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Selective Laser Trabeculoplasty in Northern Ghana

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ABSTRACT

We present an audit in Northern Ghana. A total of 283 selective laser trabeculoplasties (SLTs) were done between September 2021 and September 2024. Because of collinearity between right and left eye response to therapy, 145 eyes in 145 individuals with primary open angle glaucoma were included in the analysis. Outcomes were assessed at 1,3,6 and 12 months post index procedure. A success proportion of 75% (33/44) for any reduction in IOP from baseline and 57% (25/44) for a reduction of ≥20% was seen at one year post index SLT. No complications were seen. These findings are directly comparable to those from a major African centre but lower than Caucasian studies. This proof of effect in a rural setting adds to the evidence supporting use of this therapy as an important element in primary open angle glaucoma management in this region.

Introduction

Glaucomas, are a group of chronic ocular diseases characterized by progressive optic neuropathy and visual field loss. The most prevalent is primary open angle glaucoma which is a significant public health concern worldwide, including in Ghana.[1] The principal therapy for primary open angle glaucoma is the lowering of intraocular pressure. This can be by medicine, surgery or laser.[2] Selective Laser Trabeculoplasty (SLT) has emerged as a minimally invasive and effective treatment option for open-angle glaucoma. Like its predecessor argon laser trabeculoplasty, SLT targets the trabecular meshwork. It uses a larger spot size but with Q-switcher frequency doubled YAG it delivers a fraction (about 1%) of the energy. Both have similar results in terms of pressure reduction but SLT does not result in extensive damage meaning it may be repeated more often. The mechanism of action is still not fully understood but a biological response results in reduction of the intraocular pressure.[3]

SLT has been proven both effective in lowering intraocular pressure and cost-effective in a resource rich environment.[4] In 2021 Philippin et al published a landmark randomized controlled trial demonstrating the effectiveness of this therapy in a specialist hospital in Tanzania.[5]

Laser machines, however, are complex pieces of engineering requiring a suitable environment and stable power supply. Neither are freely available across most of the African continent as illustrated in a recent paper concerning ultrasound equipment where access to equipment and maintenance was the key barrier to implimentation.[6] If SLT is to become integral to glaucoma management in an African context it is important that the effectiveness is assessed in more challenging settings and with other populations. This study contributes by reporting an audit of SLT procedures performed in an eye unit in Northern Ghana, both a more challenging situation and a different population.

Methods

The audit was undertaken in the Ophthalmology Department, Tamale Teaching Hospital and Northern Community Eye Hospital, Tamale, Northern Ghana. Patients presenting for the first time receive a full examination. If glaucoma is diagnosed a minimum of baseline intra-ocular pressure (IOP), visual field testing, gonioscopy, pupillary examination and evaluation of their optic disc is undertaken. All individuals with a diagnosis of primary open angle glaucoma were offered SLT. All who received SLT between 1st September 2021 and 1st September 2024 were included in the audit. The inclusion and exclusion criteria are shown in table 1.

Inclusion criteria
• Age >18 years • Ability to give informed consent • Ability to perform visual field perimetry • Diagnosis of primary open angle glaucoma • No prior glaucoma surgery • Have SLT to one or both eyes

Inclusion criteria
• Secondary glaucoma (e.g. pigment dispersion syndrome, rubeosis, trauma, etc.) • Angle closure • Any contraindication to SLT (e.g. unable to sit at the laser-mounted slit-lamp, past history of or active uveitis, inadequate visualization of trabecular meshwork) • Congenital or early childhood glaucoma • Visually significant cataract with intention to undergo cataract surgery in the subsequent year • Recent cataract surgery within previous 3 months • Any active treatment for another ophthalmic disease • Any history of retinal ischemia, macular oedema, diabetic retinopathy, age-related macular degeneration • Any previous intraocular surgery, except uncomplicated cataract surgery more than 3 months prior to recruitment • Pregnancy at the time of recruitment or intention to become pregnant within the duration of the trial

Table 1 Criteria for inclusion and exclusion in audit of SLT in Tamale, Northern Ghana

Following informed consent SLT was undertaken. A standard application of 100 shots of 6mJ through 360 degrees was used for all eyes. Post-operatively all eyes received prednisolone forte 1% tds for one week. The pressure was checked at one hour post laser.

Appointments were provided for review at 1, 3, 6 and 12 months following the SLT. If at any stage the pressure was rising a repeat SLT was undertaken at no charge to the patient.

The audit received approval from the Ethical Review Committee of Tamale Teaching Hospital, Tamale, Ghana. Descriptive statistics were used to describe the patient population and outcomes looking at both any drop in intraocular pressure from the presenting pressure and a success outcome criterion of ≥20% drop in IOP from presenting IOP. Both success proportions and Kaplan-Meier survival analysis were used for estimations of success.

