

Journal of Ophthalmology of Eastern Central and Southern Africa

(Formerly East African Journal of Ophthalmology)

www.coecsa.org

ISSN 2308-6327



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College of Ophthalmology of Eastern, Central and Southern Africa (COECSA)

Teams for better ophthalmology care

The College of Ophthalmology of Eastern, Central and Southern Africa (COECSA) annual scientific congress has been successfully held in the different countries of the Eastern, Central and Southern Africa (ECSA) region over the last 4 years. This year, the annual congress will make its half-decade mark. The Uganda Ophthalmology Society will host it on the 16th - 18th August at the Commonwealth Speke Resort Munyonyo, Kampala, under the theme “*Team Work in Eye Care*”.

With a few years remaining to 2020, the Vision 2020: reducing avoidable blindness target year, there has been tremendous success in fighting avoidable blindness globally. However, the challenge still remains with 39 million people estimated to be blind and 285 million to be visually impaired¹. The usual suspects: cataract, glaucoma, uncorrected refractive error, childhood blindness as well as the emerging threats such as diabetic retinopathy still remain major challenges, particularly in sub Saharan Africa. This year's congress is dedicated to exploring how the different stakeholders of eye care in the region have worked together and/or can begin to work together to re-energise efforts to fight avoidable blindness. It comes on the backdrop of several economic, political and technological changes since the vision 2020 declaration in 1999. These have created challenges such as reduced donor support, which needs to be innovatively and sustainably overcome; as well as opportunities such as low cost technological advances that must be exploited.

There have been several success stories from teams created for better eye care in the ECSA region. This has been noted in establishment of COECSA speciality communities, the LINKS program that has given birth to networks for diabetic retinopathy and retinoblastoma, as well as increased opportunities for collaboration and shared learning among the different stakeholders.

Communities of practise: COECSA has established different communities of practise that bring together different ophthalmologists interested in a particular area and enable them to exchange ideas. Some of these have cascaded into development of regional treatment guidelines. In the planning of this year's congress, we reached out to these different communities to set the agenda of breakout sessions and have conversations around the most pressing issues in their different areas. They will learn from each other and recommend some action points going forward. For example, in the anterior segment session, the key discussion is on how to establish corneal banks in the different ECSA countries using the Ethiopian case study. In the glaucoma session, the key discussion is on stopping glaucoma in Africa. The manager's session will focus on why programs succeed and community eye health will take stock of case studies of successful interventions for public eye health.

Role of non-ophthalmologists: If we are to succeed in our efforts, there is need to not only work together as ophthalmologists but as all stakeholders in eye care. For example, the success of a cataract program comes not only from having the best surgeon, but also from a manager who plans and handles logistics and an ophthalmic clinical officer who screens and does pre-op basics. There also needs to be someone to do biometry, a theatre anaesthetist/nurse to block, a counsellor to advise post op care, a follow-up nurse to ensure follow-up, and an optometrist to ensure best correction. Therefore, this year's congress is dedicated to recognising the role of managers, administrators, allied health and educators in eye care. Unlike the previous congresses, which focused mostly on ophthalmologists, this year's congress will provide special sessions for educators, managers, and allied health workers to exchange views on their individual roles in eye care. Our hope is that this will cascade into establishment of non-ophthalmologist COECSA communities of practise and set a precedent for subsequent congresses.

Integrating to primary health care: A great deal more still needs to be done to maximise human resource for eye care. Although there have been tremendous leaps in training human resource for eye care, with an increase in the number of ophthalmologists, ophthalmic clinical officers, and optometrists, the numbers are still insufficient. For example, in Uganda, the host country, there is only 1 ophthalmologist per million and 5 OCOs per million. These figures fall far too short of the VISION 2020 recommendations of 4 ophthalmologists per million and 10 OCOs per million². One way to address this gap, as we continue to encourage training, is to integrate eye care into primary health care. A number of regional studies show that mid cadre and primary health workers still have insufficient knowledge and skills and knowledge in eye care³⁻⁶. Other studies show that in developing countries, primary health care workers can help reduce the levels of blindness, especially in children^{7,8}. Having front line health workers not well skilled and equipped in eye care has a number of potential problems such as misdiagnosis, mistreatment, delayed referral and eventual poor outcomes. In two separate studies in Tanzania and Kenya, patients who visited lower health care facilities were more likely to present late to eye hospitals^{9,10}. This highlights the fact that all efforts to train and equip primary health care workers in eye health should be encouraged.

Interdisciplinary networks: Diabetic retinopathy is now one of the emerging leading causes of avoidable blindness¹¹. The Vision 2020 LINKS program has tremendously contributed to addressing this by initiating a global DR-Network. This network consists of NCD managers at ministries of health, program administrators, physicians, and ophthalmologists. It has created a

platform of shared learning on the best practise. For example, at a DR-Net review meeting in 2016 on the side-lines of the IAPB congress in Durban, it emerged unanimously that the best practise for screening for DR was if ophthalmologists and physicians began talking. There was overwhelming evidence that ophthalmologists needed to move from their comfort zones in the eye clinics and take the screening to the physicians' diabetic clinics. Most of the institutions in the ECSA region have already adopted this and have set up fundus cameras in the diabetic clinics.

Another network that has been set up through the LINKS program is the retinoblastoma network. Retinoblastoma is one of the leading causes of blindness and mortality¹². Management is more difficult in Africa due to late presentation of the children to the hospitals, lack of well-trained ocular histopathologists, limited treatment options and social complexities. The retinoblastoma network has brought the different players together and linked them to centres of excellence in India and Europe. This will help in creating an enabling environment to find local solutions to this problem.

Teamwork in research: The COECSA congress provides a great opportunity for researchers in the region to share their work. There is enormous potential for researchers in the region to collaborate on large multi-centre projects. This year's congress will have two special sessions on research skills for lecturers and young ophthalmologists with an interest in research. It will also have the launch of the COECSA research repository, a platform that will increase the research output of eye related research in the region¹³.

Unity is our strength and with these partnerships, we will bring this vision into reality.

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REFERENCES

1. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol*. 2011;bjophthalmol-2011-300539.
2. Palmer JJ, Chinanayi F, Gilbert A, Pillay D, Fox S, Jaggernath J, *et al*. Mapping human resources for eye health in 21 countries of sub-Saharan Africa: current progress towards VISION 2020. *Human Res Health*. 2014; **12**(1):44.
3. Courtright P, Seneadza A, Mathenge W, Eliah E, Lewallen S. Primary eye care in sub-Saharan Africa: do we have the evidence needed to scale up training and service delivery? *Annals Trop Med Parasitol*. 2010; **104**(5):361-367.
4. Kortlang C, Koster J, Coulibaly S, Dubbeldam R. Prevalence of blindness and visual impairment in the region of Segou, Mali. A baseline survey for a primary eye care programme. *Trop Med Intern Health*. 1996; **1**(3):314-319.
5. Kalua K, Gichangi M, Barassa E, Eliah E, Lewallen S, Courtright P. Skills of general health workers in primary eye care in Kenya, Malawi and Tanzania. *Human Res Health*. 2014; **12**(1):S2.
6. Byamukama E, Courtright P. Knowledge, skills, and productivity in primary eye care among health workers in Tanzania: need for reassessment of expectations? *Intern Health*. 2010; **2**(4):247-252.
7. Alemayehu W, Melese M, Bejiga A, Worku A, Kebede W, Fantaye D. Surgery for trichiasis by ophthalmologists versus integrated eye care workers: a randomized trial. *Ophthalmology*. 2004; **111**(3): 578-584.
8. Gilbert C, Foster A. Childhood blindness in the context of VISION 2020: the right to sight. *Bull World Health Org*. 2001; **79**(3):227-232.
9. Al-Attas AH, Williams CD, Pitchforth EL, O'Callaghan CO, Lewallen S. Understanding delay in accessing specialist emergency eye care in a developing country: eye trauma in Tanzania. *Ophthalmic Epidemiol*. 2010; **17**(2):103-112.
10. Gichuhi S, Kabiru J, Zindamoyen AMb, Rono H, Ollando E, Wachira J, *et al*. Delay along the care-seeking journey of patients with ocular surface squamous neoplasia in Kenya. *BMC Health Services Res*. 2017; **17**(1):485.
11. Leasher JL, Bourne RR, Flaxman SR, Jonas JB, Keeffe J, Naidoo K, *et al*. Global estimates on the number of people blind or visually impaired by diabetic retinopathy: a meta-analysis from 1990 to 2010. *Diabetes Care*. 2016; **39**(9):1643-49.
12. Rodriguez-Galindo C, Wilson MW, Chantada G, Fu L, Qaddoumi I, Antoneli C, *et al*. Retinoblastoma: one world, one vision. *Pediatrics*. 2008; **122**(3):e763-e70.
13. Arunga S, Bore M, Kavuma D. The COECSA research repository. *JOECSA*. 2016; **19**(2): 45.

Branch retinal vein occlusions: a review

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ABSTRACT

Introduction: Branch Retinal Vein Occlusion (BRVO) is the second most common retinal vascular disease with a prevalence of 0.8%. The Branch Vein Occlusion Study was the first trial to show efficacy of treatment of macular oedema in BRVO with grid laser which was considered the gold standard for several years. Since then several other studies have been done on various classes of drugs and surgery and there are great strides that have been made in enhancing the visual and anatomical outcome. In this review article, we did a pubmed search of publications done over the years on the natural history of BRVO as well as the treatment options. The studies included clinical trials, systematic reviews and case reports.

Results: Currently anti-Vascular Endothelial Growth Factors (AntiVEGFs) appear to have the best outcomes in terms of anatomical and visual recovery. Other therapies that have shown promise are the intravitreal steroids, grid laser, antiVEGFs and steroids combined with lasers. Parsplana vitrectomy appears to be as efficacious as antiVEGF but is very invasive and no good clinical trials have been done yet.

Conclusion: Great strides have been made in improving the outcome of BRVO especially the macular oedema if prompt and correct treatment is administered to the patient.

Key words: Branch retinal vein occlusion, Macular oedema, Laser, Steroids, AntiVEGFs

INTRODUCTION

Retinal vascular occlusions are the second most common cause of retinal vascular disease after diabetic retinopathy¹. Visual loss in Branch Retinal Vein Occlusion (BRVO) is due to Macular Oedema (ME), vitreous haemorrhage, capillary non-perfusion at the macula and neovascular glaucoma².

In this review we shall look at the natural history of the disease, the management of ME with laser, intravitreal steroids and intravitreal anti-Vascular Endothelial Growth Factor (Anti-VEGF) therapies. We shall also look at the role of sector laser photocoagulation for the resultant neovascularization that occurs in ischaemic BRVOs as well as some of the systemic therapies.

Risk factors: The pathogenesis of Retinal Vascular Occlusion (RVO) is multifactorial. BRVO may be due to a combination of three primary mechanisms: compression of the vein at the arteriovenous (A/V) crossing, degenerative changes of the vessel wall, and abnormal haematological factors³.

Arteriovenous (A/V) crossings: Anatomic features of A/V crossings and secondary effects of arteriolar sclerosis may explain the vulnerability of the crossing site to venous occlusion. In the majority of A/V crossings, the thin-walled vein lies between the more rigid thick-walled artery and the highly cellular retina. The artery and vein also share common adventitial sheath and the narrowing of the venous lumen that normally occurs at the A/V crossing provide the setting for BRVO³.

Degenerative changes of vessel wall: In the area of the A/V crossing, alteration of the endothelium and intima media is present and following the compression from the overlying artery BRVO results. The formation of the thrombus follows as a secondary process.

Systemic hypertension, diabetes mellitus, atherosclerosis, and smoking are reported to be more common in patients with RVO³.

Haematological disorders: Haematological factors that may result in retinal vascular occlusion include hyperviscosity due to high haematocrit and dysregulation of the thrombosis-fibrinolysis balance as is seen in resistance to Activated Protein C and deficiency of Protein C or Protein S³.

Anti-phospholipid antibodies and hyperhomocysteinemia: Circulating Antiphospholipid Antibodies (APA) leads to a hypercoagulable state and recurrent thrombosis through thrombocyte activation and inhibition of the natural anticoagulant pathways by binding of membrane phospholipids. They are associated with a 3- to 10-fold increased risk of venous thrombosis.

An elevated level of the amino acid, homocysteine is now generally accepted to be a risk factor for systemic vascular disease. Homocysteine appears to have a deleterious effect on vascular endothelium and may induce increased platelet aggregation and thrombosis³. The results of meta-analyses confirm total homocysteine to be an independent risk factor for RVO⁴.

Natural history

Rogers *et al*⁵ concluded that Visual Acuity (VA) generally improved in eyes with BRVO without intervention, although clinically significant improvement beyond 20/40 was uncommon.

Hayreh⁶ noted that VA was only affected if the BRVO occurred in one of the temporal arcades. Initially in temporal BRVO, VA was 20/60 or better in 51% and 20/70 or worse in 49%. Overall, in eyes with initial VA of 20/60 or better, 75% had improved or stable VA, and in eyes with initial VA of 20/70 or worse 69% had improved VA. The median time to macular edema resolution was 21 months in major BRVO and 18 months in macular BRVO.

In a study by Hayreh and Zimmerman⁷, it was established that there were 2 clear different entities. These were the major BRVO and the macular BRVO. They had different clinical presentations, progression and prognosis. Major BRVO is due to occlusion of 1 of the 4 major branch retinal veins. It involves the entire segment of the retina drained by the vein, extending all the way up to the peripheral retina. Macular BRVO is due to occlusion of one of the veins from the macular region.

The common findings established for branch retinal vein occlusions were retinal haemorrhages in the macula region, macular oedema, serous macular detachment, epiretinal membranes, serous retinal detachment, perivenous sheathing, optic disc pallor, lipid deposits, cotton wool spots, preretinal and subhyaloid haemorrhages, vascular changes which included retinal venous engorgement and attenuation in some cases, retinal arteriole attenuation and sheathing, retinal collateral. Retinal and disk neovascularization was seen only in major BRVO. The median time to resolution of major BRVO was 4 years (IQR, 2.2–9.8 years) and was 1.5 years (IQR, 1.0–6.0 years) for macular BRVO. This difference was statistically significant ($P = 0.0002$)⁷.

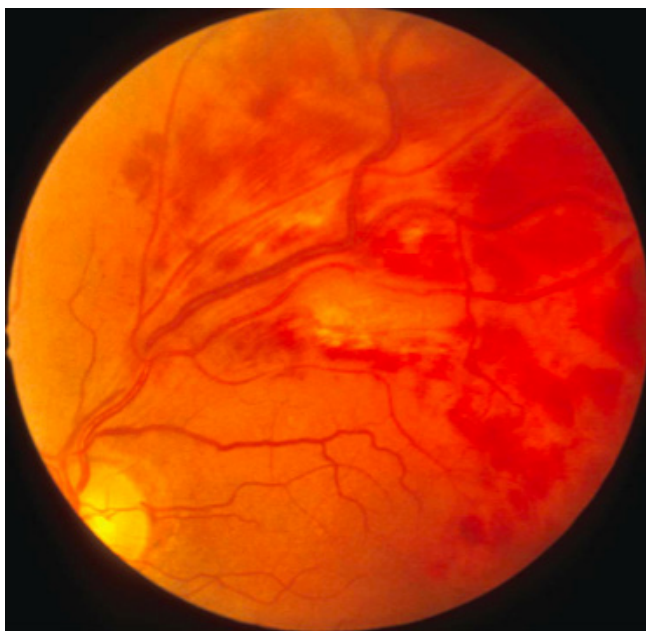


Figure 1: Major BRVO

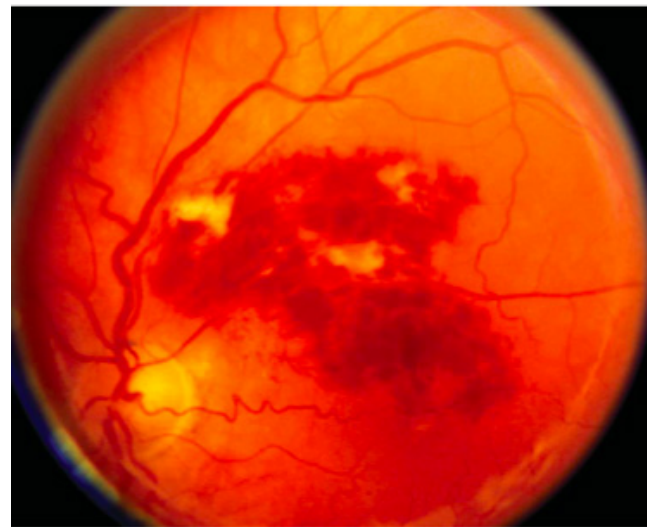


Figure 2: Macular BRVO

Visual fields: Initially in the region of the temporal BRVO, minimal to mild defect was seen in 72% and moderate in 26%. On follow-up, in temporal BRVO, visual field defect improved or remained stable in 68% of eyes with minimal-mild initial defect, and improved in 52% of eyes with moderate to severe initial defect⁶.

