal intraocular pressures in both eyes while 39 individuals had normal cup/disc ratios and high intraocular pressures. Patients are classed according to Octopus 1-2-3 results using the worse eye for assessment.

Finally, we looked at the presenting visual acuities of patients who had undergone ICCE and ECCE/IOL surgery. The results are seen in Table 7: thirteen of 20 ECCE/IOL eyes (65%) had a presenting vision of 6/18 or better compared to 10 of 31 ICCE eyes (30%). While these numbers are small for statistical analysis, the test of two proportions showed that the difference was statistically significant (p=0.02).

Table 7 Presenting visual acuities in 31 eyes which had intracapsular cataract extraction (ICCE) and 20 eyes with extracapsular cataract and intraocular lens surgery (ECCE/IOL) in the Volta region of Ghana, 2001.

Visual Acuity	**ICCE [N=31eyes]**	**ECCE/IOL [N=20eyes]**
6/6 to 6/12	6 (19%)	8 (40%)
6/15 to 6/21	4 (11%)	5 (25%)
6/24 to 6/60	4 (11%)	5 (25%)
<6/60 but > CF 3m	1 (3%)	-
CF < 3 meters	11 (35%)	-
HM or LP	3 (10%)	2 (10%)
NLP	2 (6%)	-

The causes for visual acuities of < 6/18 in the two groups are seen in Table 8. Finally, we found that only 3 of the 7 couched eyes had good anatomic outcomes with presenting or pinhole acuities of >6/60. The remaining 4 eyes had visual acuities of either light perception or no light perception.

Table 8 Causes of presenting visual acuity of less than 6/18 in 21 eyes that had intracapsular (ICCE) surgery and 7 eyes that had extracapsular cataract surgery with an intraocular lens (ECCE/IOL).

Diagnosis	**ICCE (N= 21 eyes)**	**ECCE/IOL (N=7)**
Refractive error	3	4
Uncorrected aphakia	11	-
End stage glaucoma	4	-
Retinal detachment	2	-
Aphakic bullous keratopathy	1	1
Optic atrophy	-	1
Cystoid macular edema	-	1

DISCUSSION

In the Volta region, the prevalence of moderate to severe bilateral blindness (≤6/60 OU) among those 40 years and older was found to be 4.4%. Eighty-one percent of the blind had preventable or treatable causes in one or both eyes, including cataract (53.9%), glaucoma (20.6%) and refractive error (6.9%)[Table 4]. The prevalence of severe bilateral

blindness (<6/120 OU) was 2.8%. This is higher than others have reported for West Africa (Table 9), which reflects the older age of our population.

In the only available population-based survey from Ghana (1991), Moll found the prevalence of severe bilateral blindness (<6/120 OU) for those 30 years and older to be 1.7%[1]. The major causes were cataract (62.5%), onchocerciasis (12.5%), corneal opacity (8.2%) and refraction (4.2%). The absence of glaucoma as a causative factor for blindness in Moll's study may be attributed to the fact that this study was done by non-ophthalmologists.

To the best of our knowledge, this is the first study which has assessed the prevalence of glaucoma in any West African country[5]. Among those 40 years and older, we found a corrected prevalence of glaucoma of 7.6%. This is consistent with what has been found in Barbados (7% in those 40 years and over)[6,7] and St. Lucia[8] (8.8% in those 30 years and over), two Caribbean island nations populated by descendents of West Africans. Moreover, in this study, glaucoma was the second leading cause of blindness, affecting 20.6% of the blind in at least one eye. Reports from Togo[9] and Cameroon[4] are similar. In both, glaucoma was the second leading cause of blindness. These reports indicate that glaucoma is a serious public health problem in West Africa.

To the best of our knowledge, this is also the first population-based report to compare the outcomes of ECCE/IOL and ICCE surgery in West Africa. It should be noted that all of the patients in this report had their cataract surgeries done in Ghana and that nearly all were operated in the Volta region with about one-quarter of the eyes being operated by each of the three authors (JPG, SF, FKA); the remainder were operated at various sites throughout Ghana. The outcomes of cataract surgery were assessed by comparing the 'presenting visual acuity,' defined as the visual acuity with the usual prescription where glasses were available. Our data showed that 13 of 20 eyes (65%) which had ECCE/IOL surgery had ≥6/18 presenting vision while only 10 of 31 eyes (32%) which had ICCE surgery achieved this level (Table 7). The difference was statistically significant (p=0.02). However, since the numbers are small, one must be careful in drawing conclusions. As with other reports, most of the poor visual outcomes in the ICCE group were from uncorrected aphakia due to lost or broken spectacles (Table 8)[3,10].

Two recent audits of ECCE/IOL surgery, one from Ghana by the principal investigator[12] and the other from East Africa,[13] found that more than 70% of eyes achieved 20/60 or better uncorrected vision following ECCE/IOL surgery. These results show that it is possible to have excellent visual outcomes with ECCE/IOL surgery in Africa. At the same time, it remains to be proven that good results are generally being obtained with intraocular lens implant surgery throughout Ghana and Africa. Additional population-based surveys are needed. Finally, it should be noted that 4 of 7 eyes (57%) which had been couched were hopelessly blind. This suggests that couching is not a good option for Africa.

Strengths and weakness of the study

In our study, our end-points for blindness used well recognized objective criteria.

The end-points for diagnosing glaucoma in our study were problematic. In the developed world, formal perimetry, preferably with computerized visual field testing on two separate days, is needed to confirm the diagnosis of glaucoma. Due to financial and technical constraints, this was simply not possible in our circumstances. We relied on confrontation visual field testing to assess gross visual field loss in order to diagnose glaucoma. If anything, this would tend to underestimate the prevalence of glaucoma. For glaucoma suspects, we extrapolated from clinic data to arrive at a corrected value for the prevalence of glaucoma. This method seems reasonable, but it is not proven. Future studies should perform perimetry in the field as part of their protocol.