Results

There are records of 283 SLT procedures being undertaken. No follow-up was available at any time point on 45 and a further four had no pre-operative IOP recording. Of the remainder, 56 were only eyes and 89 bilateral (figure 1). No complications were encountered.

The average difference in pressure drop between right and left eyes in those with bilateral SLT was 0.1mmHg SD 6.5 variance 42 correlation coefficient =-0.14. When right eyes only were taken in those with bilateral and combined with the only eyes the sample was split to compare between individuals and the average pressure drop difference

was -0.9mmHg SD 13.5 variance 183 correlation coefficient =0.76. This shows a strong correlation between the pressure drop in fellow eyes compared to eyes between individuals. On this basis the remainder of the analysis was done on only eyes or, where the SLT was bilateral, right eye findings. A total of 145 eyes in 145 individuals were included in the analysis. (figure 1).

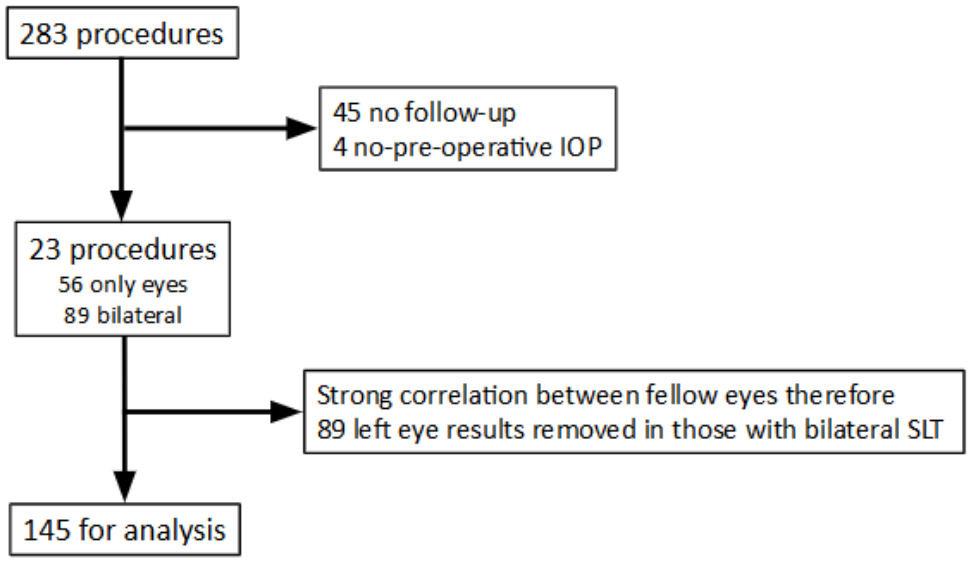

Figure 1 Flow diagram showing process of elimination of cases to arrive at final data-set for analysis. All 283 cases of SLT undertaken between 1st September 2021 and 1st September 2024 in Tamale, Northern Ghana were reduced to 145 for analysis - one eye per person.

Of these 145, 61 were female and 70 male with the gender not recorded for 14. The average age was 56 years (SD 16) ranging from 14-92 years and the mean presenting IOP was 23.8mmHg (SD 9.7) ranging from 9-66mmHg. 22 eyes had repeat SLT during the first year (9 at 1 month, 2 at 2 months, 5 at 3 months, 5 at 6 months and one at 9 months) following the index SLT.

	Number of individuals	Any Drop N (%)	Range of change (mmHg)	Drop ≥20% N (%)
IOP at 1 month	121	99 (82%)	-13 to 34	75 (62%)
IOP at 3 months	60	46 (77%)	-11 to 46	31 (52%)
IOP at 6 months	52	39 (75%)	-12 to 47	28 (54%)
IOP at 12 months	44	33 (75%)	-16 to 28	25 (57%)
Last recorded IOP	145	108 (75%)	16 to 47	77 (53%)

Table 2 Success proportions at different time points following index (first) SLT for outcomes criterion of any drop in IOP and a drop in IOP of ≥20% from presenting IOP in Tamale, Northern Ghana

Table 2 shows the intraocular pressure findings at 1, 3, 6 and 12 months. Some had follow-up at only single time points and others at multiple time points. It can be seen the proportion with any drop in recorded IOP at 1 month was 82% falling to 75% at 6 months. When looked at with a success criterion of ≥20% reduction in IOP the success proportion at one month was 62% falling by about 10% at subsequent time points. The final row of table 2 shows the findings for the entire population looking at their final time point of examination. Three quarters had a drop in IOP from that pre-laser and just over a half (52%) a drop of ≥20%.