Management options

Central lasers in BRVO: For many years central laser was the treatment modality of choice following the results of the Branch Vein Occlusion Study (BVOS)⁸. It reported spontaneous improvement in about one-third of cases in the first 3 months. Grid laser was performed at 3 months in eyes that had persistent ME or VA less than 20/40.

At the end of 3 years, treated eyes were more likely to gain 2 lines of visual acuity (65%) compared to untreated eyes (37%). Furthermore, treated eyes were more likely to have 20/40 or better vision at 3 years follow-up (60% vs 34% untreated), with a mean visual acuity improvement of 1.3 lines ETDRS versus 0.2 lines in the untreated group⁸.

Intravitreal steroids: The gains from laser as can be seen were not startling. Intravitreal steroids in the form intravitreal triamcinolone (IVTA, 1mg and 4mg) were then tested against laser in the Standard Care vs. Corticosteroid for Retinal Vein Occlusion (SCORE) trial⁹. There was no significant difference in terms of visual acuity of central foveal thickness at 1 year. There were however significant number of cases of cataract and raised IOP in the 4mg IVTA group.

A sustained release form of dexamethasone, Ozurdex was tested the GENEVA Study¹⁰. Peak visual acuity improvement was seen at day 60 with deterioration of vision after 3 months. A repeat injection at 6 months yielded similar results.

AntiVEGF drugs

Ranibizumab: Elevated levels of VEGF have been found in BRVO hence the rationale to treat macular oedema

in BRVO with antiVEGF drugs. Campochiaro *et al*² established through a clinical trial that run over 2 years that visual acuity and anatomical gains were far greater in the ranibizumab group (both 0.3mg and 0.5mg) than in the sham group. They started off with 6 monthly injections then switched to PRN dosing. Most patients required 0-3 injections in the 2nd year showing that there is need for several injections to maximize patient benefit and that long-term follow up is important.

Bevacizumab: Bevacizumab has been found to be effective with both Pro Re Nata (PRN) dosing and Treat and extend (TREX) dosing. In the PRN regimen, re-injection was done if the foveal thickness was >250 or there was persistent or recurrent macular edema affecting visual acuity. Patients required 3.8 ± 1.5 injections over 2 years with a provision for rescue laser at the end of 3 months¹¹.

TREX dosing was also found to be as effective, however it was found to require fewer injections over time which could translate to significant cost savings¹². A comparison between ranibizumab and bevacizumab was carried out in the MARVEL study with each drug administered on a PRN basis for the management of BRVO with macular edema. Both drugs resulted in a rapid restoration of anatomy and function with a mean increase in visual acuity (ranibizumab-18.08 letters and bevacizumab-15.55 letters). Rescue laser therapy was only needed in 16% of eyes¹³.

A comparison of the efficacy of bevacizumab to grid laser reported that bevacizumab treatment resulted in better and faster visual recovery¹⁴. Commencing treatment early with AntiVEGF agents has also been shown to have maximum visual benefit. The vision gained in eyes treated with anti-VEGF agents from the beginning was 18.3 letters at the end of 12 months compared to 12.1 letters when the patient was initially treated with sham and crossed over to anti-VEGF agents at the end of 6 months ($P < 0.01$)¹⁵.

Aflibercept: Aflibercept is one of the latest additions to the AntiVEGF family of drugs. It is a soluble receptor fusion protein with a VEGF binding affinity and duration of action in the eye greater than its predecessors. It also binds to other angiogenic factors including placental growth factors.

The VIBRANT study was a double-masked, multicenter trial to assess the efficacy of aflibercept compared to macular laser in eyes with macular edema secondary to BRVO. Patients in one arm of the study received 6 injections of 2 mg aflibercept, and patients in the other arm received baseline laser. Rescue laser therapy occurred as needed after 12 weeks. At the end of 6 months, the eyes treated with aflibercept had more favorable outcomes in terms of reduced central foveal thickness (aflibercept 280.5 microns/laser 128microns) or visual recovery (aflibercept 17 letters/laser 6.9 letters)¹⁶. Outcomes at 52 weeks follow-up indicated that aflibercept injections at 8 weeks interval after the first 6

months helped maintain vision and foveal thickness in the aflibercept arm of the study¹⁷.

Medical therapy

It is reported that an increase in small platelet aggregates may play a component in BRVO pathogenesis.

Houtsmuller *et al*¹⁸ compared the effect of ticlopidine, an antiplatelet aggregative factor, versus placebo in 54 patients with BRVO and found a significant improvement in visual acuity in 69% BRVO patients of ticlopidine group versus 52% of the placebo group in a six-month follow-up.

Glacet Bernard *et al*¹⁹ examined the efficacy of troxerutin, an antierythrocyte and antiplatelet aggregative drug, versus placebo in 26 patients with BRVO less than five months from symptom onset. In a two-year follow-up, there was a significant improvement in visual acuity, as well as in macular edema, in patients treated with troxerutin compared to those treated with placebo.

Tissue Plasminogen Activator (t-PA) intravitreally or directly into the retinal vein is another treatment option for BRVO. Small studies have demonstrated safety and an improvement in visual acuity and foveal thickness with t-PA treatment^{20,21}.

Low-Molecular-Weight Heparins (LMWHs) have also been used and are considered to be effective for the treatment of BRVO with improved visual acuity, supporting the hypothesis that BRVO is a venous thrombotic disorder. No increased risk of vitreous haemorrhages was observed during treatment with LMWH^{22,23}.

Combination therapy

Tomomatsu *et al*²⁴ assessed the efficacy of bevacizumab combined with Targeted Retinal Photocoagulation (TRP) compared to bevacizumab alone and concluded that the combination therapy helped reduce recurrence of macular edema.

The RELATE trial evaluated the combination of grid and scatter photocoagulation 24 weeks after randomization into the ranibizumab group. The authors found no additional benefits of laser in terms of improvement in vision, resolution of macular edema, or reduced number of intravitreal injections²⁵.

The Retinal Vein Occlusion Associated Macular Edema study (RABAMES) compared the efficacy of intravitreal ranibizumab to grid laser and combination therapy. In this study, treatment was instituted immediately and duration of follow-up was 6 months. The eyes in the ranibizumab group were treated with 3 monthly injections followed by observation for the next 3 months. The study found that eyes treated with ranibizumab recovered vision faster than the grid laser and the combination group. There was no distinct advantage of combination therapy over ranibizumab in terms of functional or vision recovery or prevention of recurrence. However, foveal thickness increased in the ranibizumab group whereas it decreased in the grid laser group between months 3 and 6 follow-ups with no associated variation in visual acuity²⁶.

Azad *et al*²⁷ compared the efficacy of ranibizumab and laser, bevacizumab and laser with that of laser alone in the management of BRVO with macular edema. The authors found that the gain in visual acuity in the ranibizumab-laser group was significantly higher than the bevacizumab-laser group or the laser-only group. The bevacizumab-laser group also had better gains in visual acuity compared to the laser only group. There was no significant difference in the reduction of CFT in each of the three groups. The authors concluded that a combination of anti-VEGF agents and early laser results in better gains in visual acuity and reduces the number of subsequent injections.

A Cochrane database review reported that there is no benefit in performing early (before 3 months) or late laser (after 6 months) in eyes with macular edema secondary to BRVO²⁸.

The European Vitreoretinal Society (EVRs) also found that for medical management, monotherapy with anti-VEGF agents were superior to any form of combination therapy²⁹.

Surgical management

Pars plana vitrectomy with ILM peeling is being suggested as an option for the management of macular edema with BRVO. The rationale for this treatment includes relief of traction, improved oxygenation of vitreous and retina thereby preventing photoreceptor loss, removal of inflammatory, and permeability factors such as VEGF and upregulation of epidermal growth factors which help the healing process. The EVRS found vitrectomy with ILM peeling was the most effective management reporting visual gains that were almost twice as high as anti-VEGF agents at 24 months postoperatively²⁹.

Scatter laser: Scatter laser to the affected quadrant is part of the care given by some ophthalmologists. This helps reduce the VEGF drive by ablating ischaemic retina. It has been shown to be effective in the management of ME secondary to BRVO when used in combination intravitreal avastin and macula grid laser with a reduction in CMT and improvement in VA³⁰.

Looking ahead: Conbercept is a novel antiVEGF agent. It is a recombinant fusion protein of key extracellular domains from human VEGF receptors 1 and 2 and IgG Fc produced in a Chinese hamster ovarian cell line. It blocks all VEGF-A isoforms as well as VEGF-B, VEGF-C, and placental growth factor. Intravitreal injection of conbercept is shown to be safe and effective for the treatment of ME secondary to BRVO, based on 6-month follow-up data with no significant differences in terms of reduction in central macular thickness, visual acuity improvement and average number of injections compared to ranibizumab³¹.

Ziv-aflibercept (Zaltrap; Regeneron, New York, USA), is an antiVEGF drug which is a recombinant fusion protein with a similar mechanism to aflibercept. It has

been shown in a case report by Chhablani³² to be effective in the management of macular oedema secondary to CRVO. Studies on its effect in macular oedema secondary to BRVO are still pending.

Subthreshold grid laser therapy has been studied for its effects on macular oedema secondary to BRVO and it was found to be as effective as standard threshold grid laser in terms of reduced foveal thickness and visual acuity gains at 6 months, 1 year and 2 years³³.

Subthreshold laser has also been found to be useful in reducing central macular thickness in patients with persistent macular oedema secondary to BRVO without inducing any significant retinal damage especially in cases where the vision was >20/40³⁴.

CONCLUSION

Branch retinal vein occlusion is the second most common retinal vascular disease after diabetic retinopathy and can be a potentially blinding condition. Since the BVOS, there are now several modalities of treatment that can be employed ranging from threshold and subthreshold lasers, intravitreal corticosteroids and antiVEGF agents as well as systemic agents. These have all been shown to stabilize, hasten recovery and/or improve visual acuity while at the same time alleviating complications such as neovascular glaucoma and vitreous haemorrhage.

REFERENCES

1. Lam FC, Chia SN, Lee RM. Macular grid laser photocoagulation for branch retinal vein occlusion. *Cochrane Database Syst Rev*. 2015; **5**:CD008732.
2. Campochiaro PA, Heier JS, Feiner L, Gray S, Saroj N, Rundle AC, *et al*. Ranibizumab for macular edema following branch retinal vein occlusion: Six-month primary end point results of a phase III study. *Ophthalmology*. 2010; **117**(6):1102-12.
3. Rehak, J. Branch retinal vein occlusion: pathogenesis, visual prognosis, and treatment modalities. *Curr Eye Res*. 2008; **33**(2): 111–131.
4. Cahill MT, Stinnett SS, Fekrat S. Meta-analysis of plasma homocysteine, serum folate, serum vitamin B12, and thermolabile MTHFR genotype as risk factors for retinal vascular occlusive disease. *Am J Ophthalmol*. 2003; **136**(6):1136–1150.
5. Rogers SL, McIntosh RL, Lim L, Mitchell P, Cheung N, *et al*. Natural history of branch retinal vein occlusion: an evidence-based systematic review. *Ophthalmology*. 2010; **117**: 1094–1101. [PubMed: 20430447]
6. Hayreh S. Ocular vascular occlusive disorders: Natural history of visual outcome. *Prog Retin Eye Res*. 2014; **4**: 1–25.
7. Hayreh S, Zimmerman B. Fundus changes in branch retinal vein occlusion. *Retina*. 2015; **35**(5):1016–1027.

8. The Branch Vein Occlusion Study Group: Argon laser photocoagulation for macular edema in branch vein occlusion. *Am J Ophthalmol.* 1984; **98**(3):271-282.
9. Scott IU, Ip MS, VanVeldhuisen PC, Oden NL, Blodi BA, Fisher M, *et al.* A randomized trial comparing the efficacy and safety of intravitreal triamcinolone with standard care to treat vision loss associated with macular edema secondary to branch retinal vein occlusion: The Standard Care vs Corticosteroid for Retinal Vein Occlusion (SCORE) study report 6. *Arch Ophthalmol.* 2009; **127**(9):1115-28.
10. Haller JA, Bandello F, Belfort R Jr, Blumenkranz MS, Gillies M, *et al.* Dexamethasone intravitreal implant in patients with macular edema related to branch or central retinal vein occlusion twelve-month study results. *Ophthalmology.* 2011; **118**(12):2453-60.
11. Hikichi T, Higuchi M, Matsushita T, Kosaka S, Matsushita R, Takami K, *et al.* Two-year outcomes of intravitreal bevacizumab therapy for macular oedema secondary to branch retinal vein occlusion. *Br J Ophthalmol.* 2014; **98**(2):195-199.
12. Rush RB, Simunovic MP, Aragon AV, Ysasaga JE. Treat-and-extend intravitreal bevacizumab for branch retinal vein occlusion. *Ophthalmic Surg Lasers Imaging Retina.* 2014; **45**(3):212-216.
13. Guignier B, Subilia-Guignier A, Fournier I, Ballonzoli L, Speeg-Schatz C, Gaucher D. Prospective pilot study: Efficacy of intravitreal dexamethasone and bevacizumab injections in the treatment of macular oedema associated with branch retinal vein occlusion. *Ophthalmologica.* 2013; **230**(1):43-49.
14. Leitritz MA, Gelissen F, Ziemssen F, Szurman P, Bartz-Schmidt KU, Jaissle GB. Grid laser photocoagulation for macular oedema due to branch retinal vein occlusion in the age of bevacizumab? Results of a prospective study with crossover design. *Br J Ophthalmol.* 2013; **97**(2):215-219.
15. Brown DM, Campochiaro PA, Bhisitkul RB, Ho AC, Gray S, Saroj N, *et al.* Sustained benefits from ranibizumab for macular edema following branch retinal vein occlusion: 12-month outcomes of a phase III study. *Ophthalmology.* 2011; **118**(8):1594-1602.
16. Campochiaro PA, Clark WL, Boyer DS, Heier JS, Brown DM, Vitti R, *et al.* Intravitreal aflibercept for macular edema following branch retinal vein occlusion: The 24-week results of the VIBRANT study. *Ophthalmology.* 2015; **122**(3):538-544.
17. Clark WL, Boyer DS, Heier JS, Brown DM, Haller JA, Vitti R, *et al.* Intravitreal aflibercept for macular edema following branch retinal vein occlusion: 52-week results of the VIBRANT study. *Ophthalmology.* 2016; **123**(2):330-336.
18. Houtsmuller JA, Vermeulen M. Klotz, *et al.* The influence of ticlopidine on the natural course of retinal vein occlusion. *Agents Actions Suppl.* 1984; **15**: 219-229.
19. Glacet-Bernard A, Coscas G, Chabanel A, Zourdani A, Lelong F, Samama MM. A randomized, double-masked study on the treatment of retinal vein occlusion with troxerutin. *Amer J Ophthalmol.* 1994; **118**(4): 421-429.
20. Murakami T, Takagi H, Kita M, *et al.* Intravitreal tissue plasminogen activator to treat macular edema associated with branch retinal vein occlusion. *Amer J Ophthalmol.* 2006; **142**(2): 318-320.
21. Hattenbach LO, Steinkamp G, Scharrer I, Ohrloff C. Fibrinolytic therapy with low dose recombinant tissue plasminogen activator in retinal vein occlusion. *Ophthalmologica.* 1998; **212**(6): 394-398.
22. Lazo-Langner A, Hawel J, Ageno W, Kovacs MJ. Low molecular weight heparin for the treatment of retinal vein occlusion: a systematic review and meta-analysis of randomized trials. *Haematologica.* 2010; **95**(9): 1587-1593.
23. Ageno W, Cattaneo R, Manfredi E, *et al.* Parnaparin versus aspirin in the treatment of retinal vein occlusion. A randomized, double blind, controlled study. *Thrombosis Res.* 2010; **125**(2): 137-141.
24. Tomomatsu Y, Tomomatsu T, Takamura Y, Gozawa M, Arimura S, Takihara Y, *et al.* Comparative study of combined bevacizumab/targeted photocoagulation vs bevacizumab alone for macular oedema in ischaemic branch retinal vein occlusions. *Acta Ophthalmol.* 2016; **94**(6): e225-230.
25. Campochiaro PA, Hafiz G, Mir TA, Scott AW, Solomon S, Zimmer-Galler I, *et al.* Scatter photocoagulation does not reduce macular edema or treatment burden in patients with retinal vein occlusion: The RELATE Trial. *Ophthalmology.* 2015; **122**(7):1426-1437.
26. Pielon A, Mirshahi A, Feltgen N, Lorenz K, Korb C, Junker B, *et al.* Ranibizumab for Branch Retinal Vein Occlusion Associated Macular Edema Study (RABAMES): Six-month results of a prospective randomized clinical trial. *Acta Ophthalmol.* 2015; **93**(1):e29.
27. Azad SV, Salman A, Mahajan D, Sain S, Azad R. Comparative evaluation between ranibizumab combined with laser and bevacizumab combined with laser versus laser alone for macular oedema secondary to branch retinal vein occlusion. *Middle East Afr J Ophthalmol.* 2014; **21**(4):296-301.
28. Lam FC, Chia SN, Lee RM. Macular grid laser photocoagulation for branch retinal vein occlusion. *Cochrane Database Syst Rev.* 2015; **5**:CD008732.
29. Adelman RA, Parnes AJ, Bopp S, Saad Othman I, Ducournau D. Strategy for the management of macular edema in retinal vein occlusion: The European Vitreo Retinal Society Macular Edema study. *Biomed Res Int.* 2015; **2015**:870987.

