Postoperative vision outcomes after cataract surgery in the Eastern region of Ghana

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Abstract

Background

The reporting of cataract surgical outcomes serves as quality control checks to optimize postoperative vision outcomes and/or minimize ensued complications. However, there is paucity of data from low-and-middle-income countries such as Ghana. This study determined postsurgical visual outcomes after cataract surgery and assessed factors associated with poor postoperative visual acuity in the Eastern region of Ghana.

Methods

The study gathered data by mixed methods approach; quantitative and qualitative. Systematic random sampling was used to select 384 medical folders of patients who underwent cataract surgery from January 1 to December 31, 2017 in selected hospitals with ophthalmologists in the eastern region of Ghana. A pretested questionnaire was used to collect postoperative vision outcome data. Similarly, a key informant interview guide was employed to gather relevant ophthalmic expert views on predictors of postoperative outcomes using the World Health Organization cutoffs. Quantitative data were summarized with descriptive statistics (means, frequencies, percentages) and a logistic regression model. Qualitative data was explored with thematic or content analysis. Cataract surgical outcomes were measured based on visual acuity six weeks after surgery.

Results

Good postoperative visual acuity ($\geq 6/18$), borderline ($6/24$ - $6/60$), and poor visual outcomes ($< 6/60$) were estimated at 71.6%, 26.8%, and 1.8%, respectively. The major systemic comorbidities were hypertension (21.4%) and diabetes (9.4%), whereas the determinants of poor visual outcomes were postsurgical complications, biometry, comorbid, and complications during surgery. Only postsurgical complication (OR = 1.72, $p = 0.000$) was significantly associated with poor postoperative visual acuity. Further, ophthalmic surgeons reported postsurgical complications (90.0%) as the significant risk factor to sub-standard visual outcomes in the region.

Conclusions

Although our results showed satisfactory postoperative visual acuity after cataract surgery, nearly one-third had borderline and poor visual outcomes. Hence, measures needed to improve borderline cases and further mitigate complications associated with poor postoperatively visual acuity are warranted.

Background

Globally, cataract is the leading cause of blindness and second to refractive errors as the primary cause of vision impairment[1-3]. Cataract remains the commonest cause of blindness in sub-Saharan Africa and accounts for two-fifths of all blindness within the region[4, 5]. The prevalence of cataracts varies

across geographical areas[6, 7]. Refractive errors are recognized as a predisposing factor for cataracts among people of all ages[8]. The increased burden of refractive errors [4] and higher life expectancy [9] in sub-Saharan Africa could increase the burden of cataract.

Cataract surgeries are conventional means to restore vision in patients with untreated cataracts. Despite the improvement in cataract surgical services in the past decade, there remains an unmet need for cataract treatment in lower-and-middle-income regions[9, 10]. The advancement in cataract surgical procedures and state-of-the-art technologies, and the availability of cataract management protocols has caused a drift towards the monitoring of post-operative vision outcomes[11, 12]. The evaluation of post – cataract surgical outcomes is an essential marker for qualitative control among ophthalmologist and for standardizing care receive by patients [13].

The World Health Organization has institutionalized guidelines to monitor cataract surgical outcomes (CSOs). In particular, the protocol recommends that, during the preoperative and twelve weeks of postoperative periods, surgeons should aim at the following postoperative vision cutoffs: (a) good outcomes – 6/6-6/18; greater than 80% and 90% with available correction and best correction respectively, (b) borderline- <6/18 – 6/60; less than 15% and 5% with accessible correction and optimal correction respectively, (c) poor - <6/60; less than 5% with available correction and best correction precisely[13].

Although several authors have investigated postoperative vision outcomes previously, discrepancies exist in their reported outcomes, limiting the applicability of their results[14-17]. Similarly, previous results are diverse and mixed among the various risk factors that have been suggested as influencing poor visual outcomes after cataract surgery[14-17]. Whereas regional-specific findings remain critical in administrative and healthcare planning, data are generally scarce in Ghana. Hence, this study assessed postoperative vision outcomes after surgery and explored factors associated with poor visual outcomes. The findings from the study will serve as a quality control check among surgeons performing cataract surgery and present an opportunity to optimize vision outcomes among recipients of cataract surgery.

Methods

Study design

The study used mixed methods to collect data (quantitative and qualitative). Patients' medical records which included their biographical (age of the patient, gender, district and occupation) and clinical (preoperative visual acuity, type of surgical technique used, postoperative visual acuity, diabetes status, hypertension status, pre-existing ocular comorbidities, and complications during and after surgery) data were extracted through a thorough medical record review. A key informant interview was conducted to obtain in-depth information on the determinants of cataract surgical outcomes and the cause of poor postoperative visual acuity.

