SA Ophthalmology Journal

The official journal of the Ophthalmological Society of South Africa

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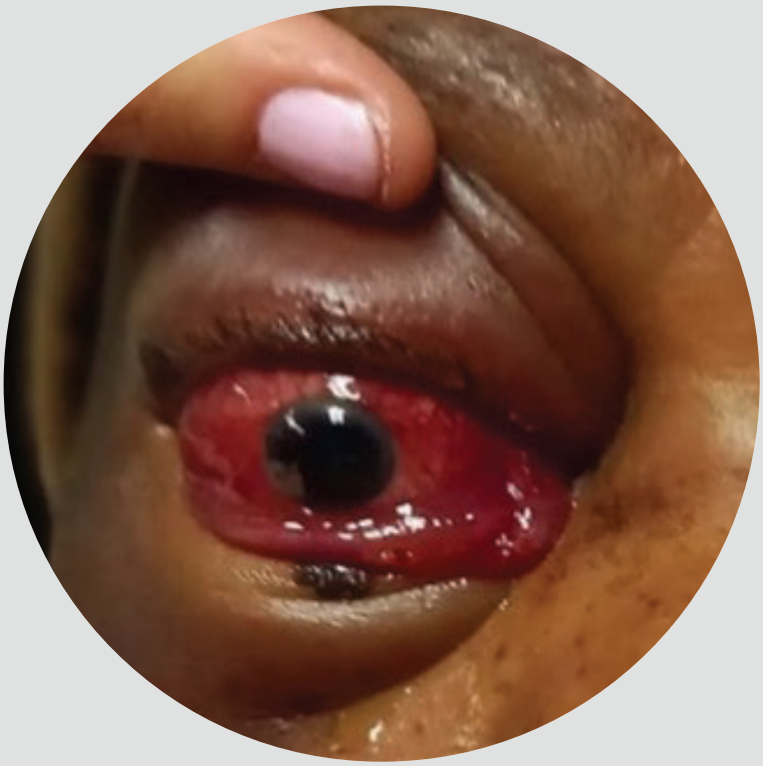

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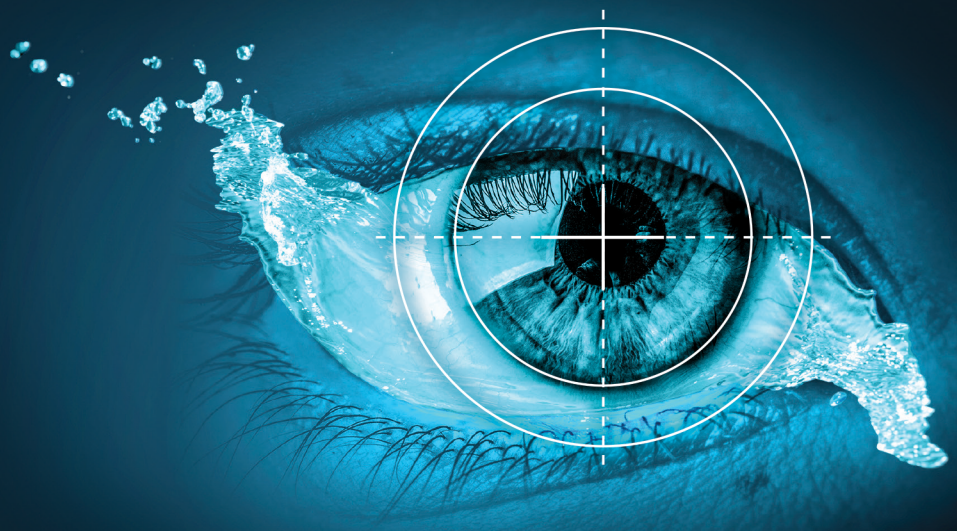

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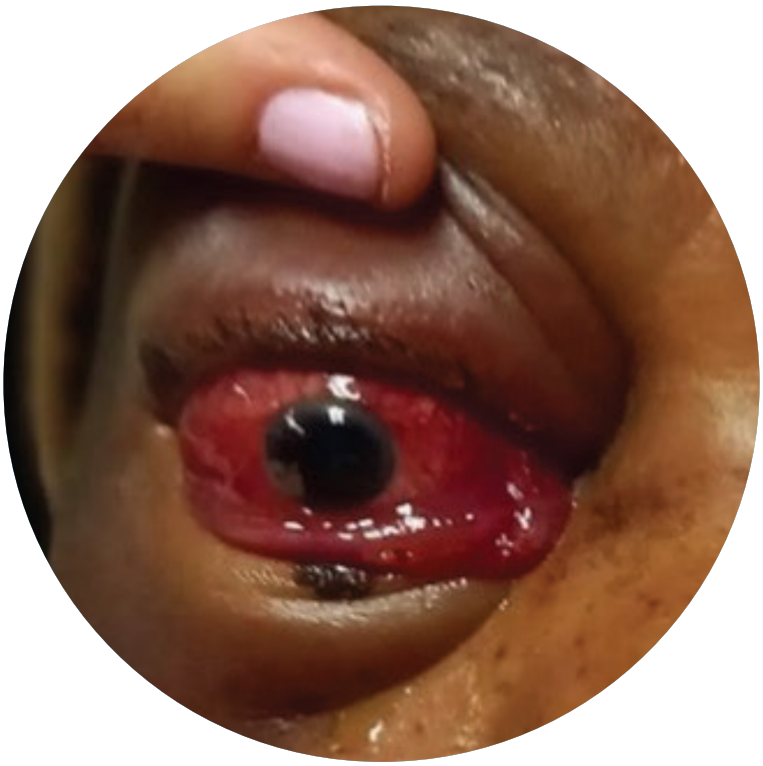