30. Yang CS, Liu JH, Chung YC, Chou YB, Hung KH. Combination therapy with intravitreal bevacizumab and macular grid and scatter laser photocoagulation in patients with macular edema secondary to branch retinal vein occlusion. *J Ocul Pharmacol Ther.* 2015; **31**(3):179-185.
31. Li F, Sun M, Guo J, Ma A, Zhao B. Comparison of conbercept with ranibizumab for the treatment of macular edema secondary to branch retinal vein occlusion. *Curr Eye Res.* 2017; **42**(8): 1174-78.
32. Chhablani J. Intravitrealziv-aflibercept for recurrent macular edema secondary to central retinal venous occlusion. *Indian J Ophthalmol.* 2017; **63**(5): 469-470.
33. Parodi MB, Spasse S, Iacono P, Di Stefano G, Canziani T, Ravalico G. Subthreshold grid laser treatment of macular edema secondary to branch retinal vein occlusion with micropulse infrared (810 nanometer) diode laser. *Ophthalmology.* 2006; **113**(12):2237-2242.
34. Inagaki K, Ohkoshi K, Ohde S, Deshpande GA, Ebihara N, Murakami A. Subthreshold micropulse photocoagulation for persistent macular edema secondary to branch retinal vein occlusion including best-corrected visual acuity greater than 20/40. *J Ophthalmol.* 2014; **2014**:251257.

Prevalence and pattern of manifest strabismus in paediatric patients at CCBRT, Dar es Salaam, Tanzania

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ABSTRACT

Background: Awareness on the magnitude of strabismus burden is crucial in preventing development of amblyopia, restore binocularity, aid in development of stereopsis and improve treatments outcomes.

Objective: To determine the prevalence, and pattern of strabismus presentation in paediatric patients at Comprehensive Community Based Rehabilitation in Tanzania (CCBRT).

Design: Retrospective descriptive hospital based study.

Subjects: Children aged 16 years and below presenting with strabismus at CCBRT between January 1, 2014 and June 30, 2014.

Methods: All strabismus coded files of patients below 16 years were identified from medical records. The data collected included patients' demographic data; age at onset of strabismus; visual acuity; characteristics of the deviation; refractive status; binocular functions and amblyopia assessment; and relevant ocular and systemic findings.

Results: The prevalence of strabismus was 5.9%. Males were 49.1% and females 50.9%. Family history was present in 3.3% of the patients. Most of the patients (61.8%) were below five years; average 4.6 years. A third of the patients (32.5%) presented within one year of onset of strabismus; average duration 25.7 months. Systemic and ocular co morbidities were present in 17.9% and 46.2% of the patients respectively. About half (47.9%), had normal vision. Esotropia was the commonest deviation (63.3%); exotropia, 24% and hypertopia 2.8% . In 76.9% the strabismus was unilateral and alternating in 22.6%. Most of the deviations (42.9%) were between 30-50 prism dioptres. Hyperopia was in 51.7%; myopia in 14.4% and astigmatism 11.6% of the eyes. Amblyopia was noted in 25.9% of the patients. Binocular single vision assessment was done in 14.1%; 62.5% had a negative result.

Conclusion: The prevalence of strabismus in this study was high at 5.9%. Esotropia was the commonest deviation.

INTRODUCTION

Geographical and racial variation in prevalence and patterns of strabismus in children has been described. Esotropia has previously been described to be more common mainly based on studies of the Caucasian population. In Japan and Indian studies exotropia has been described as more common owing to steady increase of intermittent exotropia over the years. There is a paucity of studies devoted exclusively to strabismus in children in Africa^{1,2}. Awareness on the magnitude of strabismus burden in our population is crucial in preventing development of amblyopia, restore binocularity, aid in development of stereopsis and improve treatments outcomes. The objectives of the study were to determine the prevalence, and pattern of strabismus presentation in paediatric patients at CCBRT, Dar es Salaam, Tanzania.

MATERIALS AND METHODS

This was a retrospective descriptive hospital based study. The study population included children below 16 years of age presenting with strabismus at CCBRT between January 1, 2014 and June 30, 2014. The data collected included patients' demographics; age at onset of the strabismus; visual acuity; characteristics of the deviation; patients refractive status; status of binocular functions and assessment of amblyopia; and relevant ocular and systemic findings.

RESULTS

Two hundred and twelve patients presented with strabismus; out of a total of 3,600 patients during the study period. Thus the prevalence of strabismus was 5.9%. The distribution was almost equal between the two genders; male 49.1% and female 50.9%. Family history was present in 3.3% of the patients (Figure 1).

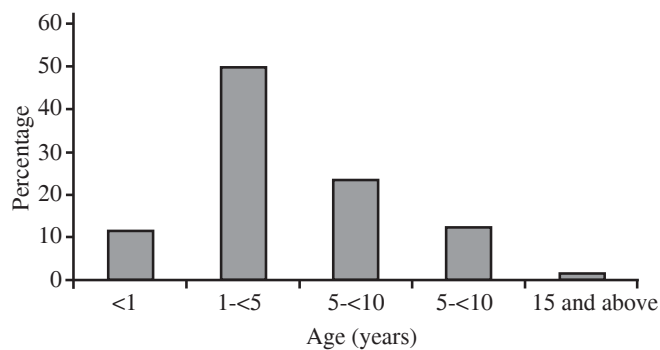


Figure 1: Age distribution at presentation (n=212)

Most of the patients (61.8%) were below five years of age. The average age was 4.6 years and the range was one week to 15 years.

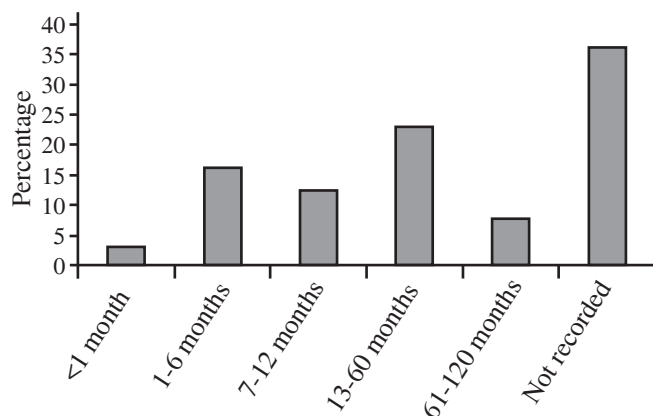


Figure 2: Duration of strabismus at presentation

A third of the patients (32.5%) presented within one year of onset of strabismus. The average duration of strabismus at presentation was 25.7 months. In 36.3% of the patients the duration of symptoms was not recorded (Figure 2).

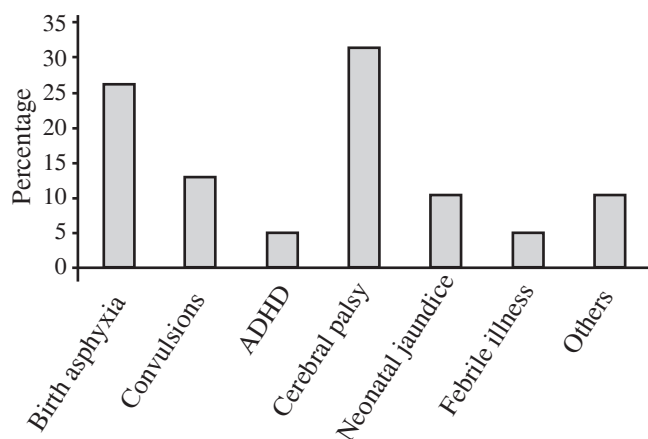


Figure 3: Systemic co morbidities

Systemic co morbidities were present in 17.9% of the patients, of which cerebral palsy was the commonest. Others included hydrocephalus (1), hemiparesis (1) prematurity (1) and albinism (1) (Figure 3).

Table 1: Ocular co morbidities (n=98)

Associated ocular findings	No.	(%)
Aphakia	3	2.9
Pseudophakia	33	31.7
Cataracts	9	8.7
Nystagmus	16	15.4
Cerebral visual impairment	8	7.7
Glaucoma	5	4.8
Duane syndrome	5	4.8
Ocular nerve palsies	5	4.8
Optic atrophy	4	3.8
Macular scars	4	3.8
Retinoblastoma	2	1.9
Others	10	9.6
Total	104	100

Ocular co morbidities were noted in 46.2% of the patients. The commonest ocular co morbidity was pseudophakia cerebral visual impairment and nystagmus co existed with the others in some patients. Others included retinal detachment (2), pathological myopia (2), ptosis (2), microcornea (2), choroidal coloboma (1) and retinitis pigmentosa (1) (Table 1).

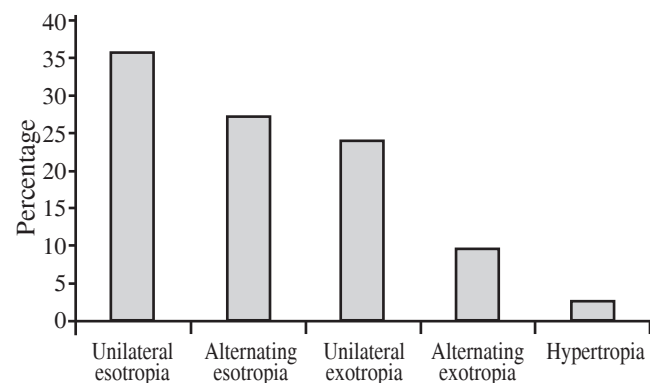


Figure 4: Type of deviation (n=212)

Esotropia was the commonest deviation. Hypertropia was combined with horizontal strabismus except in one patient. Two thirds of the cases had unilateral strabismus while in a third it was alternating (Figure 4).

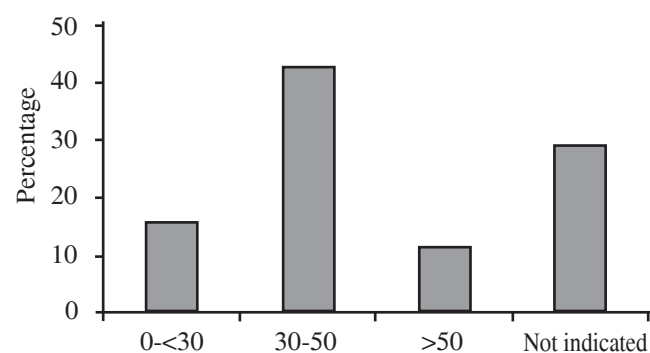


Figure 5: Size of the deviation (Prism diptres) (n=212)

Majority of the patients had deviation of 30-50 prism dioptres. In a third of the patients the size of the angle was not indicated (Figure 5).

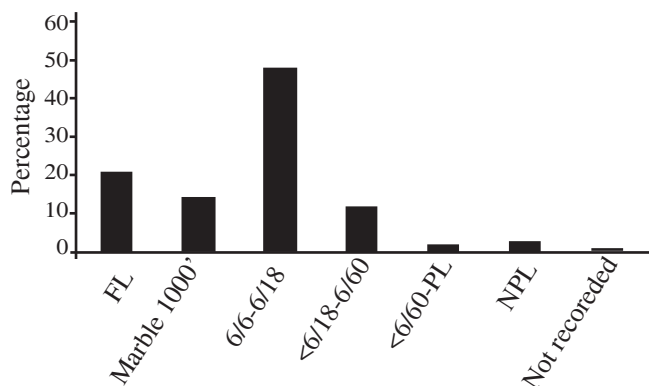


Figure 6: Visual acuity assessment (n=212)

All except two children had vision assessed; with most having normal visual acuity (Figure 6).

Table 2: Refractive status (n=424 eyes)

Refractive status	RE	LE	Both	(%)
Plano	9	12	21	5.0
Myopia < -0.50	0	0	0	0.0
Myopia $\geq$ -0.50	32	29	61	14.4
Hyperopia < +0.50	8	5	13	3.1
Hyperopia $\geq$ +0.50	107	112	219	51.7
Astigmatism $\geq$ 0.50	31	30	61	14.4
Not done	25	24	49	11.6
Total	212	212	424	100

Hyperopia was the commonest refractive status. Hyperopia $\geq$ +4 dioptres was present in 13% of the eyes. High myopia $\geq$ -6 dioptres and astigmatism $\geq$ 2 dioptres were noted in 2.1% and 3.8% of the eyes respectively.

Amblyopia assessment: Amblyopia was noted in 25.9% of the patients; 44.3% did not have amblyopia while in 29.7% assessment was not done.

Binocular single vision: Assessment was done in 30 (14.1%) patients. Majority of these, 24 (11.3%) had stereopsis assessed while 2.8% had prism fusion test. Of those who had stereopsis assessed, the test was negative in 62.5% and positive in 37.5%.

DISCUSSION

The prevalence of strabismus in our hospital based study was 5.9%. The worldwide population based studies show a prevalence of 2-5%³. School based and rural studies done in Tanzania, Nigeria and Sudan reported a lower prevalence range of 0.5% to 2.6%⁴⁻⁶.

The proportion of males (49.1%) and females (50.9%) was similar to what has been noted in a Hong Kong study involving 2704 strabismus patients, where males were 46.8% and females 53.2%².

Esotropias (63.2%) were twice as common as exotropias (34%); similar to what is reported in other studies^{1,2,6,7}. In a study in Nigeria, congenital esotropia and accommodative esotropia constituted 50.0% and 18.8% of cases respectively while, exotropia constituted 31.3%⁷. Although, studies in Cameroon, Hong Kong and Asia have reported more exotropias compared to esotropias^{2,8,9}.

A third of our patients (32.5%) presented within the first year of life when esotropias are known to set in¹⁰. In 36.3% the duration of the strabismus was not recorded. It is important to note the duration of strabismus since it can be a pointer to health seeking behaviour with regards to strabismus and also be an indicator to onset of amblyopia.

Majority of the patients (62.8%) had constant unilateral strabismus while a third had the alternating type. It is expected that the unilateral strabismus do not have binocular single vision. Although this was assessed in only 14.2% of the patients, 62.5% had negative results, which is consistent with laterality of the deviations. Challenges associated with binocular vision assessment in children include the age factor, difficulties in understanding the instructions and interpretation of the pictorial elements presented.

Almost half of the patients (42.9%) had deviations of 30-50 prism dioptres. In 29%, the size of the angle was not indicated. This is an important parameter in strabismus because its measure determines progression of the deviation and management of the strabismus during surgery or where accommodative component is involved¹¹.

There was significant proportion of patients with systemic (17.9%) and ocular (46.2%) co morbidities. Among the systemic, birth asphyxia with or without cerebral palsy, convulsions and neonatal infections are known triggers of strabismus¹². Strabismus can also result from sensory deprivation such as in cataracts, ptosis or retinal problems. Of note is retinoblastoma presenting as strabismus, which was noted in two of our patients. This emphasizes the importance of complete systemic and ocular evaluation in children presenting with strabismus.

Majority of the patients (47.9%) presented with normal vision according to WHO standards. Possible causes of poor vision in the study included amblyopia, refractive errors, ocular and systemic co morbidities such as cerebral palsy causing difficulties in assessment of vision due to depressed mental state.

Risks of amblyopia in the study which was noted in 25.9% of the patients included long duration before presentation (average 25.7 months), constant unilateral strabismus (62.8%), refractive errors and high proportion of ocular co morbidities; some of which are amblyogenic. In a third of the patients, assessment for amblyopia was not done. Strabismic amblyopia occurs in 40-50% of the patients^{13,10}. In our study, it is possible this was under diagnosed considering amblyopia was not assessed in a third of the patients. It is important that all patients with strabismus are assessed so that where possible timely

management is instituted to prevent permanent loss of vision and long term sequel of amblyopia¹⁴.

Study limitations

- (i) Information missing on medical records could not be obtained.
- (ii) Intermittent strabismus could have been missed or classified with the constant ones.

CONCLUSIONS

The prevalence of strabismus was high, (5.9%). Esotropia was the commonest type of strabismus. A significant proportion of patients had systemic and ocular comorbidities. Amblyopia was present in 25.9% of the patients.