Study setting

The Eastern region is one of the sixteen regions of Ghana with a population of 2,633,154 according to the 2010 population census[18]. The region has over 26 districts, 136 sub-districts (Figure 1), 31 government hospitals and 19 operational eye clinics with five ophthalmologists sparsely distributed across the zonal areas. Overall, five health facilities, namely the Eastern Regional Hospital Koforidua New Juaben District; St. Dominic's Hospital, Akwatia in the Kwaebibrem District; Nsawam Government Hospital, Nsawam in the Akwapim South District; Volta River Authority (VRA) Hospital, Akosombo in the Asuogyaman District; Tetteh Quarshie Memorial Hospital, Akuapem Mampong in the Akuapem North District, were included in our study.

Eligibility criteria

All hospitals within the region that had at least one ophthalmologist and performed cataract surgeries between January 1 and December 31, 2017 were eligible for inclusion in the medical record reviews and key informant interviews. Only ophthalmologists and ophthalmic nurses were considered legit to provide surgical outcomes hence these two groups were included for the key informant interview.

Participant recruitment

According to the Ghana National Eye Care Secretariat's Data Register, 1028 cataract surgeries were performed in the Eastern Region in 2016. Similarly, an earlier study in Ghana that reviewed 1288 cataract extraction cases estimated 41.2% of patients to have had very good postoperative vision outcomes [19]. This proportion has been used in this study to calculate the sample size from the Cochran single proportion formula $n = z^2 p(1-p)/e^2$; where n is the sample size; z , the normal standard deviation at a 95% confidence interval; p , prevalence estimate from previous studies – 42.1% [19]; e , margin of error at 5%. Overall a total of 447 patient medical records were considered for review after a 20% allowance for missing information. Of note, five ophthalmic nurses from five of the selected facilities were trained as research assistants on extracting data from patient records. Research assistants were tasked to send list of all patients who received cataract surgery in their respective facilities in 2017. The list from all the five facilities was put together, and patient names were sorted alphabetically to create a sample frame. The sample frame included all 1028 names of patients who had cataract surgery between January 1 and December 31, 2017. A proportion-to-size computational approach and at a sampling interval of 2, $K=1028/447$ was used to obtain the study sample. A research assistant extracted data from the completed questionnaires. Sixty-three clinical records (14%) were excluded as a result of incomplete information leaving with 384 that were included for final analyses. Further, for the qualitative part of the study, in total, ten ophthalmologist and/or ophthalmic nurses were purposively recruited for in-depth key informant interviews.

Data collection and management

Data collection spanned from January to December 2017. A pretested data abstraction form was used to extract cataract surgical outcomes data from patients' medical records. Similarly, a key informant interview (KI) guide (a qualitative-in-depth interview toolkit used to gather individual-level information) were employed to ascertain ophthalmic experts' view on factors affecting cataract surgical outcomes. The KI tool covered on protocol for cataract surgeries, factors affecting cataract surgical outcomes, common causes of poor cataract surgical outcomes, areas for improvement in cataract surgeries, availability of monitoring tools, and routine evaluation of cataract surgical outcomes. The postoperative vision cutoffs for this study were categorized as: (a) good outcomes – 6/6-6/18; greater than 80% and 90% with available correction and best correction respectively, (b) borderline- <6/18 – 6/60; less than 15% and 5% with accessible correction and optimal correction respectively, (c) poor - <6/60; less than 5% with available correction and best correction precisely. Hard copies of the filled data abstraction form were kept under key and lock, and KI audio files were protected with a password. Raw data entries were protected by an alphanumeric string password accessible only by the principal investigator.

Quality control

The data abstraction form and the KI guide for the study were both pretested at the Begoro District hospital. The difficulties in application and inconsistencies identified after the pretest were used to revise the data abstraction questionnaire and KI guide. The final questionnaire and interview guide were checked for their validity, and internal consistency was ascertained by Cronbach's alpha. All data gathering tools were prepared in English and they did not require translation. A checklist was used to double-check the quantitative data extracted by research assistants. Thematic analyses from key informant interviews were made by the principal investigator alone to minimize errors.

Ethics approval

Ethical approval was obtained from the institutional review board of the Ghana Health Service (Reference - GHS-ERC 160/12/17). Permissions were sought from the management of the selected hospitals before patient medical records were reviewed. Written informed consent was obtained from all key-informants, and participation was voluntary. All protocols adhered to the tenets of the declaration of Helsinki.