Survival analysis for an outcome of ≥20% reduction in IOP is shown in figure 2.

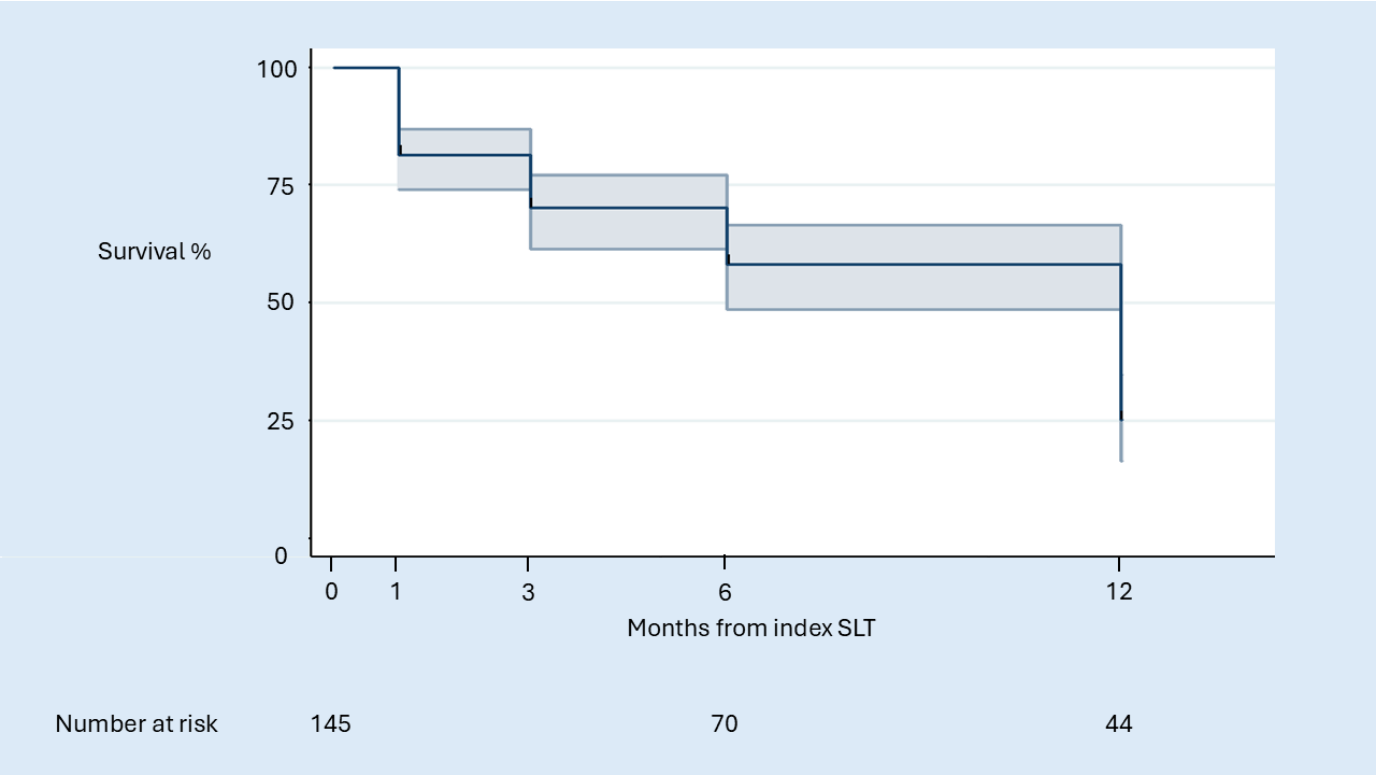

Figure 2 Kaplan-Meier survival plot of SLT in Tamale, Northern Ghana for outcome of ≥20% reduction in IOP prior to index (first) laser. Survivor function with 95% CI.