ACKNOWLEDGEMENTS

- (i) Fred Hollows Foundation for the Fellowship Sponsorship in Paediatric Ophthalmology at CCBRT, Dar es Salaam.
- (ii) The staff and supervisors at CCBRT Dar es Salaam for support and guidance during the training and research project.
- (iii) Department of Ophthalmology, University of Nairobi for the opportunity to train and conduct research at CCBRT Dar es Salaam.

REFERENCES

1. www.slideshare.net/hmirzaeee/review-of-strabismus
2. Yu BCO, Fan DSP, Wong VWY, Wong CY, Lam DSC. Changing patterns of strabismus, a decade of experience in Hong Kong. *Br J Ophthalmol*. 2002; **86**: 854-856.
3. Donnelly UM, Stewart NM, Hollinger M. Prevalence and outcomes of childhood visual disorders. *Ophthalmic Epidemiol*. 2005; **12**: 243-250.
4. Susanne HW, David AR, Rebecca B, Lucia K, Allen F. Prevalence of eye diseases in primary school children in a rural area of Tanzania. *Br J Ophthalmol*. 2000; **84**:1291-1297.
5. Benedicta AA, Oseluese AD, Ebele GA. Prevalence and pattern of strabismus in primary school pupils in Benin City, Nigeria. *Nigerian J Ophthalmol*. 2014; **22**: 38-43.
6. Aalaa OT, Samira MI. Prevalence of manifest horizontal strabismus among basic school children in Khartoum city. *Sudanese J Ophthalmol*. 2015; **7**: 54-57.
7. Azonobi IR, Olatunji FO, Addo J. Prevalence and pattern of strabismus in Ilorin. *J West Afr Med*. 2009; **28**(4):253-256.
8. Ebana mvogo C, Bella- Hiag AL, Espesse M. Strabismus in Cameroon. *J Fr Ophthalmol*. 1996; **19**: 705-709.
9. Mohny BG, Greenberg AE, Diehl NN. Age at strabismus diagnosis in an incidence cohort of children. *Am J Ophthalmol*. 2007; **144**(3):467-469.
10. Chia A, Roy L, Seenyen L. Comitant horizontal strabismus: an Asian perspective. *Br J Ophthalmol*. 2007; **91**(10):1337-1340.
11. Helena BH, Kenneth WW. Principles of strabismus surgery for common horizontal and vertical strabismus types. Chapter 12; Open access textbook; 2016.
12. Njambi L, Kariuki MM, Masinde S. Ocular findings in children attending occupational therapy clinic at Kenyatta National Hospital. *East Afr J Ophthalmol*. 2009; **15**: 21-26.
13. Chew E, Ramalay NA, Tamboli A, Zhao J, Podgor MJ, Klebanoff M. Risk factors for esotropia and exotropia. *Arch Ophthalmol*. 1994; **112**: 1349-1355.
14. Chua B, Mitchell P. Consequences of amblyopia on education, occupation, and long term vision loss. *Br J Ophthalmol*. 2004; **88**: 1119-1121.

Prevalence of strabismus and the outcomes of its management among children attending Ruharo Eye Center, South Western Uganda

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ABSTRACT

Background: Strabismus consists of any deviation of binocular alignment and is present in 2 to 4% of the world's child population. Strabismus can be both the cause and the effect of poor binocularity. When it appears in the early years of life, strabismus may lead to states of sensorial adaptation such as retinoic correspondence anomaly and amblyopia given that binocular single vision has a critical role in maintaining alignment. On the other hand, if strabismus arises after binocular vision development, diplopia and image confusion appear, which persist indefinitely or until motor alteration is corrected.

Aim: To determine prevalence of strabismus and outcomes of its management among children attending Ruharo Eye Center, South western, Uganda from January 2014 to December 2015.

Methods: In this retrospective descriptive study, medical records of all strabismus patients aged below 16 years seen at Ruharo Eye Center, South western, Uganda from January 2014 to December 2015, were reviewed. Information was collected on demographic characteristics, refractive errors, types of strabismus, management and outcomes.

Results: A total of 8,665 children were seen at REC during the period from January 2014 to December 2015. Of these, 125 children had strabismus thus a prevalence of 1.4%. There were 56 males (44%) and 69 females (55%) with mean age of 14 years, from 4 months to 15 years. Twenty nine children (23.2%) had amblyopia and eighty six children (68.8%) had refractive errors of more than 0.5 diopter. Patients with hypermetropia were 45 (36.0%), myopia 38 (30.4%) and astigmatism 3(2.4%). Esotropia accounted for 80% and exotropia 20% and both were the common types. In our study, the management of strabismus cases included: glasses (30), eye patching (30) and surgery (34). Of the 34 patients operated, post-operative alignment was achieved in 25 cases (73.53%) and under correction occurring in 17.65%.

Conclusion: The prevalence of paediatric strabismus at Ruharo Eye Center was 1.4%. The most common type of paediatric strabismus in this study was esotropia. The surgical success rate was generally good.

INTRODUCTION

Strabismus consists of any deviation of binocular alignment and is present in 2 to 4% of the world's child population¹. It can be both the cause and the effect of poor binocularity. If strabismus arises after binocular vision development, diplopia and image confusion appears, which persists indefinitely or until motor alteration is corrected².

Strabismus is a common cause of amblyopia and its identification at an earlier age may prevent the development of amblyopia and improve the chance of restoring binocularity as well as effectively treating strabismus -associated amblyopia. Moreover, visual loss in childhood may have negative impact on their development and education. With early management of strabismus, improved visual acuity and better cosmetic outcomes can be achieved^{3,4}.

Strabismus causes considerable psychosocial problems in patients and their families and dramatically decreases their quality of life⁵. In fact, the appearance of ocular misalignment may interfere with social and psychological development with potentially serious effects for all patients with strabismus⁶⁻¹⁰.

Patients with strabismus have several treatment options available to improve eye alignment and coordination. These include glasses, eye patching and

surgery, which aim at maximizing binocular single vision, maintaining visual acuity or visual field in both eyes and improving mental and social functions. Outcome of strabismus surgery are categorized as normal alignment, under correction (residual deviation) or overcorrection¹¹.

Few studies have been done in Uganda on strabismus but none was specifically done in children. For the year 2015, 104 children with strabismus were seen at Ruharo Eye Center (Ruharo records, 2015) however its prevalence is not known in our set up. Different therapeutic options are used to manage paediatric strabismus at Ruharo Eye Center but no study has been done so far to assess the outcomes.

Therefore, we conducted this study to determine the prevalence of strabismus and the outcomes of its managements among children at Ruharo Eye Center in order to design better management strategies for strabismus patients in the future.

MATERIALS AND METHODS

The records of 2014 and 2015 were used to identify all the children who attended the clinic during that period and the strabismus cases out of them.

Inclusion criteria: All cases of paediatric strabismus with full medical records and onset age of strabismus below

16 years based on inclusion criteria, we analyzed 125 cases that were reported from January 2014 to December 2015. Data were extracted from questionnaires. For all children with strabismus, data regarding history, socio-demographic and clinical presentation was collected.

Data collection: Gender, age of onset and age at time of presentation, family history of strabismus, refractive errors (Spherical equivalent = Sphere + 1/2 Astigmatism) with or without amblyopia, the type of strabismus, the type of management, and their outcomes. Based on direction, strabismus types are classified as esotropia, exotropia. The strabismus management included: glasses, eye patching, surgery and follow-up.

Successful outcome in our survey was defined as postoperative residual deviation to be less than 8 prism diopters. Misalignments were defined as undercorrection or overcorrection both with more than 8 prisms of deviation. The excel dataset was imported into STATA 12.0 statistical software for analysis. Participants' characteristics were described using appropriate summary statistics that is mean or median for continuous variables and frequency or proportions for categorical variables.

The prevalence of strabismus among children who attended Ruharo Eye Center from January 2014 to December 2015 was calculated as a percentage of all children with strabismus out of all children consultancies at REC within the same period.

Proportions and pie-chart were used to describe the types of paediatric strabismus. Two-way tables and bar-chart were used to present the distribution of various outcomes of strabismus management among children attending Ruharo Eye Centre from January 2014 to December 2015 by treatment method used.

RESULTS

A total of 8,665 children were seen at REC during the period from January 2014 to December 2015. Of these, 125 children had strabismus thus a prevalence of 1.4%. There were 56 males (44%) and 69 females (55%) with mean age of 14 years, from 4 months to 15 years. Twenty nine children (23.2%) had amblyopia and 86 (68.8%) had refractive errors of more than 0.5 diopter. Patients with hypermetropia were 45 (36.0%), myopia 38 (30.4%) and astigmatism 3 (2.4%). Esotropia accounted for 80% and exotropia 20% and both were the common types. In our study, the management of strabismus cases included: glasses, eye patching and surgery.

Table 1: Frequency of different types of managements

Mode of treatment	Number (n)	Proportion (%)
Surgery	34	31.8
Glasses	30	27.7
Patching	30	27.7
Patching and glasses	7	6.4
Patching, glasses and surgery	1	0.9

Out of 29 children with amblyopia 15 (51.7%) had a good outcome with three or more lines of improvement from the base line, 9 (31.03%) had -1 to +1 line of improvement and 5 (17.2%) had +2 lines of improvement from the baseline after three months of treatment (Figure 1).

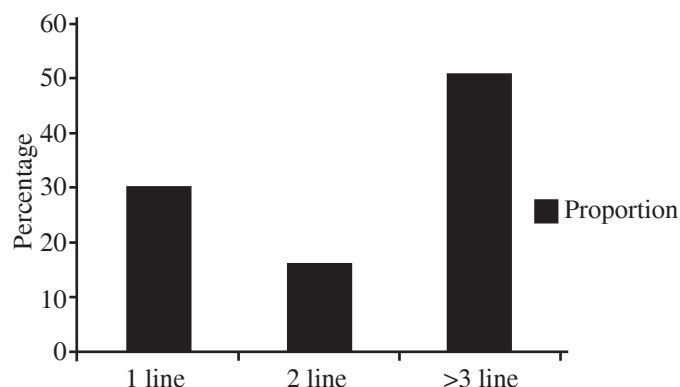


Figure 1: Outcome of patching (n=29)

Among the 30 patients who were treated with eye glasses, 12 (40%) were full accommodative, but 17 (56.7%) were not accommodative. One patient was lost to follow up.

Among the 34 patients who underwent strabismus surgery, 25 (73.5%) achieved alignment, 6 (17.7%) had undercorrection and 3 (8.8%) patients were lost for follow up. In general, the postoperative eye position of patients with strabismus was straight (73.5%) (Figure 2).

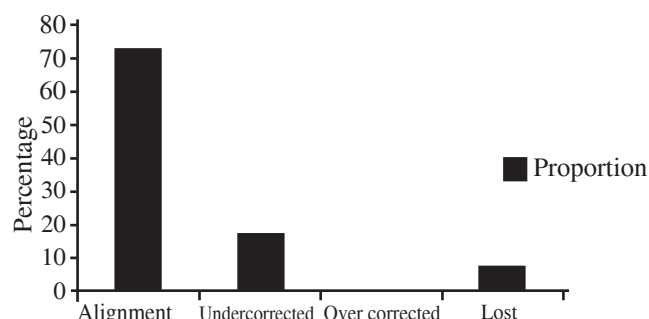


Figure 2 : Outcome of surgery (n=34)

DISCUSSION

This study was done on 125 patients with paediatric strabismus. The prevalence of strabismus at Ruharo Eye Center was 1.4%. A similar prevalence of 1.5% was found in the younger sample of Head Start children¹². A study done in Hispanic/Latino and African-American showed a prevalence of (2.4%), (2.5%) children who participated in the MEPEDS¹³. Also the prevalence of 2% to 5% was reported in studies done in European-based (white) and African American populations¹⁴, but they were population-based studies and cannot be comparable with our study.

In our study, the main types of strabismus were esotropia and exotropia. Matsuo *et al*¹⁵ assessed 86,220 preschool children and found 1,113 cases strabismus of

which exotropia and esotropia was the most common frequent types. Also in the study of Yu *et al.*, 2002 in Hong Kong¹⁶, on 2,704 strabismus patients, they reported that exotropia and esotropia were the most common types.

Esotropia was the commonest type of strabismus in our study with 80% of the cases. Same results were seen in a study done in Minnesota on 627 children, and in Rasht on 291 strabismus children which reported that esotropia (76%) was more common than exotropia (24%)^{17,18}. However, Najafi¹⁹ in Tehran, found a prevalence of 61.5% exotropia and 33.6% esotropia cases.

In this study, 73.5% of surgical cases had successful outcome and (17.5%) were undercorrected. In a similar study done in Romania (73%) had successful outcome, (21. 6%) had surgical under correction and (4.5%) were overcorrected¹¹. In Thailand (61.5%) had successful surgical outcome as was the case in Tehran with 90.3%²⁰.

In conclusion, the prevalence of strabismus was 1.4%. Esotropia and exotropia are the most common types of paediatric strabismus. The surgical success rate was generally good.

ACKNOWLEDGEMENTS

Special thanks are extended to Ruharo Eye Centre and Department of Ophthalmology at MUST.

REFERENCES

1. Garcia CAdA, Sousa, ABD, Mendonca, MBDM, *et al.* Prevalence of strabismus among students in Natal/RN-Brazil. *Arq. bras. oftalmol.* 2004; **67**(5): 791-794.
2. Bicas HEA. Visão binocular e estrabismo. *Arq. bras. oftalmol.* 1987; **50**(1): 36-41.
3. Simons K. Amblyopia characterization, treatment, and prophylaxis. *Surv Ophthalmol.* 2005; **50**(2): 123-166.
4. Woodruff G, Hiscox, F, Thompson, JR, *et al.* The presentation of children with amblyopia. *Eye (Lond).* 1994; **8** (Pt 6): 623-626.
5. Lilakova D, Hejcmanova D, Novakova D. [Effect of strabismus on the quality of life in adults]. Ceska a slovenska oftalmologie: casopis Ceske oftalmologicke spolecnosti a Slovenske oftalmologicke spolecnosti. 2003; **59**(3): 184-187.
6. Burke JP, Leach CM, Davis H. Psychosocial implications of strabismus surgery in adults. *J Pediat Ophthalmol Strabismus.* 1997; **34**(3): 159-164.
7. Sabri K, Knapp CM, Thompson JR, *et al.* The VF-14 and psychological impact of amblyopia and strabismus. *Invest Ophthalmol Visual Sci.* 2006; **47**(10): 4386-4392.
8. Jackson S, Harrad R, Morris M, *et al.* The psychosocial benefits of corrective surgery for adults with strabismus. *Br J Ophthalmol.* 2006; **90**(7): 883-888.
9. Coats DK, Paysse EA, Towler AJ, *et al.* Impact of large angle horizontal strabismus on ability to obtain employment. *Ophthalmology.* 2000; **107**(2): 402-405.
10. Keltner JL. Strabismus surgery in adults: functional and psychosocial implications. *Archives Ophthalmol.* 1994; **112**(5): 599-600.
11. Reza BM, Reza MM, Mojgan K, *et al.* Pediatric strabismus: prevalence and surgical outcomes in Yazd, Iran. *Guoji Yanke Zazhi (Int eye Sci)* 2013; **13**(8):1521-1524.
12. Adler-Grinberg D. Need for eye and vision care in an underserved population: refractive errors and other ocular anomalies in the Sioux. *Optomet Vision Sci.* 1986; **63**(7): 553-558.
13. Group M.-e.P.E.D.S. Prevalence of amblyopia and strabismus in African American and Hispanic children ages 6 to 72 months: the Multi-ethnic Pediatric Eye Disease Study. *Ophthalmology.* 2008; **115**(7): 1229-1236. e1.
14. Friedman DS, Repka, MX, Katz J, *et al.* Prevalence of amblyopia and strabismus in white and African American children aged 6 through 71 months: the Baltimore Pediatric Eye Disease Study. *Ophthalmology.* 2009; **116**(11): 2128-2134. e2.
15. Matsuo T, Matsuo C. Comparison of prevalence rates of strabismus and amblyopia in Japanese elementary school children between the years 2003 and 2005. *Acta Med Okayama.* 2007; **61**(6): 329.
16. Yu CB, Fan DS, Wong VW, *et al.* Changing patterns of strabismus: a decade of experience in Hong Kong. *Br J Ophthalmol.* 2002; **86**(8): 854-856.
17. Medghalchi A. A study on prevalence of horizontal strabismus in patients under 14 years. 2003. *J Guilan Univ Med Sci.* 2003; **12**(47):80-85.
18. Mohny BG. Common forms of childhood strabismus in an incidence cohort. *Amer J Ophthalmol.* 2007; **144**(3): 465-467.
19. Najafi A. Prevalence of different types of strabismus in Labbafinejad Hospital. *Med Sci J Islamic Azad Univesity-Tehran Med Branch.* 2007; **17**(1): 33-36.
20. Kampanartsanyakorn S, Surachatkumtonekul T, Dulayajinda D. *et al.* The outcomes of horizontal strabismus surgery and influencing factors of the surgical success. *J Med Ass Thai.* 2005; **88**(Suppl 9): 94-99.

