Indications and Outcomes of Corneal Transplant Surgery in Ghana

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Abstract

Background: Corneal blindness contributes to 25% of all blindness. We review corneal transplant, a common surgical remedy, in Ghana to determine indications and visual outcomes in resource-poor environments. **Methods:** A retrospective cross-sectional study of keratoplasty evaluating indications, pre- and postoperative outcomes complications and their associations, between January 2014 and December 2018 at a teaching hospital in Ghana. Descriptive statistics and McNemar's test were used for the analyses. **Results:** Seventy-five eyes were studied. The mean ± standard deviation (SD) age of patients was 45.08 ± 17.85 years, the majority being 20–39 years (58.7% were male). Pseudophakia bullous keratopathy (PBK) was the commonest indication for keratoplasty (26.7%) followed by keratoconus (21.3%). Preoperatively 96% of eyes were blind with vision <3/60 with 64% out of the total eyes with vision <1/60. Postoperatively, 60% of all grafts had uncorrected vision of 3/60 or better after the last follow-up. McNemar's test revealed a statistically significant difference between postsurgical and pre-surgical visual acuity (VA) ($p < 0.001$). The median follow-up period was 12 months. The commonest postsurgical complication was raised intraocular pressure (IOP) (22.7%) with a total of 14.7% of grafts failures. **Conclusion:** In this setting, PBK is the leading indication for corneal transplant. Visual outcomes for corneal transplant in this resource-poor area are not worse than in other settings. We need to pay attention to corneal transplant services to cater for the expected increase in PBK from the increasing cataract surgical rate.

Keywords: Indications, Outcomes, Corneal Transplant, Keratoplasty

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Introduction

Blindness and visual impairment resulting from diseases of the cornea are a significant public health problem in the developing world (1). In Africa, corneal disease contributes to about 25% of all blindness compared to 2% in the United Kingdom and other developed countries, 4.5% in India, and 7% worldwide (2–4). Many of these corneal diseases will require corneal transplantation.

Corneal transplantation is the surgical replacement of a diseased host corneal tissue with a healthy donor cornea (4). Worldwide, there are an estimated 12.7 million patients in need of corneal transplant, whereas only one cornea is available for every 70 persons (5). The imbalance in the supply and demand is further aggravated in developing countries where corneal transplantation procedures are rarely performed, due to multiple factors (5, 6). General indications for corneal transplant have been categorized under four main umbrellas which include optical, tectonic, therapeutic, and cosmetic (4). The corneal transplant service in Ghana is inadequate as there is no corneal banking service in addition to there being only a few trained surgeons in the country (7). It is imperative to note that the few corneal tissues used were imported into the country, and also there were only two surgeons trained to perform corneal transplant in Ghana at the time of this study. This study reviews corneal transplantation in Ghana and analyzes the indications and outcomes of the surgery. There has been no known study on the indications and outcomes of this procedure since its commencement in the country. This will serve as a guide to assist in restructuring local policies on corneal transplantation services.

Methods

This was a retrospective cross-sectional study conducted at the Komfo Anokye Teaching Hospital (KATH) located in Kumasi, Ghana. The study population consisted of patients that had undergone keratoplasty from January, 2014 to December, 2018.

The inclusion criteria were all corneal transplant surgeries performed and recorded within the study period and who had completed a minimum of 3 months follow-up. The maximum follow-up end point was a year (12 months) after surgery. The exclusion criteria were incomplete record data, keratoprosthetics, and corneal transplant performed for non-optical reasons. Primary identification of keratoplasty procedures from the theater registers was done, and the services of records personnel were obtained for case file extraction. Variables extracted from the participant's records were: demographics, indication for surgery, type of surgery, preoperative and postoperative visual acuity (VA), and postoperative complications including graft-rejection.

All transplant surgery was done by trained corneal specialist and tissues were obtained from CornealGen (http://corneagen.com/) and imported by courier preserved in OptiSol (Chiron Ophthalmics, Irvine, California) and ice packs. Graft failure was defined as either primary graft failure or secondary graft failure resulting in a significant permanent central macular corneal haze or opacity in the donor button. Ethical approval was obtained from the Committee on Human Research, Publications and Ethics of KNUST, School of Medical Sciences and Komfo Anokye Teaching Hospital (Ref. No: CHRPE/AP/086/19).