COVER PIC:
Patient at initial presentation showing marked right periorbital oedema, ptosis, proptosis, conjunctival injection and chemosis

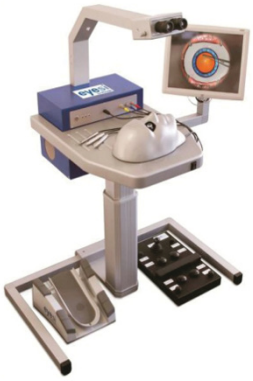
Revolutionising ophthalmic training

Welcome to our first issue of 2024! We have included a review article, two original studies and two case reports in this issue, which is to be published in time for the 2024 OSSA Congress in Gqeberha. One of the original studies hails from the University of Cape Town (UCT), who will also be presenting on the role of simulated surgery training in teaching ophthalmic surgery and the progress that has been made in this regard, at the congress. This topic has been discussed in the SAOJ on a couple of occasions in the recent past and it may be useful to revisit it up here again, especially after the acquisition of the Eyesi virtual simulator and the plan to potentially introduce a similar Alcon unit at the OSSA conference this year.

In November 2023, the UCT Division of Ophthalmology, under the auspices of its Community Eye Health Institute (CEHI), officially launched the Simulation Ophthalmic Surgical (SOS) training programme of its Simulated Surgery Training Unit (SSTU). The launch was attended by, amongst others, representatives from the Royal College of Ophthalmologists (RCOphth) and the European Society of Cataract and Refractive Surgeons (ESCRS). The role of simulation is increasingly being recognised in ophthalmic training for new skill acquisition and refining established techniques. The American Academy of Ophthalmology (AAO) notes that, "Simulation based training has proven value in teaching surgical skills to ophthalmology residents and fellows. Additionally, simulations can be effective for the practicing ophthalmologist to prepare for a specific procedure which he or she has not had recent experience with, prior to performing that procedure on a patient." While the RCOphth states that, "Simulation training using artificial model eyes and artificial intelligence (AI) is transforming the way trainee ophthalmologists develop surgical and clinical skills by simulating live surgery situations. Frequent practice on simulators enables trainees to become familiar with surgical steps and refine their techniques in a safe environment." I think that we can all agree that simulated surgery provides a protected environment for developing skills in less experienced trainees; fosters lower stress levels in terms of teaching surgery for trainers; and ultimately is safer for our patients.

The SSTU at UCT, was initiated by Hon A/Prof Will Dean and Emeritus Prof Colin Cook who both helped establish the original wet lab. Will Dean completed the studies that made up his PhD here. These studies centred on manual small-incisional cataract surgery (MSICS) and glaucoma surgery in the form of trabeculectomy. The studies commenced in 2017 and subsequent courses started in 2019. Since 2019, more than 120 trainees from South Africa and 20 other countries around the world have benefited from the courses. Additional courses have since been added, viz. basic microsurgery, cataract surgery by phaco-emulsification and retinal surgery in the form of pars-plana vitrectomy (PPV). Funds raised via donations were used to purchase the Eyesi virtual simulator from Haag-Streit, which is the only one of its kind in sub-Saharan Africa, if not the whole African continent. Eyesi Surgical is a high-end virtual reality simulator for intraocular surgery training. The Eyesi platform can be equipped with interfaces for cataract and vitreoretinal surgery. Training units range from basic skills-training through to surgical procedures and complications management. This acquisition has added tremendous value to the SOS courses.

Orbis International allows access to their online Cybersight platform for pre-training material and videos. Envision Africa set up the initial Phaco lab, Alcon has donated microscopes and phaco machines; and Genop also donated phaco machines. The RCOphth have donated



three phaco machines to the unit and ESCRS has agreed to provide funds for expanding the unit, as well as funding trainees and trainers. James Rice was instrumental in acquiring the EyeSi, developing the simulated PPV course and has a keen interest in low-cost simulation. Jonathan Pons from eSwatini, is a regular trainer on the MSICS and glaucoma courses. Jill de Villiers, Jonel Steffen and David Steven have all been actively involved in teaching on courses. Dr Deon Minnies, director of the CEHI, manages many parts of the SOS programme.