Pattern of posterior segment injuries after ocular trauma at the vitreoretinal unit at Kikuyu Eye Unit, Kenya

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ABSTRACT

Background: Ocular trauma is a significant cause of monocular blindness worldwide. Eye injuries involving the posterior segment have been a matter of concern particularly due to the related poor visual outcome. These injuries require specialised intervention and follow up care to achieve best possible visual outcome.

Objective: This study aimed to give baseline information on pattern of posterior segment eye injuries in the East Africa set up.

Design: Retrospective case series of eye injuries involving posterior segment treated at Kikuyu Eye Unit, a tertiary referral eye hospital in Kenya between 1st January 2010 and 31st December 2014.

Results: One hundred and six eyes of 102 patients were reviewed, including 25 children. Seventy three patients (71.6%) were male and majority were in the 31-40 years age group. The most known circumstance of injury was road traffic accident in 9 (8.8%) patients. Metal was the most common agent causing these injuries in 15 (14.7%) eyes. Seventy nine eyes (74.5%) had closed globe injuries. Retinal detachment and vitreous haemorrhage were the most common findings, at 49 (46.2%) and 47 (44.3%) eyes respectively. Eighty nine eyes (84.0%) were blind at initial review with presenting vision acuity <3/60.

Conclusion: Ocular injuries involving the posterior segment were most common in young males. Closed globe injuries were the most common type of injuries (75%). Most eyes were blind at presentation indicating the severity of these injuries and need for specialised intervention.

Key words: Ocular trauma, Posterior segment injury in East Africa

INTRODUCTION

Ocular trauma is a major cause of significant ocular morbidity¹. Posterior segment ocular injuries involve the vitreous humour, retina, optic nerve and choroid as well as posterior segment blood vessel lacerations. They can be as a result of blunt or penetrating injury resulting in either closed or open globe injuries. In some cases there is the retention of a foreign body.

In defining all ocular injuries, the Birmingham Eye Trauma Terminology (BETT) is widely accepted and used to standardize findings on assessment of the eye. It was developed based on extensive experience and repeated reviews of eye injuries².

Worldwide, there are approximately 1.6 million people blind from eye injuries, 2.3 million with bilateral visual impairment and 19 million with unilateral vision loss¹. Trauma in general, is a major cause of disability worldwide and developing countries carry the heaviest burden, and yet they are the least able to afford the costs³.

In Kenya, eye injuries contributed to 2.7% of all ocular morbidity in 2010⁴. There is no study that has been done in Kenya so far to evaluate the characteristics of posterior segment injuries. Consequently, the presentation, management and outcome of treatment for these injuries remain unknown. On the other hand, the overall financial costs of treatment and rehabilitation

can only be estimated as there is no local data on cost of inpatient treatment for eye trauma patients with posterior segment complications.

There exist certain risk factors in general for ocular trauma including age, sex, and socioeconomic status. With regard to available literature, the majority of those injured are young adults with an average age of around 30 years. As Soliman *et al*⁵ and Omolase *et al*⁶ described, the cause of injury is largely dependent on the environment of the population studied and nature of their day to day activities.

MATERIALS AND METHODS

This study was a retrospective case series. The study included all patients with ocular trauma involving posterior segment structures seen at Kikuyu Eye Unit's (KEU) vitreoretinal unit between 1st January 2010 and 31st December 2014. We excluded eyes with severe anterior segment injuries that precluded posterior segment examination as well as those that had missing records.

The list of all ocular trauma cases was identified by carrying out a computer search at the medical records department in Kikuyu Eye Unit. The search was guided by the ICD-10 code for eye injuries. The corresponding patients' hospital files were retrieved from the records department with the help of the hospital's records clerk.

All patients whose eyes sustained posterior segment injuries within the study period and who met the inclusion criteria were identified on perusal of the files by the principal investigator as well as the research assistants. Additional records were sought from the hospital's theatre register to identify patients who had been operated on in the vitreoretinal theatre as a result of trauma. Their relevant data was entered in a pre-designed data collection sheet on perusal of the medical records and then entered in MS Excel spread sheet after checking for completeness.

Prior to the study, ethical approval was obtained from Kikuyu Eye Unit as well as the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH/UON-ERC).

RESULTS

The study involved 106 eyes of 102 patients in the period from January 2010 to December 2014. Most of the patients were from Kiambu County where the hospital is located. Most of the patients, 73 (71.6%) were male. The male to female ratio was 2.5:1.

The mean age was 27.8 years (range 1-68 years). The age group most affected by injuries involving the posterior segment was between 31-40 years (27.5%) followed closely by the age group between 21-30 years (25.5%). There were 25 children included in the study (Figure 1).

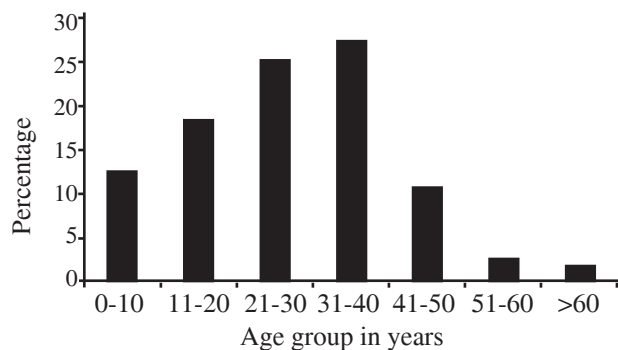


Figure 1: Distribution of patients by age

Seventy nine (74.5%) eyes had closed globe injury while 25.5% had open globe injury. Metal was the most common known agent causing these injuries in 15 (14.7%) eyes. It must however be noted that in 47 (46.1%) cases, the cause of injury was either unknown or unreported (Figure 2).

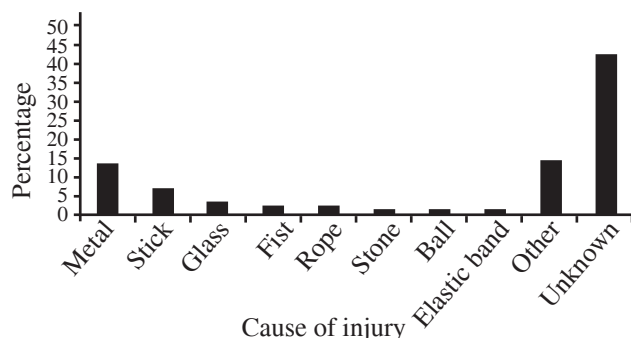


Figure 2: Cause of injury (n=102)

Out of the recorded circumstance of injury, the most common was through Road Traffic Accidents (8.8%) (Figure 3).

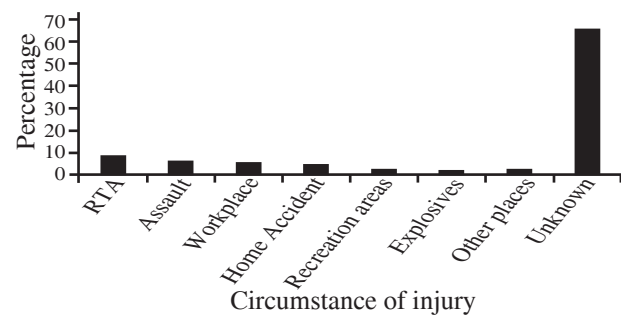


Figure 3: Circumstances of injury among patients (n=102)

Fifty one eyes, (48.1%) had anterior segment involvement alongside posterior segment injury. However, only those with an accessible posterior segment (either by clinical examination or by ultrasound scan) were included in the study.

Seventy (68.60%) patients were self-referral while 20 (19.60%) patients were referred from other health facilities. Seventy two (70.6%) patients did not have treatment as compared to 19 (18.6%) who had received treatment prior to presenting at KEU.

Majority of eyes (84.0%) with posterior segment injury during the study period were found to be blind at presentation (<3/60) (Table 1).

Table 1: Visual acuity at presentation

Presenting VA in the injured eye	Frequency (n=106)
6/6 -6/18	3 (2.8%)
<6/18-6/60	9 (8.5%)
<6/60- 3/60	5 (4.7%)
<3/60	89 (84.0%)

Retinal detachment was the most observed finding in 49 (46.2%) eyes and vitreous haemorrhage in 47 (44.3%) eyes. Forty two patients had more than one finding in the same eye (Figure 4).

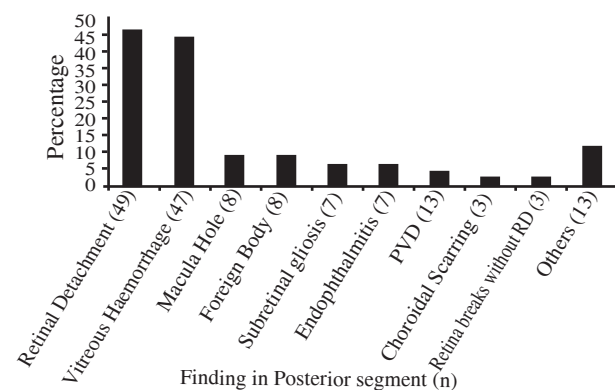


Figure 4: Posterior segment findings at presentation after ocular injury

DISCUSSION

The study involved 106 eyes of 102 patients in the period from January 2010 to December 2014. There was a preponderance of young males to injuries of the posterior segment. This finding is attributed to the social and professional activities that young males are likely to be involved in activities that put them at a higher risk of injury. Young people spend more time outdoors and are also likely to be involved in risky behaviour like taking alcohol, involvement in fights or working without protective wear. According to the USEIR, the male to female ratio is 3.8:1 indicating that even in the developed countries, males are more likely to get eye injuries than females⁷.

After the fifth decade, the risk of injury appeared to reduce. This could be attributed to the fact that older people are less adventurous and their injuries occur in the home environment.

The mean age in our study was 27.8 years (range 1-68 years). There were 25 children (persons who were below sixteen years of age at time of presentation) included in the study. This was comparable to other studies specifically for posterior segment ocular trauma, such as that by Erdurman *et al*⁸ in Turkey who found the mean age of patients to be 26 years. Warrasak *et al*⁹ in Thailand found a mean age of 33.1 years. Soliman *et al*⁵ in Egypt found the average age in ocular trauma in general to be 22 years. Similarly in available but unpublished studies done in Kenya in regard to eye trauma, the commonest age group affected is between 20-40 years.

There was no significant difference in the laterality of the eye affected. Four patients had both eyes injured in the circumstances of assault and road traffic accidents. This is in keeping with USEIR data on ocular injuries where there are more people with unilateral vision loss as compared to people with bilateral visual impairment after ocular injury¹.

In our study, circumstance of injury in most patients was unrecorded (65.7%). Recording of nature, place, source of injury as well as other circumstances surrounding injury on first contact with health care provider is crucial. This comes into play when preventive efforts are needed such as patient education and workplace safety. Notably, medical records are increasingly needed for medicolegal purposes. Out of the recorded causes of injury, metallic objects were found to be the commonest cause (14.7%). Sticks accounted for 7.8% of the injuries. Glass and stone accounted for 3.9% and 2% of the injuries respectively. Other causes of injuries in our study included fist, belts and rubber bands. Our findings however differ from those of Kakembo *et al*¹⁰ in Kenya who found sticks to be the commonest cause in ocular trauma in patients admitted to the national referral hospital's eye ward. Notably however, the highest numbers of cases in that study were in age group between 0-10 years.

In the 25 eyes of children included in this study, the commonest recorded cause of injury was stick in 8 children. Stick injuries in children are as a result of their most common play tool in our set up. As sticks are vegetative material, it is a matter of concern as it increases the risk of endophthalmitis. This compares to Murithi *et al*¹¹ in Kenya in a review of globe injuries in children who found stick to be the commonest causative agent (40.7%) and with the study by Kakembo *et al*¹⁰ who also had a predominance of children in her study and found sticks to be the commonest cause of ocular trauma. However, a prospective study would be useful to verify the above findings as most of the causes of injury were not recorded in the patient records or were unknown.

Road traffic accidents and assault were the commonest circumstances surrounding injury. In Turkey most of the eye injuries involving the posterior segment were work related (26.1%) followed by assault related injuries (19.1%)⁸. In Thailand, the most common causes of injuries were industrial and automobile accident⁹. In Egypt, majority of ocular trauma was due to assault¹⁴. This largely shows circumstances surrounding eye injuries vary from one region to another and may be related to everyday economic activities, work environment policies, transport safety and security.

Most patients (90%) presented after 24 hours of injury. This could have negatively contributed to their final visual outcome. Patients may not be aware of the extent of injury until when significant vision is lost; therefore they seek a specialised eye hospital.

Nineteen (18.6%) eyes received treatment prior to presenting to KEU as compared to 72(70.6%) which did not. This is in keeping with the fact that most patients were self-referrals. The most common treatments received prior were antibiotics and mydriatic eye drops. As most referred patients had already received treatment from the referral centres, this shows that the surrounding facilities are able to give basic eye care prior to referral. Some can give advanced treatment like corneal and scleral repair as well as refer appropriately. In this regard, further vision loss is averted following trauma. Strengthening these primary and secondary eye care facilities in terms of resource is vital in managing minor eye trauma and appropriate referral of major trauma cases.

Studies regarding injuries involving the posterior segment show that closed-globe injuries and sharp penetrating injuries in open globes are significant predictors of good visual outcome^{9,12}. In this study however, we did not find an association of either to the final visual outcome.

Forty eight percent of all eyes had anterior segment involvement alongside posterior segment injury. Ocular injuries involving both anterior and posterior segment have shown to have poor outcomes particularly retinal detachment and presence of RAPD^{13,14}. There is however a paucity of studies comparing anterior segment only injuries with combined anterior and posterior segment injury outcomes. In this study, cataract was the

commonest finding in anterior segment. Erdurman *et al*⁸ found hyphema and cataract to be the most common anterior segment pathology in 29% and 21% of the eyes with posterior segment injuries from ocular contusion that resulted to closed globe injuries.

Retinal detachment (46.2%) and vitreous haemorrhage (44.3%) were the most common presentations after ocular trauma. Retinal detachment also accounted for the most common cause of poor vision. There were 8 (9.4%) eyes with traumatic macula hole as well as the same number of eyes with foreign body lodged in the vitreous or retina. In addition, 42 eyes were found to have more than one finding on examination e.g. vitreous haemorrhage and retinal detachment.

Similarly, Erdurman *et al*⁸ found retinal detachment to be the most frequent pathology (31%) in eyes having contusion injury while vitreous haemorrhage alone occurred in 20% of eyes. In open globes however, retinal detachment has been shown to be higher, occurring in approximately 40–50% of the eyes^{12, 15}. However, final prognosis is similar in eyes with retinal detachment whether secondary to open or closed globe injuries¹⁵. Retinal detachment following open globe injury is also higher than in closed globe among the paediatric age group but the outcome after intervention, like for adults is similar¹⁷.

There were 7 eyes with endophthalmitis at presentation, comprising 26% of all eyes with open globe injury. Diagnosis was made after clinical assessment and on ocular ultrasound. All the 7 eyes with post traumatic endophthalmitis had presented with vision of perception of light (PL). Only 2 had retained foreign bodies. The rate of endophthalmitis has been shown to vary from < 1% to 17%¹⁸. In this study however, the rate of endophthalmitis would be biased due to a small number of eyes with open globes as well as the study focused only on globes with posterior segment involvement. Yang *et al*¹⁹ and Andreoli *et al*²⁰ demonstrated multiple risk factors for endophthalmitis including delay in primary repair, ruptured lens capsule, intraocular foreign body, dirty wounds and intraocular lens placement. However, most authorities agree that the three most important risk factors for posttraumatic endophthalmitis are the presence of an intraocular foreign body, delay in closure of the globe >24 hours, location and extent of laceration¹⁸. In spite of intervention, studies on post traumatic endophthalmitis have shown poor visual outcome with only approximately 44% of the eyes retaining vision better than 20/400^{19, 21}.

Eighty nine eyes (84.0%) were blind at initial review. Therefore, every effort should be made to consult a vitreoretinal unit for timely intervention to save or sustain useful vision. Since most of these injuries are in young patients, a lot of blind years are saved.

Study limitations: The whole eyeball is usually injured in ocular trauma and therefore visual outcome may not entirely be due to posterior segment injuries only.

CONCLUSIONS

Injuries involving the posterior segment were most common in young males. Out of the known circumstances surrounding injury, RTA and physical assault were the most common in this study. Retinal detachment and vitreous haemorrhage were the most common presentations after ocular trauma with retinal detachment accounting for the most common cause of poor vision.

