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Results and safety profile of trainee cataract surgeons in a community setting in East Africa

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Abstract

Purpose:

To evaluate the results and safety profile of assistant medical officer ophthalmologists (AMO-O) performing cataract surgery in the last stage of their surgical training, before their appointment to local communities.

Methods:

We retrospectively analyzed the records of patients who underwent cataract surgery by AMO-Os at Dar es Salaam, Comprehensive Community Based Rehabilitation for Tanzania Disability Hospital between September 2008 and June 2011. Surgical options were either extracapsular cataract extraction (ECCE) or manual small incision cataract surgery (MSICS), both with polymethylmethacrylate intraocular lens implantation.

Results:

Four hundred and fourteen patients were included in the study. Two hundred and twenty-five (54%) underwent ECCE and 189 had MSICS. Mean logarithm of the minimum angle of resolution (logMAR) uncorrected visual acuity (UCVA) improved from 2.4 ± 0.6 preoperatively to 1.3 ± 0.8 1 week postoperatively (*t*-test, $P < 0.001$) and to 1.1 ± 0.7 3 months postoperatively (*t*-test, $P < 0.001$). Mean logMAR best-corrected visual acuity (BCVA) was 0.7 ± 0.5 1 week postoperatively and 0.6 ± 0.5 3 months postoperatively. There was no significant difference in mean logMAR UCVA ($P = 0.7$) and BCVA ($P = 0.7$) postoperatively between ECCE and MSICS. 89.5% achieved BCVA better than 6/60 and 57.3% better than 6/18 with a follow-up of 3 months. Posterior capsule rupture and/or vitreous loss occurred in 34/414 patients (8.2%) and was more frequent ($P = 0.047$) in patients undergoing ECCE (10.2%) compared with MSICS (5.3%).

Conclusion:

AMO-O cataract surgeons at the end of their training offer significant improvement in the visual acuity of their patients. Continuous monitoring of outcomes will guide further improvements in surgical skills and minimize complications.

Keywords: Africa, assistant medical officer-ophthalmologist, cataract surgeons, complications, extracapsular cataract extraction, manual small incision cataract surgery, training

In the era of phacoemulsification for cataract surgery, extracapsular cataract extraction (ECCE) and manual small incision cataract surgery (MSICS) are still widely held to be the techniques of choice for the developing world.[1,2,3,4,5] Both MSICS and ECCE are affordable[6] and are considered safe and effective for the treatment of cataract patients in community eye care settings. MSICS appears to provide better postoperative uncorrected visual acuity (UCVA)[1] and faster rehabilitation[7] compared with ECCE although the technique is more challenging.

In Tanzania, in addition to medical doctors, there is a special cadre of health professionals, created to care for the large population, called assistant medical officers (AMOs). AMOs can specialize in ophthalmology for 2 years and become AMO ophthalmologists (AMO-O) who perform cataract surgery. AMO-O's are a subtype of nonphysician cataract surgeons previously described by Lewallen *et al*.[8] AMO-Os deliver high-volume cataract surgery in community eye care settings and are essential in reducing the backlog of cataract-related visual disability. AMO-Os are more likely to set up their practice and stay in rural areas than ophthalmologists tied to larger centers and in addition, their training is shorter and less expensive compared to ophthalmologists.[8,9]

Ensuring sufficient training of AMO-Os in cataract surgery is necessary to achieve good visual outcomes and maintain low rates of complications. This is particularly important in an African community setting, where follow-up may not be optimal and management of complications more challenging. In this study, we evaluate the results and safety profile of AMO-O cataract surgeons. The surgeries were supervised by trainers and performed entirely by the AMO-O in the last stage of their surgical training (6–9 months), before operating independently in their local communities. Patients with diabetes were excluded from the surgical cohort for AMO-Os.

Methods

We retrospectively analyzed the records of patients who underwent cataract surgery by nine AMO-O at Dar es Salaam Comprehensive Community Based Rehabilitation for Tanzania (CCBRT) Disability Hospital over 2 years and 9 months, between September 2008 and June 2011. The research was approved by the CCBRT Research and Ethics Committee and adhered to the tenets of the Declaration of Helsinki. Inclusion and exclusion criteria are outlined in Table 1.