The HPCSA / CMSA will now be engaged on the topic and encouraged to consider making simulated cataract surgery courses a prerequisite for trainees who intend applying for registrar training posts, like the AAO and RCOphth, who have already taken this step.

Please continue to support us by submitting your valuable work for publication in the SAOJ.

Prof Nagib du Toit
MBChB(UCT), DipOphth(SA), FRCS(Ed), FCOphth(SA), MMed(UCT), PhD(UCT)
Editor-in-Chief: South African Ophthalmology Journal

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2. A cover sheet is to be submitted with each manuscript. It should contain the title of the manuscript, the names of all authors in the correct sequence, their academic status and affiliations. The ORCID ID number for each author should be supplied (https://orcid.org/). The corresponding author should include his/her name, address, phone and email address.

3. Articles should be between 2 000 and 3 000 words in length. A 200-word abstract should state the main conclusions and clinical relevance of the article. Use the headings Background, Methods, Results and Conclusion. Five keywords are to be supplied at the end of the abstract.

4. Authors should declare any interests, financial or otherwise, regarding the publication of their article, under the headings of Funding and Conflict of interest. If none, this should be stated. An ethics statement regarding patient consent and/or Ethics Board approval should be included. Authors should also indicate whether the submission forms part of an 'MMed dissertation by publication' by stating so clearly on the title page.

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8. Abbreviations and acronyms should be defined on first use and kept to a minimum.

9. All figures, tables and photographs should also be submitted electronically. Each figure must have a separate self-explanatory legend. The illustrations, tables and graphs should not be embedded in the text file, but should be provided as separate individual graphic files, and clearly identified. Photographs should be saved as a 300 dpi JPEG file. Graphs and algorithms, which need to be editable, should be saved as MS Word documents or in PowerPoint. Tables should be saved either in MS Word or in a PowerPoint document. Photographs and X-rays need to be suitably anonymised. Permission should be obtained for the use of patient photographs.

10. Articles are to be submitted by email to the Editor-in-Chief, Prof Nagib du Toit at the following email address: journaleditor@ossa.co.za The text should be in MS Word. Pages should be numbered consecutively in the following order wherever possible: Title page, abstract, introduction, materials and methods, results, discussion, acknowledgements, tables and illustrations, references.

11. The Editor reserves the right to shorten and stylise any material accepted for publication.

12. For all accepted articles, authors will be requested to provide five (5) multiple choice CPD questions related to their paper.

13. Authors need to disclose whether they used artificial intelligence (AI)-assisted technologies (such as Large Language Models, chatbots, or image creators) in the production of submitted work. Authors who use such technology should describe, in both the cover letter and the submitted work, how they used it. Authors should not list AI and AI-assisted technologies as an author or co-author, nor cite AI. Chatbots (such as ChatGPT) should not be listed as authors because they cannot be responsible for the accuracy, integrity, and originality of the work. Authors should carefully review and edit the result because AI can generate authoritative-sounding output that can be incorrect, incomplete, or biased and all plagiarism that may have been produced by the AI, should be excluded.

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An overview of acute management in chemical eye injuries

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Abstract

Chemical eye injuries are true ophthalmic emergencies and require immediate intervention. Causative agents can be classified as alkalis, acids, and irritants. Alkali burns are more common and can cause significant tissue damage due to deep tissue penetration. Grading of ocular injuries is critical for determining acute treatment and visual prognosis. A thorough assessment of all the ocular structures assists with comprehensive and individualised treatment. Immediate management starts with copious irrigation, aimed at diluting and removing the inciting agent. Thereafter, the main goals of treating chemical eye injuries are to minimise inflammation, promote re-epithelialization, support stromal collagen synthesis, and inhibit collagen breakdown. Acute surgical management includes amniotic membrane transplant and tuboplasty. Poor immediate management results in more challenging treatment of acute disease, while poorly controlled acute disease results in more treatment-resistant chronic ocular disease. Early and appropriate intervention is fundamental to a good visual outcome in chemical eye injuries.

Keywords: PubMed was searched using the keywords chemical eye injury, chemical eye injuries and ocular chemical burns.