REFERENCES

1. Bmj.com -eye trauma. Available at: bestpractice.bmj.com/best-practice/monograph/961.html. Last accessed 19/01/2017.
2. Kuhn F, Morris R, Witherspoon C, Mester V. The Birmingham Eye Trauma Terminology system (BETT). *J Fr Ophthalmol*. 2004; **27**(2):206–210.
3. Wesson H, Bachani A, Wekesa J, *et al*. Assessing trauma care at the district and provincial hospital levels: a case study of hospitals in Kenya. *Injury*. 2013; **44** (Suppl 4):S75–80.
4. National Strategic Plan for Eye Health and Blindness Prevention 2012 to 2018. p30.
5. Soliman MM, Macky TA. Pattern of ocular trauma in Egypt. *Graefes Arch Clin Exp Ophthalmol*. 2008; **246**(2):205–212.
6. Omolase CO, Omolade EO, Ogunleye OT, *et al*. Pattern of ocular injuries in Owo, Nigeria. *J Ophthalmic Vis Res*. 2011; **6**(2):114–118.
7. Kuhn Ferenc. Ocular Traumatology. 1st ed. Springer. 2008. p59.
8. Erdurman FC, Sobaci G, Acikel CH, *et al*. Anatomical and functional outcomes in contusion injuries of posterior segment. *Eye Lond Engl*. 2011; **25**(8): 1050–1056.
9. Warrasak S, Euswas A, Hongsakorn S. Posterior segment trauma: types of injuries result of vitreo-retinal surgery and prophylactic broad encircling scleral buckle. *J Med Ass Thai*. 2005; **88**(12): 1916–1930.
10. Kakembo A, Kollmann MH, Adala HS. Ocular injuries in Africa. *Soc Sci Med*. 1983; **17**(22): 1729–1735.
11. Murithi I, Gichuhi S, Njuguna MW. Ocular injuries in children. *East Afr Med J*. 2008; **85**(1):39–45.
12. Matthews GP, Das A, Brown S. Visual outcome and ocular survival in patients with retinal detachments secondary to open- or closed-globe injuries. *Ophthalmic Surg Lasers*. 1998; **29**(1):48–54.
13. Globocnik Petrovic M, Lumi X, Drnovsek Olup B. Prognostic factors in open eye injury managed with vitrectomy: retrospective study. *Croat Med J*. 2004; **45**(3):299–303.
14. Unver YB, Acar N, Kapran Z, Altan T. Prognostic factors in severely traumatized eyes with posterior segment involvement. *Ulus Travma Ve Acil Cerrahi Derg. Turk J Trauma Emerg Surg*. 2009; **15**(3): 271–276.

15. Brinton GS, Aaberg TM, Reeser FH, *et al.* Surgical results in ocular trauma involving the posterior segment. *Am J Ophthalmol.* 1982; **93**(3):271–278.
16. Rouberol F, Denis P, Romanet JP, Chiquet C. Comparative study of 50 early- or late-onset retinal detachments after open or closed globe injury. *Retina.* 2011; **31**(6):1143–49.
17. Sarrazin L, Averbukh E, Halpert M, *et al.* Traumatic paediatric retinal detachment: a comparison between open and closed globe injuries. *Am J Ophthalmol.* 2004; **137**(6):1042–49.
18. Callegan MC, Engelbert M, Parke DW, Jett BD, Gilmore MS. Bacterial endophthalmitis: Epidemiology, therapeutics, and bacterium-host interactions. *Clin Microbiol Rev.* 2002; **15**(1):111–124.
19. Yang C-S, Lu C-K, Lee F-L, *et al.* Treatment and outcome of traumatic endophthalmitis in open globe injury with retained intraocular foreign body. *Ophthalmol J Int Ophthalmol Int J Ophthalmol Z Für Augenheilkd.* 2010; **224**(2):79–85. .
20. Andreoli CM, Andreoli MT, Klock CE, *et al.* Low rate of endophthalmitis in a large series of open globe injuries. *Am J Ophthalmol.* 2009; **147**(4):601–608.e2.
21. Abu el -Asrar AM, al-Amro SA, al-Mosallam AA, al-Obeidan S. Post-traumatic endophthalmitis: causative organisms and visual outcome. *Eur J Ophthalmol.* 1999; **9**(1):21–31.

Causes of severe visual impairment and blindness among children: a case of Mbarali District in Southern Tanzania

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ABSTRACT

Objective: To determine the anatomical causes and diagnosis leading to severe visual impairment and blindness and explore their relationship to demographic characteristics among children in Mbarali district, Southern Tanzania.

Materials and methods: Key informants were trained on how to identify children with poor vision and other ocular abnormalities. Key informants identified, listed and referred for examination children with poor vision, white pupillary reflex, squint, and smaller and bigger than normal eyes. Children with a visual acuity of <6/60 in the better eye were recruited for the study. Cycloplegic refraction, anterior and posterior segment and ocular alignment examination were performed to ascertain the cause of Severe Visual Impairment (SVI) or Blindness (BL).

Results: Sixty six children had a visual acuity (VA) of <6/60. Seventy percent were 5 years or more. The mean age was 9.18(±4.42) (SD =4.42) years. Thirty five (53%) were females. Forty eight (72.7%) had SVI (VA<6/60) while 18 (27.3%) were BL (VA<3/60). Lens related conditions (27.3%), uncorrected refractive error (15.2%) and corneal related disorders (13.6%) were the commonest causes of SVI/BL. Majority of children with lens related conditions (72.2%), uncorrected refractive error and congenital glaucoma (75%) were females, while all 6 children with cortical blindness were males. Lens related and cortical blindness conditions were commoner among under-five than among older children (6/20, 30% vs 12/46, 26%) and (4/20, 20% vs 2/46, 4%). Un-operated cataract was the leading diagnosis causing SVI/BL. Only 4 patients were operated for cataract. There was only one patient with phthisis-bulbi related to keratomalasia.

Conclusion and Recommendations: Lens related conditions, specifically cataract was the leading cause of SVI/BL. Recruitment of an eye-doctor at Mbarali District Hospital and establishment of tertiary eye services at Mbeya Zonal Referral Hospital are recommended to enable identification, referral and comprehensive tertiary management of children with eye conditions.

INTRODUCTION

The prevalence and causes of BL in children vary between countries and are related to the socio-economic status¹. In most low resource countries including those of Africa and Asia, the causes of SVI/BL are mainly avoidable mostly involving the cornea (vitamin A deficiency, measles infection and ophthalmia neonatorum) and lens (cataract)². Improper management of corneal ulcers resulting from corneal conditions can lead to a corneal opacity or worse still a shrunken disorganized eye diagnosed as corneal scar and phthisis-bulb respectively. In the 1990s corneal scarring and phthisis bulbi secondary to measles were reported as the leading causes SVI/BL in Dodoma, Tanzania⁵. Cataract is the main lens related treatable cause of SVI/BL. Cataract surgical post-

operative visual outcome depends on early, quality surgery with appropriate optical correction and regular and long term follow up⁴. Other common causes of SVI /BL are congenital glaucoma and retinopathy of prematurity.

VISION 2020 The Right to Sight global initiative targets the control of blindness in children by focusing on eliminating corneal related blindness, provision of appropriate surgery for children with cataract and immediate optical correction, screening for babies at risk of Retinopathy of Prematurity (ROP) and provision of glasses for significant refractive errors⁵.

Most potentially blinding conditions in children can be prevented at the community level. However, the management of congenital cataract, congenital glaucoma and retinopathy of prematurity is challenging because such services can only be provided at a tertiary centre with

a Child Eye Health Tertiary Facility (CEHTF). The WHO recommends that there be 1 CEHTF per 10 million people in developing countries⁵. A number of countries in sub-Saharan Africa have established such centers according to the need while others like Tanzania have gone half way to meet this target due to the heavy investment required⁶.

The causes of blindness in children have been noted to change in the last and current decades in relation to availability of services for children⁷⁻⁹. There are no recent studies on the causes of SVI/BL in children in Tanzania. The aim of the study was to determine the anatomical causes and diagnosis leading to SVI/BL and explore their relationship to demographic characteristics among children in Mbarali district, Southern Tanzania for planning purposes.

MATERIALS AND METHODS

Study setting and design

A population based cross sectional survey was conducted in March-April 2016 in Mbarali District in Mbeya Region Southern Tanzania. The district has a population of 300, 517 of which 138, 713 are children below 16 years.

Study population

All 138,713 children from birth to 15 years in the district were eligible for the study.

Inclusion criteria: Children < 16 years with a presenting visual acuity of <6/60 in the better eye who have been living in the district for 6 months prior to the survey and whose parents agreed to participate in the study.

Exclusion criteria: Children whose parents refused to allow their children to be examined.

Data collection procedures

Selection and training of key informants: One Village Health Worker (VHW) from each village was selected by the community for training, as a Key Informant (KI). Key informants were trained on how to take visual acuity, identify children with poor vision and any other ocular abnormalities, register and refer them to an agreed examination center.

Identification of children by Key Informants: Key informants identified children by moving from house to house, visited schools and received information from parent/caretakers on children with poor vision. For suspected children, KI took visual acuity using a 6 meter string and a 6/60 optotype E chart. Any child who could not see the 6/60 optotype at 6 meters was registered.

Pre-verbal children who could not be tested using the E chart, but whose parents suspected that they had poor vision were also listed. Children were brought to the examination center by their parents/caretakers. At the agreed examination center, each KI presented the listed children for examination by an ophthalmologist and an optometrist.

Examination of identified children: A short history was taken to determine the demographic characteristics, age of onset and nature of the condition that led to SVI/BL. Presenting visual acuity of each eye was tested separately using the Illiterate Snellen chart at 6 meters. Children wearing spectacles were tested with spectacles on. Any child who could not see the 6/60 optotype on the E chart was enrolled for the study. For children not able to be tested using the E chart for various reasons, Cardiff acuity cards were used employing the standard staircase method¹⁰.

Other tests like ability to fixate and follow light were also employed to ensure whether the child could see or not. The anterior segment was examined using a magnifying loupe and torch. Cycloplegic refraction using a retinoscope was performed where indicated. Indirect and direct ophthalmoscopy was performed to elicit signs and conditions affecting the posterior segment. Extraocular motility was performed to ascertain ocular alignment. Intraocular pressure was measured using iiCARE portable tonometer. Data was collected using the WHO/PBL form for childhood blindness and low vision¹¹. All children needing further examination and treatment were referred to Mbeya Zonal Referral Hospital.

Causes of visual loss were classified according to WHO classification¹¹. Anatomical site of abnormality was recorded for each eye and the main cause of visual loss determined. The underlying aetiology was determined based on history to establish time of onset, ocular and clinical findings as: hereditary, intrauterine, perinatal, and childhood factors according to WHO guidelines. A diagnosis for each patient as a cause of SVI was reached.

Data analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS 20.0, Chicago, IL). Means were used for continuous data while categorical data are presented as percentages. Anatomical causes and diagnoses were presented as percentages out of the total number of SVI/BL children. Differences between proportions were ascertained using Chi squared test. A two-sided

p-value of less than 0.05 was considered statistically significant and 95% confidence intervals for prevalence were calculated assuming a normal approximation to the binomial distribution.

Ethical considerations

Approval to conduct the study was granted by the Research and Publication Committee of MUHAS. Permission to conduct the study in the district was given by the District Executive Secretary. Parents and caretakers consented for their children to take part in the study.

RESULTS

A total of 247 children with various eye conditions were identified by key informants, referred to examination centers and examined. Sixty six children with presenting vision of < 6/60 were enrolled for the study and were included in the analysis.

Seventy percent of children were aged five years or more with a mean age of 9.18 (standard deviation =4.42) years). There were slightly more females (53%) compared to males. Three quarters had severe visual impairment and slightly above a quarter (27.3%) were blind (Table 1).

Lens related conditions (27.3%) followed by uncorrected refractive error (15.2%) and corneal related disorders (13.6%) were the commonest causes of visual impairment/blindness among the study population (Table 2).

Table 1: Demographic and clinical characteristic of children with severe visual impairment/blindness (n=66)

Characteristic	No. (%)
Age (years)	
<5	20 (30)
5 - 15	46 (70)
Mean age (SD)	9.18 (4.42)
Sex	
Male	31 (47.0)
Female	35 (53.0)
Visual acuity categories	
<6/60-3/60	48 (72.7)
<3/60	18 (27.3)

Table 2: Anatomical causes of severe visual impairment and blindness

Cause	No. (%)
Lens related	18 (27.3)
Uncorrected refractive error	10 (15.2)
Corneal related	9 (13.6)
Squint and amblyopia	7 (10.6)
Cortical blindness	6 (9.1)
Optic atrophy	5 (7.6)
Congenital glaucoma	4 (6.1)
Retina	4 (6.1)
Whole globe	2 (3)
Uvea	1 (1.5)
Total	66 (100)

Table 3: Distribution of causes of severe visual impairment/blindness by age and sex

Cause	Sex		Age group (years)		Total
	Male	Female	<5	5-15	
Lens related	5 (27.8)	13 (72.2)	6 (33.3)	12 (66.7)	18 (100)
Refractive error	3 (30)	7 (70)	0 (0.0)	10 (100)	10 (100)
Corneal related	5 (55.6)	4 (44.4)	2 (25)	7 (75)	9 (100)
Squint and amblyopia	4 (57.1)	3 (42.9)	4 (57.1)	3 (42.9)	7 (100)
Cortical blindness	6 (100)	0 (0.0)	4 (66.7)	2 (33.3)	6 (100)
Optic atrophy	3 (66.6)	2 (33.7)	0 (0)	5 (100)	5 (100)
Congenital glaucoma	1 (25)	3 (75)	3 (75)	1 (25)	4 (100)
Retina	2 (50)	2 (50)	0 (0)	4 (100)	4 (100)
Whole globe	2 (100)	0 (0)	0 (0)	2 (100)	2 (100)
Uvea	0 (0)	1 (100)	1 (100)	0 (0)	1 (100)
Total	31(47)	35 (53)	20 (30)	46 (70)	66 (100)

The proportion of children with SVI/BL due to cataract, uncorrected refractive error and congenital glaucoma was higher among girls than boys while all children with cortical blindness were males. The proportion of lens related and cortical blindness conditions as causes of SVI/BL among under-five children was higher than that of older children (6/20, 30% vs 12/46, 26%) and (4/20, 20% vs 2/46, 4%). All children with refractive error, retina and optic nerve disorders were between 5-15 years while those with cortical blindness were aged less than 5 years.

Table 4: Diagnoses of conditions causing severe visual impairment and blindness

Anatomical cause	Diagnosis	No. (%)
Lens related	Cataract	14 (21.2)
	Pseudophakia with amblyopia	2 (3.0)
	Pseudophakia with PCO	2 (3.0)
Refractive error	Myopia (-4DS,-5DS)	2 (3.0)
	High myopia >6DS	3 (4.5)
	Mixed astigmatism	3 (4.5)
	Hyperopia	2 (3.0)
Corneal related	Corneal scar	4 (6.1)
	Phthisis bulbi	1 (1.5)
	Keratoconus	4 (6.0)
Squint	Squint with amblyopia	7 (10.6)
Cortical blindness	Cortical blindness	6 (9.0)
Optic nerve diseases	Optic neuropathy	2 (3.0)
	Primary optic atrophy	2 (3.0)
	Optic atrophy-brain tumour	1 (1.5)
Glaucoma	Congenital glaucoma TET done	1 (1.5)
	Congenital absolute glaucoma	1 (1.5)
	Congenital glaucoma	2 (3.0)
Whole globe	Congenital nystagmus	2 (3.0)
Retinal diseases	Macular scar/dystrophy	4 (6.0)
Uvea	Pan uveitis	1 (1.5)
Total		66 (100)

Un-operated cataract was the leading diagnosis causing visual impairment and blindness. Only 4 patients were operated for cataract. There was only one patient with phthisis bulbi related to keratomalasia (Table 4).

Table 5: Distribution of aetiological causes of severe visual impairment/blindness

Aetiological cause	No. (%)
Hereditary	2 (3.0)
Intrauterine	3 (4.5)
Perinatal	7 (10.6)
Childhood	19 (28.7)
Cannot determine	31 (52.8)
Total	66(100)

In 31 (47%) children, the aetiological cause of SVI/BL could not be determined while it was possible to determine in 34 (53%) children. Majority 19/31 (28%) of causes of SVI/BL occurred during childhood and included: refractive error (4), severe allergic kerato-conjunctivitis (2), developmental cataract (4), complicated cataract (1), optic atrophy (5), and keratoconus (3). Perinatal conditions included: neonatal conjunctivitis (2), cortical blindness (6) where 5 were blind since birth and one of them had cerebral palsy. Intrauterine factors included: congenital cataracts with probable congenital rubra syndrome in 3. Hereditary causes included: congenital cataracts with history of same condition in another sibling.