Structured data extraction sheet and Excel worksheets were used manually to transcribe data from patients' records. Data was analyzed using IBM SPSS Statistics 20.0. Descriptive statistics tools were used to describe the demographics. McNemar's test was used to assess change in vision before and after corneal transplant.

Results

Participants' demographics

A total of 84 records were identified from the theater registries and 82 of those records were retrieved. Out of these, 75 met the inclusion criteria and were analyzed. The cases excluded were records with incomplete data and transplants done for therapeutic or tectonic reasons. Out of the 75 eyes, more than half were males (58.67). The majority were in the 20–39 year age group while the minority were in the 80–99 year age. The youngest and oldest recipients were males, 10 and 81 years, respectively. The mean ± standard deviation (SD) recipient age was 45.7 ± 17.85 years with a median of 47 years. The highest numbers of recipients of the surgery were within the 20–39 (36%) and 40–59 (33%) year age group. Table 1 shows the frequency distribution of indications, grouped pre-operative VA and transplantation procedure.

Postoperative complications

Raised intraocular pressure (IOP) was the commonest complication present 17 (22.7%), while 20 (26%) of the participants had more than one postsurgical complication (loose sutures, flat anterior chamber (AC), hyphema, and epithelial defects) whereas 27 (36%) had no form of postsurgical complication.

Table 2 shows distribution of post-operative complications among grouped variables.

Grafts outcome

In all, 14% of the total grafts failed at the end of the follow-up period (Table 3). An exact McNemar's test showed statistically significant difference in pre- and postoperative VA after corneal transplant surgery ($p < 0.001$) that is there was a reduction in the proportion of participants with VA <3/60 from 72(96%) reduced to 34(45.3%).

Discussion

Interestingly the leading indication for corneal transplant in this research was not due to corneal opacity from infections and trauma as was hypothesized, but rather by pseudophakic bullous keratopathy (PBK) (26.7%), followed by keratoconus (21.3%) with corneal scaring (20.0%) being third. This finding is similar to what was found by some authors (8, 9) and different from other studies (10, 11) which rather had keratoconus as the leading indication in the selected populations. Keratoconus ranked second in our research and was responsible for 20.3 % of the indications.

Preoperatively, 4% of the participants in this study had moderate to severe visual impairment with best corrected (aided) VA <6/18 to 3/60. Almost all (96%) were blind with entrance-aided VA of <3/60. Among the blind eyes, 66.7% presented with VA of <1/60 in the eye indicated for surgery. All the participants had severe visual impairment and blindness in this study mainly because of the very low availability of donor tissue and the long waiting lists from a backlog of cases, similar to another study (12).

About a quarter of the patients (26.7%) that underwent keratoplasty had more than one complication. Two-thirds of complications were of early onset thus occurring within the first 2 weeks after surgery. A total of 14.7% of the grafts failed by the end of the follow-up period with a median of 12 months (average ± SD; 9.28 ± 3.86). Although this was <28.7% found in Yorston et al. (2) and 16.7% found in Yildirim et al. (13), their studies had average follow-up periods of 27.3 months and 38.9, respectively (2, 13). The reasons for the graft failures were not recorded in most of the records. For the few that were reported, some of the causes were allograft rejection, glaucoma, and microbial keratitis.

Table 1. Frequency distribution of indications, grouped preoperative VA, and transplant type, *n* = 75

VARIABLE	*FREQUENCY (PERCENTAGE %)*
Indications (*n* = 75)	
Keratoconus	16 (21.3)
PBK	20 (26.7)
Corneal scar	15 (20.0)
Infectious keratitis	7 (9.3)
Corneal dystrophy	3 (4.0)
Regraft	6 (8.0)
*Other	8 (10.7)
Transplant type (*n* = 75)	
PKP	60 (80.0)
DSEAK	14 (18.7)
DALK	1 (1.3)
Presurgical VA (aided) (*n* = 75)	
VA ≥ 6/18	0(0)
VA < 6/18–6/60	1 (1.3)
VA <6/60–3/60	2 (2.7)
VA <3/60–1/60	24 (32.0)
VA < 1/60	48 (64.0)
Postsurgical VA (unaided) (*n* = 75)	
VA ≥ 6/18	4 (5.3)
VA 6/60–< 6/18	18 (24.0)
VA <6/60–3/60	19 (25.3)
VA <3/60–1/60	23 (30.7)
VA < 1/60	11 (14.7)