Disclosure: No financial interest to declare

Introduction

Chemical eye injuries are true ophthalmic emergencies and require immediate intervention. Early recognition and treatment play a big role in the final visual outcome. The socio-economic and educational status of countries, along with the rate of protective eye equipment, correlates with the frequency and severity of these types of injuries.[1] Two population groups most commonly affected by chemical eye injuries include young males working in factories and construction industries, as well as children between the ages of 1-2 years old who are affected by domestic eye injuries.[2] The global incidence of acid attacks has increased in past years, which often results in more severe burns.[1,3,4] As these injuries occur in younger age groups, it is essential to manage burn patients well to reduce ocular morbidity and long-term healthcare costs.[5]

Etiology

Causative agents can be classified as alkalis, acids, and irritants.[6]

Alkaline mediums have a pH of greater than 7. It causes ocular damage by the saponification of fatty acids in cell

Table I. Roper Hall classification of chemical injuries[3]			
Grade	Cornea	Limbus	Prognosis
I	Corneal epithelial damage	No limbal ischaemia	Good
II	Corneal haze, iris details visible	<1/3 limbal ischaemia	Good
III	Stroma; haze, iris details obscured	1/3-1/2 limbal ischaemia	Guarded
IV	Opaque corneal, iris and pupil obscured	>1/2 limbal ischaemia	Poor

membranes and liquefactive necrosis.[4] Hydrolysis of proteins leads to extensive damage due to deep tissue penetration. An exception is lime, which results in the formation of lime salts after the dissolution of the cell membrane, which prevents further penetration. It may, however, act as a reservoir with prolonged exposure if lodged in the conjunctiva.[5]

Alkaline burns are more common due to their widespread use in industrial and domestic cleaning products.[7] This could explain why ammonia is a commonly used agent in assaults.

In contrast, acidic mediums have a pH of less than 7. Upon contact with the eye, coagulative necrosis takes place, which creates a barrier to deeper tissue penetration.

Alcohols result in de-epithelialization of the ocular surface. During the COVID-19 pandemic, chemical eye injuries due to alcohol-based hand sanitiser increased significantly.[8] The recovery process is usually rapid and the visual prognosis is excellent.[6]

Ultimately, damage to the eye occurs due to a rapid change in pH. The degree of damage correlates with the degree of pH change.[4] Eslani *et al.* report that other factors impact the severity of chemical tissue damage, which includes the temperature of the causative agent, the impact force, the concentration, as well as the duration of contact.[2]

Clinical assessment

It is important to note that many causative agents release toxic vapours upon contact and that the patient may have multi-organ involvement. The most fatal is laryngeal oedema with loss of a patent airway. If the vital signs are compromised, seek immediate help.

A thorough assessment of all the ocular structures assists with comprehensive and individualised treatment.

The eyelid should be inspected for skin and lash burns, distortion of lid margins, and abnormal lid movements. This will affect tear distribution and contribute to ocular surface pathology.

The ocular surface may be difficult to assess due to tight lids and chemosis. A Desmarre's retractor can assist with double eversion of the lid to aid the view. Limbal ischaemia will present as pale or blanched limbal areas with an epithelial defect. Accurate assessment of the proportion of surviving limbal tissue is important as it impacts corneal healing and ultimately the visual prognosis. Corneal involvement is recorded as the degree of haze and transparency. The sensation can be assessed once the topical anaesthetic has worn off or before instilling topical anaesthesia.

Anterior segment involvement may be in the form of iris changes – colour, hyperaemia, haemorrhage, and necrosis should be noted.[4] Both anterior and posterior synechiae can rapidly develop. Pupillary responses may be abnormal.

Lastly, measure the intraocular pressure. This can be either low, normal, or elevated. Due to eyelid involvement, corneal oedema, and an irregular corneal surface, Dua *et al.* claim that digital palpation may be the only accurate way of assessing intraocular pressure.[6]

Classification

Various classification systems are available, but the two most used systems are the Roper-Hall classification and the Dua classification. The Roper Hall classification is easy to apply and commonly used. A drawback of this classification is that it does not include conjunctival involvement, which is an important component in the prognostication of corneal melting and symblepharon formation.[3]

Dua *et al.* introduced a new system, which includes the percentage of conjunctival damage, as well as the degree of limbal damage – which can be assessed by fluorescein staining.[6] The proportion of surviving limbal tissue carries major prognostic value.[9] Therefore, authors agree that the Dua classification system is superior to the Roper Hall classification in predicting the visual outcome, especially in severe ocular burns.[6,10,11]

Table II. Dua classification of chemical injuries[3]				
Grade	Limbal involvement (clock hours)	Conjunctival involvement (%)	Analogue scale	Prognosis
I	0	0	0/0%	Very good
II	≤3	≤30	0.1-3/1-30%	Good
III	>3-6	>30-50	3.1-6/30.1-50%	Good
IV	>6-9	>50-75	6.1-9/51-75%	Good – Guarded
V	>9 to <12	>75 to <100	9.1-11.9/75.1-99.9%	Guarded – Poor
IV	12 (total limbus)	100 (total conjunctiva)	12/100%	Very poor

Stages of ocular surface recovery as described by McCulley[12]

Acute (Day 0-7)

During the first week of recovery, epithelial regrowth begins, provided there are adequate healthy limbal stem cells.[5] Treatment aims to support epithelial regrowth and decrease factors that delay this process, such as inflammation and preservatives in topical treatment.