DISCUSSION

The study found lens related conditions (mainly un-operated cataract) as the leading anatomical cause of SVI/BL in Mbarali district keeping with other population based studies in developing countries^{7, 8, 12}. This finding is at variance with earlier studies especially those conducted in blind schools in Kenya, Uganda, Malawi^{13, 14}, Burundi¹⁵ and one recent population based study in Uganda¹⁶ where corneal pathology specifically corneal scarring, phthisis-bulbi was the leading anatomical cause of SVI/BL.

Cataract is a treatable cause of SVI/BL. Its prevalence increases where services for cataract surgery are inadequate leading to a backlog of cases as was seen in Bangladesh¹². Majority (10/18, 56%) of cataracts in the current study were congenital and un-operated among older children more than 5 years of age. It is likely that these children have developed amblyopia and will not achieve maximum visual restoration due to increased age at and, delayed surgery¹⁷.

The four operated children were still SVI/BL despite surgery due to post-operative complications like posterior capsular opacification and probable amblyopia related to poor follow up as was found in a study in Malawi¹⁸. There is no CEHTF to provide surgery for childhood cataract in the southern part of Tanzania. The few operated patients were probably operated on outreach basis and lacked proper follow up.

In contrast to studies involving children from blind schools in Africa^{7, 8} and Asia¹² lens related conditions in the current study were commoner among females (10/14)

than males. The present study did not involve any children from blind schools as there were none in the district. It is possible that, boys with cataracts had been sent to schools outside the district leaving the girls behind.

Compared to results of a previous study in a neighbouring region of Dodoma where measles infection related corneal scarring was the leading cause of SVI/BL³ there seems to be a change in the major causes SVI/BL in this population. The change is due to availability and accessibility of primary health services for children. Successful implementations of vitamin A supplementation and measles immunization have reduced corneal related SVI/BL in Tanzania. In the present study, corneal conditions as causes of SVI/BL were responsible for only 9(13.6%). Among them, there was only one child with phthisis bulbi that could be attributed to keratomalasia as a complication of measles infection.

The finding that uncorrected refractive error was another significant cause of SVI in this study was unexpected as a previous study¹⁹ reported a very low prevalence among primary school children. Also, important to note is that 2 children were affected by the Tanzanian Endemic Optic Neuropathy indicating that the disease is prevalent even in areas outside Dar-es-Salaam and the coastal areas^{20,21}. Retinopathy of Prematurity (ROP) was not among the diagnosed causes of SVI/BL in this study. This is probably due to the fact that highly premature babies may not be surviving to develop ROP. However future studies should also screen for ROP especially in big cities where small babies are now surviving.

In this survey, the mean age of children was 9.18(±4.42) years with three quarters of them being older than 5 years of age. Cataract was the leading cause of SVI/BL among under-fives similar to the study in Bangladesh¹². The proportion of children with SVI/BL for every cause was higher among children aged 5 years and above except for cortical blindness where 80% of affected children were below 5 years. This finding may be explained by a cumulative effect of children affected by other causes of SVI/BL due to lack of services. A higher proportion of cortical blindness among under-fives may result from poor obstetric services in recent years related to birth asphyxia. Uncorrected refractive errors were a cause of SVI in older children probably due to the fact that refractive errors are known to increase with age in late childhood and adolescence²².

All children with cortical blindness due to birth asphyxia were males. According to studies male fetus have a higher incidence of cord complications, fetal distress, labour dystocia, operative delivery and low apgar score^{23,24}. In a resource constrained area, such complications lead to birth asphyxia and eventual cortical blindness in the affected child. Further research is recommended. In this study, most of the aetiological causes of SVI/BL were undetermined due to the difficulties of establishing the circumstance that led to the condition and timing of onset similar to other studies^{7, 8, 12}.

CONCLUSIONS

Lens related anomalies specifically un-operated cataract is the leading cause of SVI/BL in children in Mbarali district. Measles related corneal scarring is no longer an issue in this community. Cortical blindness was found among under-five male children while retinal diseases were prevalent in older children. Establishment of tertiary eye services to provide surgical, medical, optical, and low vision management to children in southern Tanzania is recommended. Strengthening of eye care services in the district are required to enable identification and referral of affected children to paediatric ophthalmology tertiary centers. Further studies to establish the cause of birth asphyxia with eventual cortical blindness among male children is also recommended.

ACKNOWLEDGEMENT

This study was made possible by financial support from the Standard Chartered Bank through the Seeing is Believing Child Eye Health project. Funds were administered and coordinated by The College of Ophthalmology of East, Central and Southern Africa (COECSA).

Financial and non-financial competing interests: The authors have no proprietary interest in any materials mentioned in this article.

REFERENCES

1. Gilbert CE, Foster A. Childhood blindness in the context of VISION 2020-The right to Sight. *Bull World Health Org.* 2001; **79**(3):227-232.
2. Gilbert C, Foster A. Blindness in children: Control priorities and research opportunities. *Br J Ophthalmol.* 2001; **85**(9): 1025-1027.
3. Foster A, Sommer A. Corneal ulceration, measles, and childhood blindness in Tanzania. *Br J Ophthalmol.* 1987; **71**:331-343.
4. Muhit MA. Childhood cataract: Home to hospital. *Comm Eye Health.* 2004; **17**(50):19-22.
5. World Health Organization. Preventing blindness in children. WHO/PBL/00.77. WHO, Geneva, 1999.
6. Agarwal PK, Bowman R, Courtright P. Child eye health tertiary facilities in Africa. *J AAPOS.* 2010; **14**(3):263-266.
7. Kalua K, Ngongola R T, Mbewe F, Gilbert C. Using primary health care (PHC) workers and key informants for community based detection of blindness in children in Southern Malawi. *Human Resources for Health.* 2012; **10**:37. <http://www.human-resources-health.com/content/10/1/37/&>
8. Demissie BS, Solomon AW. Magnitude and causes of childhood blindness and severe visual impairment in Sekoru District, Southwest Ethiopia: a survey using the key informant method. *Trans R Soc Trop Med Hyg.* 2011; **105** (9):507-511.
9. Omolase CO, Aina AS, Omolase BO, *et al.* Causes of blindness and visual impairment at the school for the blind Owo, Nigeria. *Annals Ibadan Postgraduate Med.* 2008; **6**(1): 49-52.

10. Adoh TO, Woodhouse JM. The Cardiff acuity test used for measuring visual acuity development in toddlers. *Vision Res.* 1994; **34**(4):555-560.
11. Gilbert C, Foster A, Negrel AD, *et al.* Childhood blindness: a new form for recording causes of visual loss in children. *Bull World Health Org.* 1993; **71**(5):485 - 489.
12. Muhit, MA, Shah SP, Gilbert CE, Foster A. Causes of severe visual impairment and blindness in Bangladesh: a study of 1935 children. *Br J Ophthalmol.* 2007; **91**:1000 -1004.
13. Njuguna M, Msukwa G, Shilio B, Tumwesigye PC, Courtright P. Causes of severe visual impairment and blindness in children in schools for the blind in eastern Africa: changes in the last 14 years. *Ophthalmic Epidemiol.* 2009; **16**(3):151-155.
14. Gilbert CE, Wood M, Waddel K, Foster A. Causes of childhood blindness in East Africa: results in 491 pupils attending 17 schools for the blind in Malawi, Kenya and Uganda. *Ophthalmic Epidemiol.* 1995; **2**(2):77-84.
15. Ruhagaze P, Njuguna KKM, Kandeke L, Courtright P. Blindness and severe visual impairment in pupils at schools for the blind in Burundi. *Middle East Afr J Ophthalmol.* 2013; **20**(1):61-65.
16. Arunga S, Onyango J, Ruvuma S, Twinamasiko A. Prevalence and causes of blindness and severe visual impairment (BL/SVI) among children in Ntungamo district, southwestern Uganda: a key informant cross-sectional population survey. *J Ophthalmol East Cent & S Afr.* 2016; **20**(1): 26-32.
17. Gogate DP, Ramsonet P, *et al.* Surgery for sight: outcomes of congenital and developmental cataracts operated in Durban, South Africa. *Eye.* 2016; **30**: 406–412.
18. Msukwa G, Njuguna M, Tumwesigye C, Shilio B, Courtright P, Lewallen S. Cataract in children attending schools for the blind and resource centers in eastern Africa. *Ophthalmology.* 2009; **116**(5):1009-12.
19. Wedner SH, Ross DA, Balira R, Kaji L, Foster A. Prevalence of eye diseases in primary school children in a rural area of Tanzania. *Br J Ophthalmol.* 2000; **84**:1291–1297. <http://bjo.bmj.com/> on November 11, 2016
20. Kisimbi J, Shalchi Z, Omar A, *et al.* Macular spectral domain optical coherence tomography findings in Tanzanian endemic optic neuropathy. *Brain.* 3418 – 3426. DOI: <http://dx.doi.org/10.1093/brain/awt221>
21. Hodson KE, Bowman RJ, Mafwiri M, Wood M, Mhoro V, Cox SE. Low folate status and indoor pollution are risk factors for endemic optic neuropathy in Tanzania. *Br J Ophthalmol.* 2011; **95**(10):1361-4. doi: 10.1136/bjo.2010.197608. Epub 2011 Jul 6.
22. Flitcroft DI. Emmetropisation and the aetiology of refractive errors. *Eye.* 2014; **28**: 169 -179.
23. Laura A, Alberto P, Mercedes V, Paz CM, Francisco M. Fetal sex and perinatal outcomes. *J Perinat Med.* 2012; **40**(3):271–276.
24. Viegas OA, Lee PS, Lim KJ, Ravichandran J. Male fetuses are associated with increased risk for cesarean delivery in Malaysian nulliparae. *Medscape J Med.* 2008; **10**(12):276. [PMC free article] [PubMed]

Haemorrhagic retinal arterial macroaneurysm: a case report

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ABSTRACT

Retinal Arterial Macroaneurysms (RAMs) are acquired saccular or fusiform dilatations of the large branches of retinal arteries, usually within the first three orders of bifurcation. RAMs are rare conditions and usually affect hypertensive elderly women. In clinical practice, RAMs are frequently misdiagnosed as they masquerade other retinal conditions. We present a case of haemorrhagic RAM which was initially misdiagnosed as vitreous haemorrhages secondary to retinal vein occlusion or posterior vitreous detachment.

Key words: Retinal arterial macroaneurysms, RAMs, Retinal vascular diseases, Vitreous haemorrhage

INTRODUCTION

Retinal Arterial Macroaneurysms (RAMs) are acquired saccular or fusiform dilatations of the large branches of retinal arteries, usually within the first three orders of bifurcation¹. Isolated cases of the condition have been described in literature since the nineteenth century¹. However, Robertson was the first to describe the lesions as retinal arterial macroaneurysms in 1973².

RAMs are rare conditions. A population-based cross sectional study done in central India found 0.07% prevalence of RAMs³. RAMs masquerade other retinal conditions and consequently, they are often misdiagnosed in clinical practice^{1,4}. We present a case of haemorrhagic RAM. The case was initially misdiagnosed as vitreous haemorrhages secondary to retinal vein occlusion or posterior vitreous detachment. The case provides clinical information that may aid in diagnosis of RAMs in patients presenting with vitreous haemorrhage. In addition, a review of literature on the current investigation and treatment of patients with RAMs is provided in order to give an update on management of RAMs.

CASE REPORT

A 58 year old woman presented in April 2017 at Lions Sight First eye unit in Blantyre, Malawi with one week history of sudden loss of vision in her right eye. She had history of systemic hypertension and was on treatment for the hypertension (enapril, hydrochlorothiazide and low dose aspirin). She denied history of trauma, any previous eye surgery or diabetes.

On examination, visual acuity was reduced in the right eye at 2/60 and normal in the left eye at 6/6. Intra-ocular pressures and anterior segments were normal in both eyes. Fundal view in the right eye was hazy with vitreous haemorrhage (Figure 1). Posterior segment examination in the left eye was normal. Ultra-sound B scan assessment of the right eye confirmed vitreous haemorrhage and showed no retinal detachment. The diagnosis was vitreous haemorrhage probably secondary to Posterior Vitreous Detachment (PVD) or retinal venous occlusion. She was on observation and was advised to come for follow up review 3 weeks later.

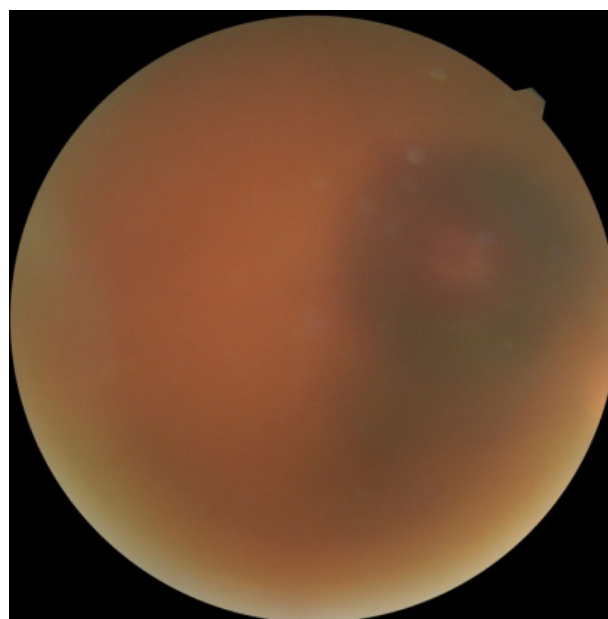


Figure 1: Retinal image of the right eye during the first visit. There is reduced visibility of the retinal arterial macroaneurysm due to associated vitreous haemorrhage

On her second appointment, her vision had greatly improved in her right eye. The visual acuity was 6/15 in the right eye and 6/6 in the left eye. Fundoscopy of the right eye (Figure 2) showed a large subretinal haemorrhage along supero-temporal retinal arteriole at arteriovenous crossing. In addition, there was a relatively small intra-retinal haemorrhage. There were no hard exudates or cotton wool spots. The fundus examination in the left eye was normal. Spectral Domain Optical Coherence Tomography (SD-OCT) showed sub-retinal fluid collection and sub-retinal haemorrhage (Figure 3). The diagnosis Retinal Arterial Macroaneurysm (RAM) in the right eye was made. The patient was still on observation and was told to come 4 weeks later.



Figure 2: Retinal image of right eye during second visit showing haemorrhagic retinal arterial macroaneurysms along supero-temporal arcade with sub-retinal and intra-retinal haemorrhages. The vitreous haemorrhage has cleared completely

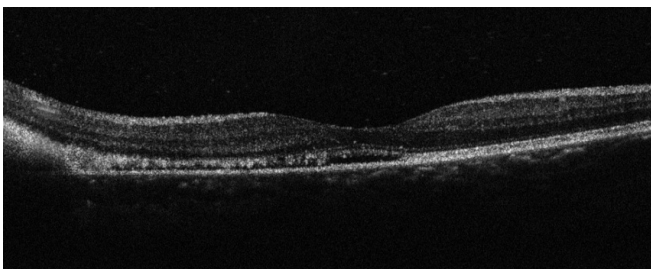


Figure 3: OCT vertical scan image of the right eye on second visit showing sub-retinal fluid collection and temporal sub-retinal haemorrhage

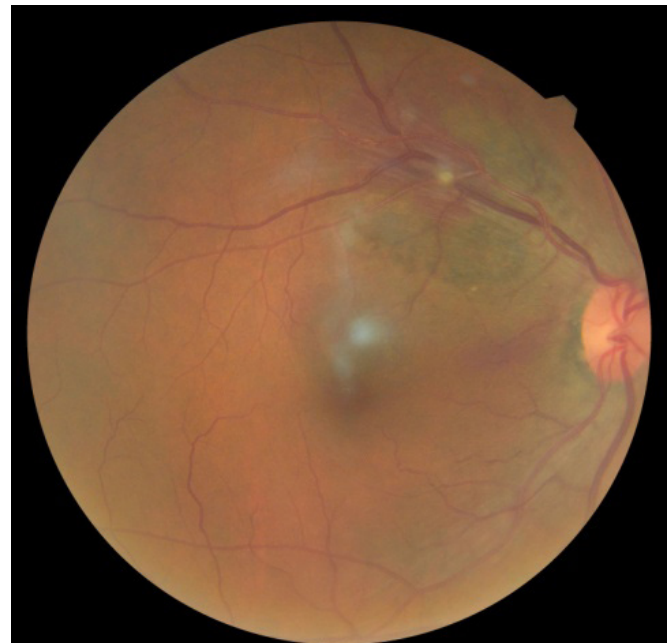


Figure 4: Retinal image on right eye on third visit showing marked resolution of retinal arterial macroaneurysm. There are also artifacts around the fovea

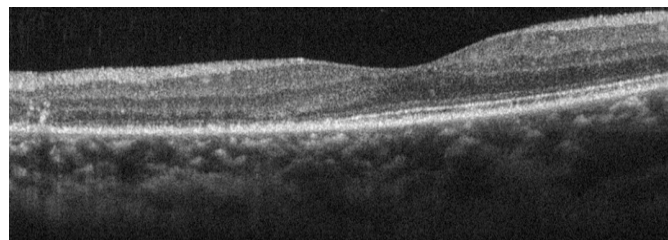


Figure 5: OCT vertical scan image of the right eye taken on third visit. The image is almost normal

On her third hospital appointment, her vision had returned to normal. The visual acuity was 6/6 in both eyes. The retinal lesion in the right eye had almost completely resolved (Figures 4 and 5).