All AMO-O trainees undergo 6–9 months of training. The cases undertaken during their final month of this program were used for the purposes of this study. Surgical options were either ECCE or MSICS. Surgical protocols, well reported in the literature for ECCE[10] and MSICS,[11] were followed. A fully trained ophthalmologist or the cataract surgeon trainer, JC, chose between the two techniques based on the density of the cataract and pupil dilation. Retrobulbar anesthesia was used in all cases. Biometry was performed using the Alcon® OcuScan® RxP Ophthalmic Ultrasound System, and a polymethylmethacrylate intraocular lens (IOL) was introduced unless surgical events contraindicated IOL placement.

The primary outcome measure was postoperative visual acuity. Secondary outcome measures were intraoperative complications and possible causes of poor surgical outcomes.

Snellen's visual acuity was transformed to a logarithm of the minimum angle of resolution (logMAR) acuity value to allow statistical analysis. Visual acuity of count fingers was taken to be logMAR equivalent of +2.0 and hand movements, the logMAR equivalent of +3.0. An unpaired *t*-test was used to compare logMAR visual acuity before and after cataract surgery in the groups of ECCE and MSICS. Analysis of variance (ANOVA) was performed to identify differences in postoperative visual acuities between the trainee surgeons. A Chi-square test was used to identify differences in the proportion of complications between the ECCE and MSICS group.

Results

Four hundred and fourteen patients were included in the study. Two hundred and twenty-five (54%) underwent ECCE and 189 MSICS. Two hundred and thirty-nine patients were male (58%). All patients attended the 1-week follow-up, and 398/414 (96%) attended the 3-month follow-up (215/225 ECCE, 96% and 183/189 MSICS, 97%). Mean age was 67 ± 12 years (range: 26–96 years, median: 68 years). Each nine AMO-O trainee performed between 35 and 56 cataract operations.

Mean logMAR UCVA improved from 2.4 ± 0.6 (range: 0–3, median: 2) preoperatively to 1.3 ± 0.8 (range: 0–3, median: 1) 1 week postoperatively (*t*-test, $P < 0.001$) and improved further to 1.1 ± 0.7 (range: 0–3, median: 0.8) 3 months postoperatively (*t*-test, $P < 0.001$). Mean logMAR best-corrected visual acuity (BCVA) was 0.7 ± 0.5 (range: 0–3, median: 0.6) 1 week postoperatively and 0.6 ± 0.5 (range: 0–3, median: 0.5) 3 months postoperatively. There was no significant difference in mean logMAR UCVA ($P = 0.7$) and BCVA ($P = 0.7$) postoperatively between ECCE and MSICS patients. There was no significant difference in mean preoperative UCVA between the groups of ECCE and MSICS patients (*t*-test, $P > 0.1$). There was no significant difference in mean postoperative UCVA and BCVA when surgeons were compared (ANOVA, $P > 0.1$).

One hundred of 184 (54.3%) of ECCE group and 76 of 123 (61.8%) of MSICS group had BCVA of 6/18 or better after 3 months of follow-up. 20 of 184 (10.9%) of ECCE group and 12 of 123 (9.8%) of MSICS group had a BCVA <6/60 3 months postoperatively [Table 2].

With respect to complications, posterior capsule (PC) rupture and/or vitreous loss occurred in 34/414 patients (8.2%). This complication was more frequent (Chi-square test, $P = 0.047$) in patients undergoing ECCE (24/225 or 10.2%), compared with MSICS (10/189, 5.3%). Iris-related complications (iris prolapse, iris trauma) were seen in 7/414 (1.7%) (3/225, 1.3%, ECCEs versus 4/189, 1.1%, MSICS, $P > 0.1$). No endophthalmitis, expulsive hemorrhage, retinal detachment, anesthetic-related complications or other serious complications were reported during the 3-months follow-up period.