Early reparative (Day 7-21)

If the epithelial defect is small, complete re-epithelialization is seen during the second phase of healing. More severe defects will show little re-epithelialization, while eyes with grade IV burns will still appear ischaemic. Surface inflammation will be ongoing while there is an epithelial defect. Keratocytes continue to synthesise collagen to repair the damaged stroma, while on the other hand, collagen production is inhibited by collagenase, which is released by inflammatory cells. The aim is therefore to maximise collagen production while minimising collagenase activity.

Late reparative (>D21)

Inflammation begins to subside and mild eye injuries show full resolution at this stage, while persistent epithelial defects, scarring, and infection become problematic in more severe injuries.[3] Clinical features of limbal stem cell deficiency also become evident three weeks after the injury.

Acute management

Immediate intervention

Regardless of the causative agent,

irrigation remains the first and most important intervention – aimed at diluting and removing the inciting agent.[13] The pH should be measured in both eyes before commencing irrigation, which should continue for at least 30 minutes and at least one litre of fluid should be used.[6] The pH measurements should be repeated every 30 minutes until a normal pH is obtained. This can either be done with litmus paper or a urine dipstick. Once the pH is within the normal range between 7 to 8, a second pH test should be performed after five minutes to ensure that the pH remains unchanged. If not, irrigation should be resumed.

The ideal fluid is isotonic, such as Balanced Saline Solution or Ringer's lactate. There is some concern that a hypotonic solution, such as water, can worsen corneal oedema, but there is not enough evidence to substantiate this.[3]

Recently, amphoteric irrigation fluids have been proposed as the preferred solution. This solution is hypertonic, and the amphoteric properties enable it to neutralise both acid and base ions. It rapidly neutralises the ocular surface pH, which limits tissue necrosis. In comparison to water, Solim *et al.* report that up to 17 times less volume is required to achieve a neutral pH.[14] Furthermore, it exerts a minimal exothermic reaction.[6] Currently there is a lack of large studies and no definitive recommendations can be made regarding the use of amphoteric irrigation fluids in chemical eye injuries.[9]

However, authors emphasise that the lack of the ideal solution should not delay immediate irrigation, as there is a correlation between time to irrigation and visual outcome.[2,9,10,13]

Irrigation will be easier to administer if the patient receives topical anaesthetic drops, as the patient will be more comfortable and able to keep their eyes open.

Crystals and embedded debris should be removed with forceps or cotton buds, as these objects continue to damage ocular structures while in situ.

Aims of management

The main goals of treating chemical eye injuries are to minimise inflammation, promote re-epithelialization, support stromal collagen synthesis, and inhibit collagen breakdown.

Decrease inflammation

Corticosteroids

Corticosteroids act by reducing inflammatory cell infiltrate, while at the same time stabilising the cell membrane of polymorphonucleocytes. Steroids should be used intensively for the first 10 days but should be rapidly tapered after this to avoid corneal melting.[10,13] The increased risk of corneal melting has been attributed to coagulative necrosis caused by ischaemia.[13] Dexamethasone 0.1% or Prednisolone acetate 1% are common choices. Dosing depends on the severity of the injury, ranging from hourly to six hourly instillations of treatment.

Progestational steroids are less potent in terms of their anti-inflammatory effects, but they also have a smaller negative impact on stromal repair and collagen synthesis.[10] Medroxyprogesterone can be administered parenterally or a topical 1% solution can be instilled six hourly.[4]

Non-steroidal anti-inflammatory drugs (NSAIDs)

There is no role for NSAIDs in the treatment of chemical eye injuries. Hossain claims that it can worsen the melting process.[15]

Promote re-epithelialization

Lubricants

Artificial tears are the mainstay of treatment in chemical eye injuries to promote corneal re-epithelialization.[10] Preservative-free drops are preferred, with hourly instillation.

Bandage contact lenses

Silicone hydrogel contact lenses can be used to protect a compromised ocular surface and promote epithelialization. Large-diameter gas-permeable scleral contact lenses are an alternative option in patients with severe pain and photophobia. It provides a hydrating reservoir of fluid between the contact lens and the ocular surface, furthermore, it protects the epithelium against friction caused by blinking.[3] The Prosthetic Replacement of Ocular Surface Ecosystem (PROSE) has also been successfully used in multiple studies.[9]

Other modalities

Fibronectin, epidermal growth factor, retinoic acid, N-acetylcysteine, and sodium hyaluronate are still in the experimental phase of development and more human studies are needed to determine their efficacy.[10]

Biological fluids

This includes autologous serum, umbilical cord serum, amniotic membrane suspension, and autologous platelet-rich plasma.[10] These agents have been used to promote re-epithelialization and accelerate wound healing. It has been used in a variety of ocular surface disorders, such as dry eyes, persistent epithelial defects, and neurotrophic ulcers, to name a few.