DISCUSSION

Our patient presented with haemorrhagic RAM. RAMs can be classified as haemorrhagic, exudative or quiescent based on the predominant clinical finding⁵. RAM is one of the few retinal conditions where haemorrhage can present at multiple levels; sub-retinal, intra-retinal, pre-retinal and vitreous¹. This was characteristic of our patient. In exudative RAMs, the RAM is predominantly associated with signs of retinal oedema⁵.

The systemic risk factors associated with RAMs are systemic hypertension, old age and female gender^{5,6}. Sclerotic arterial wall changes associated with systemic hypertensive and aging are believed to make the retinal arterioles susceptible to RAMs¹. It is not known why women are more prone to develop RAMs than men. Interestingly, women are also at higher risk of developing cerebral aneurysms than men. Cerebral arteries and retinal

arterioles share similar anatomical and physiological characteristics^{1,4}. Genetic and hormonal factors may probably account for the increased risk of the aneurysms in women^{1,4,7}.

RAMs commonly occur as solitary unilateral lesions along temporal vascular arcades. They are frequently located on the arteriovenous crossing or arterial bifurcations^{5,8}. The aneurysmal lesion in our patient was solitary and was located at an arteriovenous crossing along the supero-temporal vascular arcade. Some cases of RAMs may be associated with retinal vein occlusions^{1,4-6}.

There are variations in clinical presentation of patients with RAMs. Patients with exudative RAMs may present with gradual loss of vision secondary to macular oedema and may be misdiagnosed as diabetic macular oedema, age related macular degeneration, and retinal vein occlusions. Patients with haemorrhagic RAMs may present with sudden onset of generalized visual loss from vitreous haemorrhages. Patients with haemorrhagic RAMs may also present with central visual loss from pre-macular or sub-foveal haemorrhage^{1,5}. Haemorrhagic RAMs with secondary vitreous haemorrhage may be misdiagnosed especially in early stages as vitreous haemorrhage secondary to posterior vitreous detachment or retinal vein occlusion¹. RAMs with large sub-macular haemorrhage may mimic retinal tumours such as melanoma and cavernous hemangioma¹. Our patient presented with sudden visual loss from vitreous haemorrhage with either retinal vein occlusion or posterior vitreous detachment as possible underlying causes. Some cases of RAMs may be asymptomatic and may be diagnosed as incidental findings during examinations^{1,7}.

Fundus fluorescein angiography is the most important test in investigation of RAMs and it is particularly used in cases where the diagnosis of RAM is not clear clinically^{1,4,5}. It was not available at our hospital. Spectral domain Optical Coherence Tomography (OCT) is increasingly becoming an important imaging test in the management of patients with RAMs. It can be used to determine and monitor extent of macular oedema and sub-retinal fluid or haemorrhage^{7,9}.

Many cases of RAMs resolve spontaneously with good prognosis. Therefore, observation is warranted in most cases^{1,6}. Our patient was on observation and the RAM resolved rapidly with a good visual outcome. Interventions in selected cases include laser treatment, Anti-Vascular Endothelial Growth Factor (Anti-VEGF) therapy and pars plana vitrectomy. Laser therapy has been used for treatment of RAMs for many years and is indicated for symptomatic cases with macular oedema^{1,4,5,7,8}. The laser is either applied directly at the macroaneurysms or indirectly around the macroaneurysms. There is no clear evidence to demonstrate whether applying laser burns within the macroaneurysm or around the macroaneurysm is superior^{1,7}. Anti-VEGF therapy is a new treatment and is an alternative to laser treatment¹⁰⁻¹³. Pars plana vitrectomy is reserved for cases of non-clearing vitreous haemorrhage¹. Our case was visually symptomatic and had macular oedema. However, we initially observed our case and we did not perform any intervention such as laser

treatment or Anti-VEGF because our patient experienced rapid recovery of vision.

In conclusion, RAMs have varied clinical presentations and may be misdiagnosed as the clinical presentation can mimic other retinal diseases. Careful assessment and low threshold for diagnosis is needed especially when patients present with retinal exudation, vitreous haemorrhages or retinal haemorrhages.

REFERENCES

1. Pitkänen L, Tommila P, Kaarniranta K, Jääskeläinen JE, Kinnunen K. Retinal arterial macroaneurysms. *Acta Ophthalmol (Copenh)*. 2014; **92**(2):101–104.
2. Retinal arterial macroaneurysms - retina and vitreous - Albert & Jakobiec's Principles & Practice of Ophthalmology, 3rd Edition [Internet]. [cited 2017 Jun 16]. Available from: <http://doctorlib.info/ophthalmology/principles/17.html>
3. Nangia V, Jonas JB, Khare A, Sinha A, Lambat S. Prevalence of retinal macroaneurysms. The Central India Eye and Medical Study. *Acta Ophthalmol (Copenh)*. 2013; **91**(2):e166–167.
4. Moosavi RA, Fong KCS, Chopdar A. Retinal artery macroaneurysms: clinical and fluorescein angiographic features in 34 patients. *Eye*. 2005; **20**(9):1011–20.
5. Lavin MJ, Marsh RJ, Peart S, Rehman A. Retinal arterial macroaneurysms: a retrospective study of 40 patients. *Br J Ophthalmol*. 1987; **71**(11):817–825.
6. Koinzer S, Heckmann J, Tode J, Roeder J. Long-term, therapy-related visual outcome of 49 cases with retinal arterial macroaneurysm: a case series and literature review. *Br J Ophthalmol*. 2015; **99**(10):1345–53.
7. Speilburg AM, Klemencic SA. Ruptured retinal arterial macroaneurysm: diagnosis and management. *J Optom*. 2014; **7**(3):131–137.
8. Brown DM, Sobol WM, Folk JC, Weingeist TA. Retinal arteriolar macroaneurysms: long-term visual outcome. *Br J Ophthalmol*. 1994; **78**(7):534–538.
9. Goldenberg D, Soiberman U, Loewenstein A, Goldstein M. Heidelberg spectral-domain optical coherence tomographic findings in retinal artery macroaneurysm. *Retina*. 2012; **32**(5):990–995.
10. Chatziralli I, Maniata A, Koubouni K, Parikakis E, Mitropoulos P. Intravitreal ranibizumab for retinal arterial macroaneurysm: long-term results of a prospective study. *Eur J Ophthalmol*. 2017; **27**(2):215–219.
11. Erol MK, Dogan B, Coban DT, Toslak D, Cengiz A, Ozel D. Intravitreal ranibizumab therapy for retinal arterial macroaneurysm. *Int J Clin Exp Med*. 2015; **8**(7):11572–8.
12. Pichi F, Morara M, Torrazza C, Manzi G, Alkabes M, Balducci N, et al. Intravitreal bevacizumab for macular complications from retinal arterial macroaneurysms. *Am J Ophthalmol*. 2013; **155**(2):287–294.
13. Cho HJ, Rhee TK, Kim HS, Han JI, Lee DW, Cho SW, et al. Intravitreal bevacizumab for symptomatic retinal arterial macroaneurysm. *Am J Ophthalmol*. 2013; **155**(5):898–904.

Solar retinopathy: a case report

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ABSTRACT

A young woman presented with a history of poor vision both eyes after staring at the sun for approximately 5 minutes during a religious pilgrimage. Her vision was 6/12 at presentation. Fundoscopy revealed bilateral yellow spots on the macula. Optical Coherence Tomography (OCT) scans revealed bilateral Retinal Pigment Epithelium (RPE) damage. The patient was managed conservatively with full recovery of vision in 8 months.

Key words: Solar keratopathy, Eclipse keratopathy

INTRODUCTION

Solar retinopathy is a rare form of macular damage that occurs after intense exposure to solar radiation. It has been reported in many situations including solar eclipse viewing, religious sun-gazing and sunbathing. It has also been reported in some psychiatric disorders and psychotropic drugs¹. Most cases of solar retinopathy resolve without intervention even though some treatment options like oral steroids have been tried.

CASE REPORT

A 29 year old female patient presented with complaints of poor vision both eyes for 2 weeks. She reported that the blurring of vision started after she stared at the sun for a period of about 5 minutes during religious pilgrimage in the Rift Valley town of Subukia, Kenya. She had no associated eye pain, tearing or headache. She did not have a history of any chronic diseases.

On examination her best corrected visual acuity was 6/12 both eyes. The anterior segment was normal and the pupils were round with a normal reaction to light. On dilated fundoscopy, each eye had a small yellow spot at the fovea. The optic discs and the rest of the retina were normal (Figure 1).

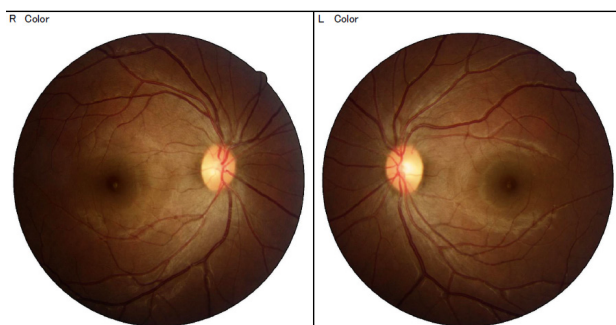


Figure 1: Fundus photos

Optical Coherence Tomography (OCT) scans done of both fovea showed increased reflectivity in the outer retinal layers and RPE defects especially for the right eye (Figures 2 and 3).

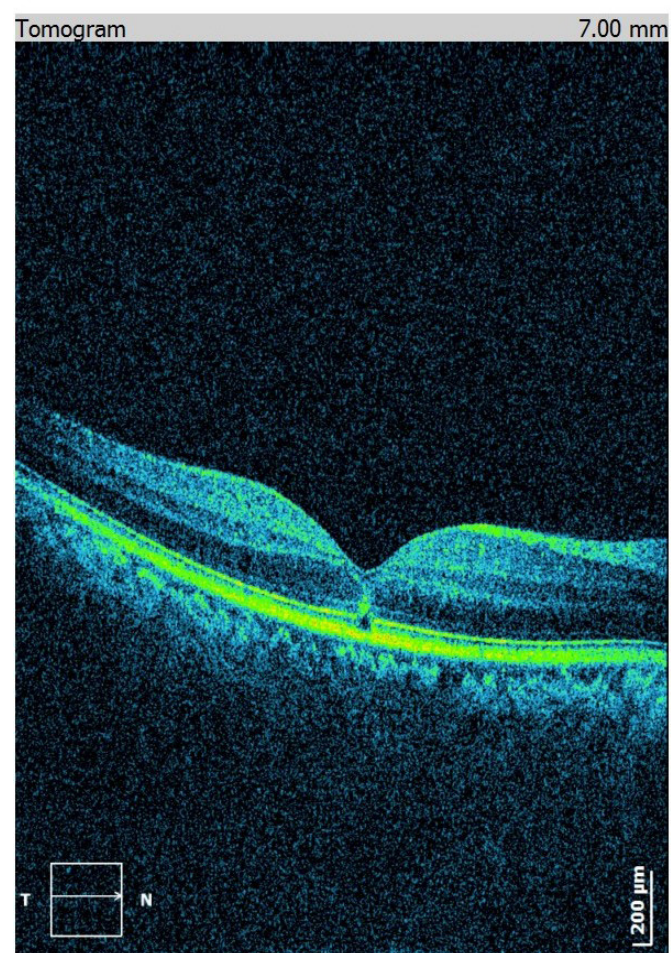
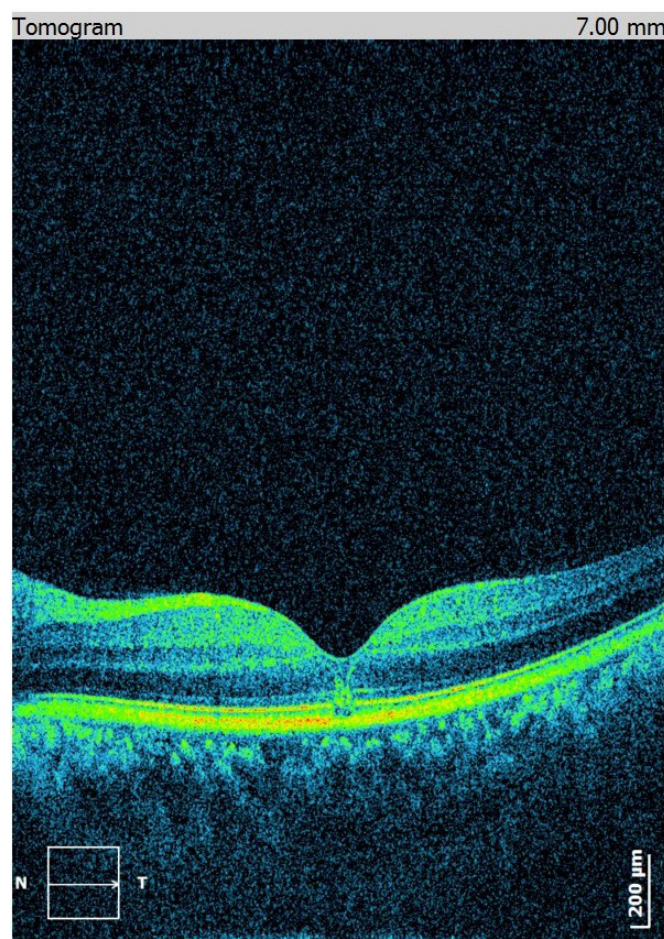


Figure 2: OCT right eye



	Central field thickness	Volume	Average thickness
ILM - IS/OS	183 μm	12.02 mm^3	245 μm

Figure 3: OCT left eye

A diagnosis of solar retinopathy was made. The patient was reassured and treated conservatively. She was followed up routinely and her vision improved gradually. She recovered full vision of 6/6 both eyes 8 months after presentation.

DISCUSSION

Ability of light to enact damage on the neurosensory retina and underlying structures has been well understood for hundreds of years². Photoc retinopathy is a nonspecific term that refers to light induced retinal damage³. Direct solar observation through a 3mm pupil produces a 4 degree temperature rise. Solar retinopathy is due to a combination of photochemical and thermal injury. It is thought that the main damage is caused by the short wavelengths in the visible spectrum at 400–500 nm,

with some mild thermal enhancement from the longer wavelengths in the infrared spectrum⁴. Sustained solar viewing over 90 seconds through a constricted pupil exceeds the threshold for photochemical retinal damage.

It typically produces a yellow-white spot lesion with surrounding gray zone at the fovea. The spot fades and may be replaced by a reddish spot with a pigment halo several days later. With prolonged exposure, a more diffuse lesion with mottling and clumping of the retinal pigment epithelium may occur.

Typically, fluorescein angiography is normal or may show a window defect. OCT demonstrates a characteristic defect at the level of the inner and outer segment junction of the photoreceptors⁵. The visual prognosis of solar retinopathy is generally favorable, and in most cases the visual loss is reversible. Some cases of permanent visual impairment or persisted central scotomas have been reported⁷. Treatment with corticosteroids has been given in cases with severe visual loss; however, there is no reliable evidence to say whether this is beneficial or not. This patient managed to regain her vision in 8 months with conservative treatment. The role of education as a preventive measure cannot be overemphasized. Appropriate protective measures when viewing an eclipse and education about the hazards of direct sun-gazing remain the best preventive measures for this condition.

REFERENCES

1. Yannuzzi LA, Fisher YL, Krueger A, *et al.* Solar retinopathy; a photobiological and geophysical analysis. *Trans Am Ophthalmol Soc.* 1987; **85**:120–158.
2. Youssef P, Sheibani N, Albert D. Retinal light toxicity. *Eye (London).* 2011; **25**(1):1-14.
3. Yanoff M, Duker J. *Yanoff and Duker's Ophthalmology, 3rd ed.* 2008 rISBN-10: 0323043321 ISBN-13: 9780323043328.
3. Kun-Hsein L, San-Ni C, Chun-Ju L. Unusual OCT and fundus auto fluorescence findings of eclipse retinopathy. *Indian J Ophthalmol.* 2012; **60**(6): 561-565.
4. Ham W, Mueller H, Ruffolo J, Jr, *et al.* Retinal sensitivity to damage from short wavelength light. *Nature.* 1976; **260**:153 - 155.
5. Jain A, Desai RU, Charalel RA, *et al.* Solar retinopathy: Comparison of OCT and fluorescein angiography. *Retina.* 2009; **29**:1340 - 45.
6. Sarah M, Eamonn O. Solar retinopathy secondary to sun-gazing. *BMJ.* PMC3604317(online).



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