Data analysis.

Microsoft Excel 13 and STATA version 15 (StataCorp LLC, College Station, TX77845, USA) statistical software was used to analyze data. Descriptive statistics, means, frequencies and percentages, were used to summarize participants' baseline characteristics. Logistic regression models were used to investigate predictors of poor postoperative vision outcomes. Crude and adjusted odds ratio with their

95% confidence intervals (CIs), were generated at a significance of $p < 0.05$. Content analysis was used to interpret qualitative data following these steps: (i) transcribing key-informant interviews to obtain an overall impression; (ii) identifying the meaning of coding unit; (iii) amalgamating and summarizing the content of each code to give insight and reflect the apparent significant factors from the KI.

Results

Out of 384 clinical records of patients that received cataract surgery from recruited hospitals in the Eastern Region of Ghana between January and December 2017 and included in our study, 63.0% (242/384) were females, and 37% males (Table 1). Majority of the reviewed cases were older adults with age ranging between 70 and 79 years, with only 0.6% below 40 years. Most, 42.5%, 35.4%, and 18.0% were pensioners, farmers, or traders, respectively. A large number of the participants (55.7%) were from the Kwaebibrem district, with Akwapim north electoral area having the least number of participants 22 (5.7%).

Table 1

Baseline characteristics of participants from selected health facilities in the eastern region of Ghana

Characteristic	n	%
Age (years)		
10-19	1	0.3
20-29	0	0.0
30-39	1	0.3
40-49	19	4.9
50-59	69	18.0
60-69	104	27.1
70-79	125	32.6
80-89	60	15.6
>90	5	1.3
Gender		
Male	142	37.0
Female	242	63.0
Occupation		
Farmer	136	35.4
Trader	69	18.0
Teacher	8	2.1
Driver	5	1.3
Mechanic	1	0.3
Student	2	0.5
Retired	163	42.5
District		
Kwaebibrem	214	55.7
New Juaben	55	14.3
Akwapim south	42	10.9
Akwapim north	22	5.7
Asuogyaman	51	13.3

n = number of participants; % = percentage

The predominant commodities among patients were hypertension (21.4%) and diabetes (9.4%). Majority (71.6%) had good postoperative visual outcomes of 6/6 to 6/18 whereas a fewer minority (1.6%) had a visual acuity below 6/60 (Table 2). Postsurgical complications (48.6%) and biometry (38.5%) were the major determinants of poor surgical outcomes and fewer (0.9%) of them attributed to during surgery complications.

Table 2

Cataract surgical outcomes of participants attending selected health facilities in the eastern region of Ghana

Cataract surgical outcomes	n	%
Comorbidities		
Hypertension	82	21.4
Glaucoma	2	0.5
Retinal Disease	2	0.5
Diabetes	36	9.4
None	262	68.2
Postoperative visual acuity		
Good outcome (6/6 - 6/18)	275	71.6
Borderline outcome (6/24 - 6/60)	103	26.8
Poor outcome (5/60 - NPL)	6	1.6
Determinants of poor visual outcomes		
Co-morbidities	13	11.9
Intraoperative complications	1	0.9
Biometry	42	38.5
Post-surgery complication	53	48.6

n = number of participants; % = percentage

The demographic characteristics of key informants, and their expert views on the determinants associated with poor cataract surgical outcomes have been reported (Table 3). The mean age of experts enrolled in our study was 47.1±7.9 years. Most (66.7%) were females, and a slight majority aged 51-60 years. Approximately thirty-four percent (33.4%) were from the Akwapim north district and with an equal

minority (22.2%) from Kwaebibirem, New Juabeng and Asuogyamang districts of the Eastern region of Ghana. Majority (90.0%) of experts identified postsurgical complications as the main cause of poor visual outcomes followed by comorbidities (80.0%) and a fewer (10.0%) highlighted maturity of cataract and use of traditional based medicine as a predisposed factor to worse cataract surgery outcomes.