Biological fluids contain various components, such as growth factors, that are not found in standard medical treatments. The composition is similar to natural tears and these fluids also have the advantage of being preservative-free.[10] Barriers to use include a complex manufacturing process, cold storage, and risk of contamination and infection.[4]

Tarsorrhaphy

A tarsorrhaphy decreases the risk of exposure, as well as blink-related microtrauma. It can be considered if the tarsal conjunctiva is vascularised with intact epithelium.[13]

Promote corneal stromal healing

Ascorbate (vitamin C) supplements

Chemical eye injuries result in a decreased ascorbate concentration in the aqueous humour. Ascorbic acid levels are about 15 times higher in aqueous, compared to the ascorbic acid levels in plasma – this suggests a possible role in ocular protection.[6] Sharma *et al.* report that ascorbate levels are about a third of normal values following chemical eye injuries.[10] Topical or systemic ascorbate is needed to reverse this deficiency.

A low level of anterior chamber ascorbate can result in corneal ulceration with subsequent perforation, as ascorbate is a cofactor in the rate-limiting step of collagen synthesis.[3,5]

Authors are not in agreement as to which method of administration is best. Some authors argue that topical administration is more effective, as anterior segment penetration is ineffective with systemic administration.[10] Others suggest that compliance is poor with topical treatment, due to pain on instillation of drops[3], while Dua *et al.* state that intravenous ascorbate is more effective than oral administration.[6] The recommended oral dose ranges from 500mg to 2000mg daily, while the topical 10% ascorbic acid can be given six hourly.[4,12,16]

However, all authors agree that ascorbate is an essential component in

management. Numerous studies have shown that the risk of corneal melt secondary to topical corticosteroids is minimal if used in combination with ascorbate.

Minimise ulceration

Tetracyclines

Tetracyclines inhibit collagenase, which decreases the risk of corneal ulceration. Increased tetracycline concentration in ocular tissues has been linked to decreased incidence of corneal ulceration.[10] Both topical and systemic tetracycline have beneficial effects and the tetracycline of choice is Doxycycline, dosed at 100mg twice daily.

Citrate

Sodium citrate has been shown to significantly decrease the development of corneal ulcers, especially following alkali burns. According to Sharma *et al*., the combination of citrate and ascorbate is superior to either supplement alone.[10] The recommended dose is 10% topical citrate drops every two hours.

Adjuvant therapy

Topical antibiotics are indicated in the first stages of healing, especially if there is an epithelial defect. It is used to prevent secondary infection and to reduce the load of commensal flora. Trimethoprim/ Polymyxin B or Fluoroquinolone drops can be used six hourly; Erythromycin ointment is an alternative option. In patients with large epithelial defects, Ciprofloxacin should be used with caution as it can precipitate in the cornea.[16]

Topical cycloplegics can be used for the treatment of ciliary spasms and the prevention of posterior synechiae formation. Atropine drops twice daily are recommended. Phenylephrine should be avoided as the vasoconstriction properties can aggravate ischaemia.[16]

Oral analgesia is indicated.

IOP control

IOP-lowering treatment is often necessary. Oral acetazolamide is the preferred treatment.[4,6] Agents that utilise outflow tracts may not be effective, as the trabecular meshwork and uveoscleral pathway are distorted by the chemical injury. Episcleral vasculopathy further impairs aqueous outflow.[3] Steroid response should also be considered as a cause. As the etiology of glaucoma is multifactorial, standard topical treatments often fail. Tube surgery is preferred, but remains challenging due to conjunctival cicatrisation, and frequent revisions are often necessary to maintain the target IOP.[3]

Debridement

Debridement should be done as early as possible. Necrotic tissue serves as a source of inflammation, which furthermore inhibits re-epithelialization.[5]

Acute surgical management

Surgical options include amniotic membrane transplant (AMT) and tenoplasty. AMT provides symptomatic relief, promotes re-epithelialization, and reduces inflammation scarring, inflammation, and neovascularization.[9,10] AMT can be used as a graft and as a patch.[9] Tenoplasty is a procedure where the Tenon's capsule is bluntly separated from the globe and the Tenon flap is then advanced to the limbus and sutured to the ischaemic sclera. It is the procedure of choice in eyes with extensive ischaemia as it has the potential of decreasing long-term complication risk, by re-establishing limbal blood supply.[4,13]

Long term complications

This includes dry eye disease, conjunctival adhesions, symblepharon, non-healing epithelial defects (neurotrophic keratopathy), limbal stem cell deficiency with secondary corneal sc≤≤arring, decompensation, thinning, melting, and perforation.