Discussion

The landmark paper for SLT in the African context is Philippin et al.[5] Their criteria for success however differed from ours. Only eyes with presenting IOPs above 21mmHg were included in the trial, both eyes in an individual were eligible and success was two tiered at <18mmHg in those with 'severe' glaucoma and <21mmHg in those with less severe glaucoma. On this basis the closest comparator would be any reduction in IOP in our cohort. At one year they reported reduction of IOP in 61% (99/163) eyes. Our finding of 75% (33/44) is directly comparable, as is our finding in the entire population of the same proportion at final time point of examination (75% (108/145)). In Caucasian populations the landmark study is the LiGHT study.[4] This study was designed primarily for quality-of-life outcomes and the outcomes were given at 36 months post index SLT. IOP success was defined as achieving 'target IOP' meaning this would be likely to more stringent that any-drop and possibly not as stringent as ≥20%. Either way the success proportion with SLT and medications if needed (as in our study) was 93% at visits during the study which is in considerable excess of our success proportion. Thus our results seem comparable in an African context and below the success proportion in a Caucasian population. It should be noted that on the survival plot the success proportion at 1 year had reduced to 25% this is less appealing. None-the-less there seems to be a clear place for this therapy in an African setting since the advantages of no expense and supply chain requirement for topical therapy are especially appealing. The duration of effect will need ongoing studies to enable mature clinical decision making in creating therapeutic plans for patients.

This audit reflects real life challenges in managing chronic conditions such as glaucoma in this environment. Distance, expense and other factors contribute to the poor proportions of individuals returning for repeat review. It has been noted many times before that the asymptomatic aspect of glaucoma until the very end stages, is a major disadvantage in this respect. The lack of awareness of the disease has been documented in Ghana and elsewhere[7,8] Perhaps the use of local terms for glaucoma[9] may be of some assistance. Other

public health initiatives may also help. The poor follow-up is also a disadvantage in reporting results of interventions since it introduces potentially large unquantifiable bias.

Our analysis showed a striking correlation in the response of fellow eyes in an individual to SLT which was not there when eyes from separate individuals were compared. This means any analysis of outcome needs to either be of single eyes from individuals, meaning the data points are truly independent, or else random effects or other statistical techniques need to be applied to allow for the correlation and prevent an over estimation of sample size.[10] The other striking observation is that the time point analysis considerably over-estimated the success proportions compared to time points in the survival analyses. We have also noted this observation in another study.[11] This highlights the care to be taken when critically appraising work that only presents time point analysis.

Conclusion

We report an audit of SLT undertaken in Northern Ghana with a 75% success proportion at one year, directly comparable to prior African studies but lower than Caucasian studies. No adverse effects were experienced. This proof of effect in a rural setting adds to the evidence supporting use of this therapy as an important element in primary open angle glaucoma management in this region.

Conflict of Interest:

None

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References:

1. The *Lancet Global Health* Commission on Global Eye Health: vision beyond 2020. Burton, Matthew J et al., The Lancet Global Health, Volume 9, Issue 4, e489 - e551.

2. Glaucoma: now and beyond. Lancet, Jayaram H, Kolko M, Friedman DS, Gazzard G., 2023 Nov 11;402(10414):1788-1801.

3. Is laser trabeculoplasty the new star in glaucoma treatment? Töteberg-Harms, Marca; Meier-Gibbons, Francesb, Current Opinion in Ophthalmology 32(2):p 141-147, March 2021.

4. Selective laser trabeculoplasty versus eye drops for first-line treatment of ocular hypertension and glaucoma (LiGHT): a multicentre randomised controlled trial. Gazzard G., Ambler G. et al., The Lancet, Volume 393, Issue 10180, 1505 – 1516.

5. Selective laser trabeculoplasty versus 0·5% timolol eye drops for the treatment of glaucoma in Tanzania: a randomised controlled trial. Philippin H, Matayan E, Knoll KM, et al., Lancet Glob Health. 2021 Nov;9(11):e1589-e1599.

6. Physicians' clinical experience and perspectives following a pilot, blended learning, point of care ultrasound course in Ghana- a mixed methods analysis. Pathak A, Limbani F, Awuku YA, Booth A, Joekes E. BMC Med Educ. 2024 Dec 4;24(1):1415.

7. Awareness of Glaucoma and Eye Health Services Among Faith-based Communities in Kumasi, Ghana. Murdoch C, Opoku K, Murdoch IJ Glaucoma. 2016 Oct;25(10):e850-e854.

8. Factors associated with adherence to treatment in patients with open angle glaucoma in Sierra Leone, West Africa: patient demographics and questionnaire. Kennedy A, Abosi U, Gilbert C, Mustapha J. Int Ophthalmol. 2022 Nov; 42(11):3479-3493.

9. Bridging the Language Barrier in Health Awareness. Opoku K, Murdoch IE. JAMA Ophthalmol. 2013;131(10):1367.

10. People and eyes: statistical approaches in ophthalmology. Murdoch IE, Morris SS, Cousens SN. Br J Ophthalmol. 1998 Aug;82(8):971-3.

11. Long-Term Safety and Outcomes of β-radiation for Trabeculectomy. Murdoch I, Puertas R, Hamedani M, Khaw PT. J Glaucoma. 2023 Mar 1;32(3):171-177.