Male sex was related with an increased risk of PC rupture/vitreous loss (25/239 (10%) in males versus 9/175 (5%) in females, Chi-square test, $P < 0.001$). Mean preoperative logMAR UCVA was comparable in men compared with women (*t*-test, $P = 0.6$). Age was not related with increased complications, and the mean age did not differ between the complicated and uncomplicated cataract groups (*t*-test, $P > 0.1$). There was no significant difference in complications between the 9 AMO-O trained surgeons.

Discussion

This is the first report assessing the results of trainee cataract surgeons at the end of training in a community eye care setting in East Africa. This study presents a 3 month follow-up with a minimal dropout rate of 4%. High retention rates were achieved due to good relations in the community, good hospital standing, and strong encouragement to attend for review by the clinicians.

There was no significant difference in mean logMAR visual acuity between ECCE and MSICS patients.

The World Health Organization (WHO) standards for best-corrected vision at 2 months after surgery are ≥6/18 for 85% of eyes and <6/60 for <5% of eyes.[12] In this study, 95% of patients had <6/60 vision before surgery with only 11% still <6/60 3 months after surgery, 32% had BCVA between 6/60 and 6/18 and 57% had BCVA >6/18. These results are similar to the cataract outcomes performed by cataract surgeons in African hospitals in Ethiopia and Eritrea included in the PRECOG study.[13] Results showed 97% of patients had a preoperative vision of <6/60, 8% demonstrated a corrected postoperative visual acuity of <6/60, 27% between 6/60 and 6/18 and 58% >6/18.[13] The surgical outcomes of both studies fall short of the WHO standard. Due to the retrospective nature of this study, we were unable to fully assess the reasons why the surgical outcomes did not meet the WHO standard as the notes were insufficiently complete. For example, a possible reason could be the contribution of macular edema or clinically significant astigmatism; however, these were not recorded. Other possible reasons include poor case selection, surgical considerations such as equipment or the WHO standards may not be applicable in the African case mix and setting.

Outcomes that did meet the WHO standards in other countries tended to have surgeons with significantly more experience. One such example was the randomized clinical trial in Pune, West India that allocated patients with age-related cataracts to MSICS or ECCE ($n = 741$ patients).[1] Eighty-seven percent of ECCE group and 90% of MSICS group had BCVA of ≥6/18. In this case, all surgeons had performed a minimum of 500 ECCE surgeries and 50 MSICS surgeries and demonstrated greater surgical experience than the AMO-O's in this study. Similarly, experienced Nepalese surgeons counting 100,000 cataract surgeries in the

4 years before the study performed 500 MSICS and had comparable BCVA of ≥6/18 in 95% of eyes at both 6 weeks and 1 year.[14] The experience of consultant ophthalmic surgeons in performing MSICS for brunescent and black cataracts in the UK[15] and in Pondicherry, India[16] showed postoperative BCVA >6/18 in 95% and 97.1%, respectively highlights the importance of training and experience despite the surgical difficulty.

The WHO also recommends aiming for <5% vitreous loss during cataract surgery. Our results show 8% vitreous loss. The Pune study[1] showed a lower PC rupture rate of 4% as did the studies in the UK[17] and Singapore.[16] Gogate *et al.*[2] reported intraoperative PC rupture in 6% of MSICS. Other studies[18,19] performing MSICS have reported PC complication rates of up to 6%. The confidence intervals of such point estimates frequently overlap, for example, our 95% estimate range was 3.6%–12.8% and for Pune was 0.5%–6.9%. In Pune, only PC rupture in association with vitreous loss was enumerated while this study included PC rupture with and without vitreous loss. The Pune study[1] showed no significant difference in PC rupture rate between ECCE and MSICS. Our study, however, had about twice the amount of vitreous loss in the ECCE group (10%) compared to the MSICS (5%). A likely explanation for this is case selection since the difficult cases were allocated to ECCE. The Pune study was a randomized trial, which eliminated this bias. The higher risk of complications in men has been previously reported.[5]

Surgical experience is a crucial consideration when assessing surgical outcomes, and one would expect ongoing audits of the AMO-Os to demonstrate improved outcomes and reduced complications with greater numbers of surgical cases. Our surgeons are trainees at the end of their 6–9-month training while those in the Pune study had 2–5 years' experience postqualification as ophthalmologists. The discrepancy in training time can alone explain the differences in surgical outcomes. However, the research team is looking into ways of finding possible causes of lower outcomes compared to the WHO standards and ways to improve training.