Conclusion

Successful management is often compromised by a lack of follow-up and poor treatment compliance. This has been attributed to a poor understanding of treatment benefits, lack of social support, psychosocial difficulties, polypharmacy, and pain with the instillation of treatment.[17] Good communication between the patient, the family, and the doctor is therefore essential to ensure a good outcome.

Early and appropriate intervention is fundamental to a good visual outcome in chemical eye injuries.

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Outcomes of penetrating keratoplasty at a tertiary institution in South Africa

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Abstract

Aims: To determine corneal graft survival rates and visual outcomes of penetrating keratoplasty (PKP) in a South African setting.

Methods: A retrospective review of 99 penetrating keratoplasties performed at Groote Schuur Hospital, South Africa over a three-year period between February 2016 and February 2019.

Results: The mean age of study participants was 38 years (14-85). The study included 60% females and 40% males. The main indications for surgery were keratoconus (58%), corneal scar (21%), regrafts (8%), pseudophakic bullous keratopathy (6%), corneal dystrophies (3%) and pellucid marginal degeneration (1%). The overall graft survival at 1-year follow up was 86%. A higher one-year graft survival rate of 94% was seen in patients with keratoconus. The total number of patients diagnosed with graft failure at one year was 13.The Kaplan-Meier survival analysis was used to assess time to graft failure. The estimate was 11.7 months (mean time to graft failure) with a 95% confidence interval from 11.4 to 12 months. In our study, best corrected Snellen acuity in the category of 6/6-6/18 was found in 59.2% of patients one year post-operatively, compared with 1% of patients in the same BCVA group pre-operatively. Patients with a BCVA equal to 3/60 or less reduced from 56% pre-operatively to 20% postoperatively at one year.

Conclusion: Penetrating Keratoplasty is an effective long term treatment option to restore visual acuity in certain corneal disorders in a middle to low-income country. Our results demonstrated a comparable one-year graft survival rate to high-income countries.

Keywords: penetrating keratoplasty, South Africa, graft failure, cornea, outcomes.

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Introduction

According to World Health Organisation, corneal opacity is one of leading causes of global blindness and visual impairment.[1,2] Bilateral blindness affects roughly 45 million people globally. In low-income countries, an estimated 10 million people are affected by corneal blindness.[1,2] Children and young adults are commonly affected by corneal disease resulting in monocular and bilateral blindness. In some areas in Asia and Africa, it has been reported that the incidence of vision loss in children and young adults due to corneal disease is 20 times higher than in high-income countries.[4]

Corneal transplant surgery, where the diseased host cornea is replaced by healthy donor cornea, can restore visual potential in such patients and is the most commonly transplanted tissue/organ worldwide.[5,6] Different methods of corneal transplant surgery exist, and these include penetrating keratoplasty (full-thickness corneal transplant) and anterior or posterior lamellar keratoplasty (partial thickness corneal transplant). Lamellar graft surgery has gained popularity during the past 10 years, especially in high-income countries.[6,7]

Low-income countries face many challenges when attempting to resolve the burden of disease associated with corneal blindness. Barriers include amongst others, poor eye bank infrastructure (resulting in shortage of donor tissue), limited number of trained corneal surgeons and socio-economic factors (e.g. poor post-operative follow up).[1;8-11;25]

Long-term graft survival is an important objective in order to improve visual acuity in these patients.[2] Groote Schuur Hospital is a tertiary institution situated in Cape Town, Western Cape Province, which offers general and specialist ophthalmic services. The aim of this study was to evaluate corneal transplant surgery outcomes at Groote Schuur Hospital, to identify causes

of graft failure and to subsequently use this data to implement changes where possible to improvements in long-term graft survival in our patients.

Materials and methods

This is a retrospective review of patients who underwent optical penetrating keratoplasty at Groote Schuur Hospital, Cape Town, South Africa between 1 February 2016 and 1 February 2019. All patients older than 13 years who received penetrating keratoplasty surgery during the specific time period were included. During the time period of this study, tectonic penetrating keratoplasty and glycerol graft corneal transplants were excluded. This study was approved by the University of Cape Town Research Ethics Committee and was in accordance with the tenets of the Declaration of Helsinki.

Data variables:

Data collected included patient demographics, namely: age, gender and their current area of residence (within 50km of Cape Town or beyond). Pre-operative variables that were recorded were best corrected Snellen visual acuity (pinhole, spectacles or contact lenses), indications for PKP and intraocular pressure (IOP). The different categories for BCVA were based on similar categories used in other studies.[11,13,18] The intra-operative data obtained included surgery performed (PKP alone or combined PKP-cataract procedure) and complications encountered. Post-operative data reviewed consisted of BCVA, IOP, graft rejection, graft failure and complications that occurred. Post-operative data was obtained at the one-month, six-month and 12-month follow-up visits.