VA, visual acuity taken using a Snellen chart at 6 m. PKP, penetrating keratoplasty; DSEAK, descement striping endothelial automated keratoplasty; DALK, descement anterior lamellar keratoplasty.
*Other, other indications included: aphakic bullous keratopathy, ulcerative keratitis, corneal degeneration, mechanical trauma, and chemical injury.

In our study, preoperatively, 96% of the participant had vision <3/60. Postoperatively this had reduced to 45.4%. Also, preoperatively only 4% of the participants in our study had moderate to severe visual impairment with the remaining being blind. This changed to almost half of the participants (49.3%) having moderate to severe visual impairment (VA of <6/18 to 3/60) after surgery. In a study by Wagoner et al. in 2009 (10), 60% of recipients achieved BA of 6/60 or better which is about twice more than what was found in our study, which is probably due to our short follow-up as most sutures have not yet been removed and most eyes have not yet refracted. Postoperative unaided VA ranged from 1/60 to 6/9 with a mean VA of 3/60. This study did not set out to look further at aided VA postoperatively which would have been expected to be much better than the unaided VA.

Table 2. Postoperative complications among grouped variables

VARIABLE	*POSTSURGICAL COMPLICATIONS (%)*
Indications	
Keratoconus	13.3
PBK	17.4
Corneal scar	9.3
Infectious keratitis	8.0
Corneal dystrophy	2.7
Regraft	2.7
*Other	4.0
Gender	
Male	36.0
Female	28.0
Age groups (years)	
<20	1.4
20–39	24.0
40–59	21.3
60–79	10.6
>79	2.7

PBK, pseudophakic bullous keratopathy

*Other, other indications included: aphakic bullous keratopathy, ulcerative keratitis, corneal degeneration, mechanical trauma, and chemical injury.

Table 3. Distribution of failed grafts amongst grouped variables

VARIABLE	*FAILED GRAFT (%)*
Total grafts (*n* = 75)	14.7
Indications	
Keratoconus	4.0
PBK	1.3
Corneal scar	4.0
Infectious keratitis	2.7
Corneal dystrophy	0.0
Regraft	0.0
*Others	2.7
Gender	
Male	6.7
Female	8.0
Age groups	
<20	1.3
20–39	5.3
40–59	6.7
60–79	0.0
>79	1.3
Transplant type	
PKP	12.0
DSEAK	2.7
DALK	0.0

PKP, penetrating keratoplasty; DSEAK, descement striping endothelial automated keratoplasty; DALK, descement anterior lamellar keratoplasty.

*Other, other indications included: aphakic bullous keratopathy, ulcerative keratitis, corneal degeneration, mechanical trauma, and chemical injury.

Conclusion

PBK is the leading indication for corneal transplant in our setting. As cataract surgical rates increases in Ghana, we should brace ourselves for a proportional increase in the incidence of PBK and thus the need for transplant to restore sight to these patients. Preoperatively, 96% of the participants were blind (VA <3/60) which reduced significantly postoperatively to 45.4%, with the majority in the working age group (20–60 years of age). This is a positive visual outcome that might guide policy restructuring on corneal transplantation services.

Limitations

Relatively few surgical cases had been performed over the study period resulting in a very small sample size compared to other studies on keratoplasty.

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Availability of data and materials

The datasets generated during and/or analyzed during the current study are available in the Harvard dataset repository (https://doi.org/10.7910/DVN/K2GFFR)

Authors' contributions

Design and Conduct of Study (SL, EOP, EKAA, AKM); data collection (EOP); data analysis and interpretation (EKAA, SL, AKM, EOP); manuscript preparation, review, and approval (EKAA, SL, AKM, EOP)

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