Table 3

Demographic characteristics of key informants and cataract surgery related factors

Variables	n	%
Age (mean $\pm$ SD)	47.1 $\pm$ 7.9	
Age group (years)		
30 -40	2	22.2
41-50	3	33.3
51-60	4	44.4
Gender		
Female	6	66.7
Male	3	33.3
Districts		
Kwaebibrem	2	22.2
New Juaben	2	22.2
Asuogyaman	2	22.2
Akuapem north	3	33.4
Determinants of surgical poor outcomes by key-informants		
Co-morbidities	8	80.0
Post-surgical complication	9	90.0
Biometry	4	40.0
Complications during surgery	4	40.0
Maturity of cataract	1	10.0
Use of traditional eye medicine	1	10.0

SD, standard deviation; n, frequency of response; %, percentage of response

Table 4. presents result of logistic regression model, showing the factors associated with poor postoperative visual acuity. All factors (comorbidities, biometry, surgical complications during surgery) were not significantly associated with postoperative visual acuity. However, the association between postsurgical complications and postoperative visual acuity was statistically significant. Thus compared with subjects that undergone cataract surgery without postsurgical complications, persons who had postsurgical complications were 72% (OR=1.72, p=0.000) more likely to experience poor postoperative visual outcomes.

Table 4

Association between determinants of poor surgical outcomes and post-operative visual acuity

Determinants of poor post-operative visual outcomes	OR	95 % CI	p-value
Comorbidities	1.09	0.07-1.22	0.130
Biometry	0.62	0.34-1.12	0.115
Surgical complication during surgery	1.39	0.67-2.88	0.379
Post-operative complication after surgery	1.72	1.48-2.01	0.000

OR, Odds Ratio; CI, Confidence Interval; Statistical significance employed logistic regression at a significance at $p < 0.05$

Protocol for cataract surgery

This section presents experts' thematic summary of the surgical protocols utilized in cataract surgery/management. Patients were counselled on the surgical procedures to be employed and the anticipated postoperative visual outcomes. Subsequently, upon a voluntary written and signed patient consent forms, subjects' preoperative visual acuity is measured. All prospective cataract candidates then undergo anterior and posterior segment examination using slit-lamp Biomicroscopy and ophthalmoscopic procedures respectively. Instances, where patients present with matured and/or hypermatured cataract light projection test was used to ascertain the integrity of the retinal quadrants in the corresponding visual field. Additional tests such as intraocular pressure, blood pressure and fasting blood sugar levels are assessed together with biometry to quantify the dioptric power of the intraocular lens. Further, under an aseptic conditions a sterilized fresh topical anesthetic agents are applied on patients eyes to achieve a local anesthesia prior to surgery. Cataractous lens were removed and replaced with an intraocular lens of equivalent dioptric power.

Based on the surgical techniques sutural or non-sutural procedures are used. Consequently, fresh topical antibiotics and anti-inflammatory eye drops are given to avoid postoperative secondary infections and inflammatory reactions. Eyes are padded with an eye shield and removed on the early mornings of postoperative day 1. Reminders on the dos and don'ts are given to receivers of cataract surgery during

their six weeks' postoperative period. On postoperative day 1, patients' visual acuity is assessed and respectively scheduled for a second postoperative review. Third, and fourth postoperative reviews are planned in two and three weeks' interval respectively. After six weeks of surgery, visual acuity was expected to be stable and all wounds healed. Refractive correction was given to those with residual refractive error.

Improving Services

It was suggested that to improve services, biometry should be taken and done well. Health education and creating awareness on the importance of regular eye checks should be encouraged so that any pre-existing eye diseases are identified and dealt with at an early stage. Counseling should be properly done and relatives advised to encourage their wards to conform to instructions given after surgery.

Access to Monitoring Tool

When asked if they had access to monitoring tool for cataract surgical outcomes, there was a unanimous response on their availability, however, none of the toolkits was used regularly. The reason for their action was attributed to tight surgery hours, forgetfulness, and the comprehensive nature of these forms (example the WHO cataract monitoring tool). On the other hand, most suggested a succinct yet detailed form will be feasible for their practice.

Discussion

The study presents data on visual outcomes after cataract surgery, and explore factors associated with poor postoperative visual acuity among cataract patients in the Eastern region of Ghana. The results showed majority had good visual outcomes, and about one-fifth had unsatisfactory postoperative visual acuity; with vision ranges lower than 6/18 to no perception of light. Regression analysis, showed a statistically significant association between postsurgical complications and poor visual outcomes. Furthermore, eye cardres pointed postsurgical complications as the primary determinant of worsen postoperative visual acuity.

Recently, the attention of cataract management has shifted from the promotion of uptake of cataract services to optimization of postoperative vision outcomes with minimize ensued complications. Multiple factors such as the type of cataract surgery, expertise of the operating surgeon, anesthetic procedures, comorbidity, intraoperative complications, biometry, preoperative functional vision status, patient biophysical health parameters are proposed to predispose cataract patients to an unsatisfactory visual outcome after surgery[20]. However, the overall role of the aforementioned elements in the outcomes of cataract surgeries are mixed, sparse, and with regional and geographical variations[14]. Given, that outcomes of surgery are considered as benchmarks to assess the quality of surgeries, and an avenue to

improve existing systems the presents evidence remains critical in hospital administrative planning and healthcare service delivery more generally.