The results of our study were also weakened by the non-random selection of the target population. Clusters were chosen empirically in each district and individual houses were chosen starting at a central point and selecting every third house. Since these are non-random methods, it weakens our data. Even so, since there was no bias to select one population over another, and since the population appears homogeneous, we believe our results are probably generalizable.

Causes of blindness and proposed interventions

Cataract

This study again confirmed that cataract is the most common cause of blindness in Africa.[14] Of the 102 moderately or severely bilaterally blind individuals, 55 (53.9%) had cataract as the cause in one or both eyes. Of 165 unilaterally blind individuals, cataract was present in 81 (49.1%). And

of the 308 people with visual impairment, 110 (35%) had cataract. Thus, about 2.4% of those over 40 years need cataract surgery for bilateral blindness, 3.5% for unilateral blindness and another 3.1% for visual impairment, yielding 9.0% of those over 40 years who would benefit from cataract surgery.

Currently, the eye care needs of the Volta region (population 1.6 million) are being met by three ophthalmologists who perform about 600 ECCE/IOL surgeries annually. Since there are about 36,000 individuals in the Volta region who need cataract surgery, there is a compelling need to increase the volume of cataract surgery.

It is our belief that increasing the cataract surgical rate (CSR) will require multiple interventions. Perhaps the most important is to offer financial incentives for all members of the eye care team to increase cataract surgical outputs. Next, since Ghana boasts more eye nurses than ophthalmologists, and since Ghanaian law restricts the practice of surgery to physicians, eye nurses should be trained to manage routine post-operative cataract cases. This would have the dual benefits of freeing additional surgical time for ophthalmologists while allowing many patients in remote areas to get their post-operative care more easily. In addition, eye nurses and optometrists should be given more training in the pre-operative evaluation of cataract patients for surgery. And, of course, more ophthalmologists must be trained. In addition, we believe that surgery centers should be established in metropolitan areas of Africa dedicated solely to performing high quality ECCE/IOL and/or phacoemulsification/IOL surgery.

Finally, the cost of cataract surgery must be considered. Cataract surgery is, after all, a commodity. And as costs go up, fewer people are able to purchase this commodity. In rural areas of Ghana, the cost of ECCE/IOL surgery varies from $30 to $60 (personal observation). If the charge for cataract surgery could be reduced, it is likely that more people would access the surgery.

Glaucoma

Glaucoma was the second leading cause of moderate to severe bilateral blindness, affecting 21 of the 102 bilaterally blind individuals (20.6%). The absolute prevalence of glaucoma was 5.0% while another 11.0% were glaucoma suspects. The corrected prevalence for glaucoma was found to be 7.5%.

Solving the problem of glaucoma will not be easy. Mass screenings would help to identify individuals early in the course of the disease. However, telling people that they are at risk for glaucoma or that they have early glaucoma seems to generate little interest. Mass education about the insidious nature of glaucoma would probably have some effect. However, people who are struggling to meet their daily needs often consider it an unaffordable luxury to take time and money to treat a condition that is not yet causing vision loss. For those diagnosed with glaucoma, the cost of treatment is considerable. Medications are expensive which often causes rural Ghanaians to quickly tire of taking treatment. For those with impending blindness, glaucoma surgery, preferably with antimetabolites, seems to be the only option[15]. Having said this, it must be acknowledged that the acceptance of glaucoma surgery in Africa, even when offered free, tends to be poor.[4] Finally, little international effort is being made to encourage national ophthalmologists to address the problem. Specifically, "Vision 2020: The Right to Sight," an initiative of the WHO, does not even mention glaucoma as one of its priorities[4].

Refractive error/uncorrected aphakia

Refractive error / uncorrected aphakia was the next most common cause of moderate to severe bilateral blindness. Seventeen individuals (16.7%) had either refractive error or uncorrected aphakia as the primary cause of blindness in one or both eyes. Uncorrected aphakia was the most common problem (N=10 individuals) with 2 of 6 bilaterally aphakic individuals (33%) not wearing spectacles because they were broken. This is consistent with other reports from the developing world where 30 to 50% of aphakic individuals do not have useable aphakic spectacles.[14]

Other causes of blindness

Retinal problems (8.8%), optic atrophy (8.8%), corneal opacity (6.9%) and iatrogenic blindness (3.9%) were less common causes of moderate to severe bilateral blindness. While we found no cases of definite onchocerciasis, this condition may have accounted for some of the cases of bilateral optic atrophy. The elimination of onchocerciasis from most of Africa is a much celebrated triumph for the WHO[16].

Trachoma, a common cause of blindness in northern Ghana, was not found in the middle Volta region. Only one case of inactive trachoma was found in this survey, and that individual had lived for many years in northern Ghana. In addition, we

noted no cases of blindness from vitamin A deficiency or measles. This is almost certainly due to the generous use of palm oil in the local diet, which is rich in vitamin A. There were, however, four cases of iatrogenic blindness. Two individuals were bilaterally blind from couching, a third had couching in one eye and a mature cataract in the fellow eye and the fourth had complications of ICCE surgery in one eye and complications of ECCE/IOL surgery in the fellow eye. Such cases reinforce the need for increased availability of quality, low-cost ECCE/IOL surgery in Africa.

CONCLUSION

Our study found that cataract is the main cause of blindness in the Volta region. Nine percent of the population over 40 years would benefit from cataract surgery in one or both eyes. Glaucoma is the second leading cause of blindness. Finally, the presenting visual acuities of eyes which had ECCE/IOL surgery were significantly better than eyes which had ICCE surgery.

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