Conclusion

To date, there is no other study evaluating the visual outcomes of another AMO-O or nonphysician training program. Our findings of poorer visual acuity and higher complication proportions with respect to the WHO benchmark need to be offset against service provision. It is important to note that the results of our AMO-O surgeons remain comparable with those reported by much higher-level surgeons elsewhere. Nonetheless, our results fall short of the WHO standards, and we are reviewing the training program and case selection procedures to seek to improve this situation. Monitoring of surgical outcomes is pivotal and has been associated with improved visual outcomes through a quality-conscious change in surgeons' attitudes, more appropriate case selection, and better management of surgical complications.[20,21,22] Although surgical training and experience are major factors for improved outcomes, factors that have also been shown to impact surgical skills of AMO-Os, include supporting staff and functioning equipment.[23] Against this background is the fact that the AMO-Os provide the much-needed cataract surgical services in the rural areas. It is cheaper and easier to train and maintain the AMO-Os compared to ophthalmologists, who would usually prefer to practice in urban settings and large hospitals. The AMO-O cataract surgical training should therefore be endorsed and strengthened.

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Conflicts of interest

There are no conflicts of interest.

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Figures and Tables

Table 1

Inclusion criteria	Exclusion criteria
Any type of age-related cataract	Complicated cataracts
Patient age ≥50 years old	Anterior or posterior segment comorbidities including corneal scar, glaucoma, and diabetic retinopathy
Visual acuity ≤6/60	Patients with diabetes mellitus
Last phase of training before completion of training	“Soft” cataract not thought to be suitable for the intended procedure or level of the surgeon
Trainee surgeon operating independently	

Criteria for inclusion and exclusion of patients from the study including the type of cataract, patient age, preoperative vision, comorbidities, competence level of the surgeon

Table 2

	All patients (%)	ECCE (%)	SICS (%)
Preoperatively UCVA			
<6/60 (poor)	392/414 (94.7)	218/225 (96.9)	174/189 (92)
6/60	22/414 (5.3)	7/225 (3.1)	15/189 (8)
1-week postoperatively UCVA			
<6/60 (poor)	173/412 (42)	106/223 (47.5)	67/189 (35.5)
6/60-6/18	175/412 (42.5)	88/223 (39.5)	87/189 (46)
>6/18 (good)	64/412 (15.5)	29/223 (13)	35/189 (18.5)
1-week postoperatively BCVA			
<6/60 (poor)	11/113 (9.7)	9/88 (10.2)	2/25 (8)
6/60-6/18	56/113 (49.6)	43/88 (48.9)	13/25 (52)
>6/18 (good)	46/113 (40.7)	36/88 (40.9)	10/25 (40)
3 months postoperatively UCVA			
<6/60 (poor)	121/399 (30.3)	67/216 (31)	54/183 (29.5)
6/60-6/18	179/399 (44.9)	97/216 (44.9)	82/183 (44.8)
>6/18 (good)	99/399 (24.8)	52/216 (24.1)	47/183 (25.7)
3 months postoperatively BCVA			
<6/60 (poor)	32/307 (10.5)	20/184 (10.9)	12/123 (9.8)
6/60-6/18	99/307 (32.2)	64/184 (34.8)	35/123 (28.4)
>6/18 (good)	176/307 (57.3)	100/184 (54.3)	76/123 (61.8)

UCVA: Uncorrected visual acuity, BCVA: Best-corrected visual acuity, ECCE: Extracapsular cataract extraction, SICS: Small incision cataract surgery

Uncorrected and best-corrected visual acuity before and after cataract surgery