Most benefactors of cataract surgery in our study had visual acuity 6/18 or better postoperatively. This finding are comparable with a studies from Liberia[14], India[21], and Kenya[22]. For example, Khanna et al [14], showed 63.5% cataract subjects to have uncorrected postoperative visual acuity better than 6/18 and a significantly higher proportion (88%) with best corrected visual acuity after surgery. Similarly, a study by Yorston et al, reported an increasing trend in optimal visual outcomes, from 77 to 90% during the second and fourth quarter of postsurgical periods[22]. On the other hand, our results contrast with a findings from Cameroon by Fortane and colleagues, which found less than half of the cataract patients with good postoperative visual outcome[16]. Moreover, in a multicenter studies utilizing samples from Asia and Africa, Limburg and co-workers reported a significantly reduced numbers (23%) of cataract recipients to have good visual outcomes and a considerably greater number of participants having borderline and poor visual outcomes levels ensuing cataract surgery[17]. The discrepancies in results may be attributed to the regional and geographic settings[14, 17, 23], differences in study designs[14, 17], the surgical procedures[23-26] as well as expertise of the operating physicians[16, 27-29].

Consistent with several published studies[14, 30-32] our study showed a significant association between postoperative surgical complications and poor visual outcomes. More precisely, persons with complications after surgery were four times more likely to experience low visual outcomes. A multiple regression analysis by Khanna et al. revealed that patients with postoperative complications (POC) were two times more likely to experience worsen visual outcome[14]. Similarly, Dervenis and coworkers observed that persons that suffered postsurgical complications such as vitreous loss had a significantly compromised postoperative visual acuity with reduced outcomes [30]. Likewise, Mimouni et al, demonstrated an independent association between preexisting postoperative complications and poor vision outcomes[31]. Nevertheless, other studies identified intraoperative complications, comorbidities, and patient characteristics as the risk factors associated with suboptimal postoperative vision outcomes[16, 21, 23, 33]. However, in the present study none of these factors mentioned previously significantly caused reduction in postoperative visual acuity.

The study has some limitations worth highlighting. The retrospective nature of the study limited researchers' ability to analyze individual surgeon-level data, hence, we recommend future prospective studies. The present investigation was a hospital-based, hence outcomes might differ from community or population based studies. Nonetheless, the qualitative nature of the study compared to previous investigations enabled researchers to gather an in-depth information to corroborates with evidence obtain from the medical record review. Moreover, to the best of our knowledge, previous studies have never investigated cataract surgical outcomes and associated factors in the Eastern region of Ghana. The findings will inform healthcare policies to optimize visual outcomes among patients that experience borderline and/or poor postoperative visual acuity.

Conclusion

Our studies showed a considerably higher number of people experienced good visual outcomes after cataract surgery. Nevertheless, a significant proportion had unsatisfactory (borderline/poor) postoperative visual acuity. There was a concordance in evidence generated from the medical record review and that of expert interviews. Specifically, all data gathering approach synergistically confirmed postsurgical complications as the primary cause of poor visual outcomes after cataract surgery. Healthcare policies and interventional programs are warranted to exterminate postsurgical complications, and consequently optimize visual outcomes among the unmet population (borderline/poor vision outcome groups).

Abbreviations

VRA: Volta River Authority, NPL: No perception of light, POC: Postoperative complications, WHO: World Health Organization, CSO, Cataract surgical outcomes

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the institutional review board of the Ghana Health Service (Reference - GHS-ERC 160/12/17). Permissions were sought from the management of the selected hospitals before patient medical records were reviewed. Written informed consent was obtained from all key-informants, and participation was voluntary. All protocols adhered to the tenets of the declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

All relevant data and materials supporting the conclusion of this article is/are available within the manuscript and its supporting information file.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AMD and ADA conceived and designed the project. AMD carried out data collection. KOA, IODJ, and PN provided technical support. AMD performed data analyses. AMD, KOA, IODJ, PN and ADA interpreted data for this study. AMD, KOA, IODJ, PN and ADA drafted the work and revised it critically for important intellectual content. ADA supervised the study. All authors read and approved the final manuscript.

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Figures

Figure 1

Map of Eastern region, with study sites (health facilities/hospitals) bearing the name as the depicted district divisions.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Dataset0202022.xlsx](#)