Outcome measures:

The primary outcome measure was graft success. This was defined by BCVA of 6/6-6/18 the lack of graft rejection and the absence of graft failure at the different time intervals. Secondary outcomes consisted of assessing the complications that were recorded.

Surgical technique:

All patients who underwent penetrating keratoplasty received a general anaesthetic. Donor corneas were obtained from National Medical Supplies (Visionshare) and prepared using a manual trephine. The donor graft was oversized by 0.25-0.5 mm compared with the recipient. The corneal donor button was sutured to the host bed with sixteen interrupted 10-0 Nylon sutures. Intracameral cefuroxime as well as subconjunctival betamethasone given at the end of surgery. All surgeries were performed either by one of the corneal consultants or by a supervised senior registrar. The post-operative regime included prednisolone acetate 1% eye drops six times daily and ofloxacin eye drops four times daily for one month. This was then changed to dexamethasone 0.1% eye drops four times daily for six months and three times daily for another six months. Loose sutures were removed when encountered and the remainder of sutures were removed at approximately 12-18 months post-op.

Post-operative care:

Patients were seen day one, week one, week two, then one, three, six and 12 months from the date of surgery, then subsequently at six-monthly intervals. At each routine follow-up visit, BCVA was measured using a Snellen Chart. IOP was measured using puff tonometry. The graft was evaluated by slit-lamp microscopy for clarity, signs of rejection or failure and any complication that might have occurred.

Evaluation criteria:

Graft rejection was considered if there was endothelial or epithelial rejection lines and keratic precipitates.[8,9] Early graft rejection was defined as graft rejection occurring at or before six months. Graft failure was defined as an existing graft with irreversible loss of clarity as a result of oedema, neovascularization or scarring.[10] Early graft failure was defined as graft failure occurring at or before six months.

Statistical analysis:

IBM SPSS version 28 was used to analyse the data. A p value <0.05 was considered as statistically significant. Categorical variables were described using frequency tables and percentages. Continuous variables were summarised using mean and standard deviation. Comparisons between proportions were made using Fisher's exact and Chi-square tests. Comparisons between two independent means were made using t-tests. Kaplan-Meier survival analysis was used to analyse time to graft rejection. Repeated measures ANOVA was used to compare overall change in IOP over time as well as specific time points.

Results

A total of 112 PKP surgeries were performed during the three-year study period and data of 99 PKP were included for analysis. Thirteen patients did not attend their one-year follow up visit and were therefore excluded from the study.

Demographics:

Table I summarises the patient's demographics. The mean age was 38 years (range 14-85; SD = 20). The majority of patients (85%) lived within 50km radius of the hospital, where they underwent PKP and attended followed-up visits.

Table I: Patient's demographics

		Count	%
Sex	Male	40	40.4%
	Female	59	59.6%
	Total	99	100.0%
Residence: Local or country	C	14	14.1%
	L	85	85.9%
	Total	99	100.0%
Age (years)	Mean (SD)	38 (20)	

C = Country ; L = Local;
SD = Standard variation

Indications:

The main indications for corneal transplant were keratoconus (58%). Refer to *Table II* for other indications.

Table II: Indications for PKP

			Count	Column %
Indications	Bullous keratopathy		6	6.1%
	Corneal dystrophy	Lattice	1	1.0%
		Fuch's	4	4.0%
	Corneal scar	Trauma	6	6.1%
		IK	13	13.1%
		Unspecified	2	2.0%
	Failed graft		8	8.1%
	Keratoconus		58	58.6%
	Pellucid marginal degeneration		1	1.0%
	Total		99	100.0%

IK = Infective keratitis

Table III: Best corrected visual acuity outcomes

BCVA category	Pre-op		1 month		6 months		1 year	
	n	%	n	%	n	%	n	%
6/6-6/18	1	1.0%	34	35.4%	47	50.0%	58	59.2%
<6/18-6/36	26	26.5%	34	35.4%	25	26.6%	17	17.3%
<6/36-6/60	16	16.3%	6	6.3%	4	4.3%	3	3.1%
<6/60-3/60	0	0.0%	0	0.0%	0	0.0%	0	0.0%
<3/60	55	56.1%	22	22.9%	18	19.1%	20	20.4%

Visual outcome:

During the study period, best corrected Snellen acuity (BCVA) was evaluated pre-operatively, at one month, six month and a year follow up visits. Pre-operatively BCVA of <3/60 was seen in 55 patients (56.1%) in the affected eye. Post-operative BCVA in the operated eye at one-year in the 6/6-6/18 group was seen in 58 patients (59.2%)

The distribution of BCVA at different time intervals is summarised in *Table III.*

Intraocular pressure:

Repeated measures ANOVA was used to compare overall change over time as well as specific time points. IOP increased significantly over the entire time period (Wilk's lambda = 0.792, p = 0.004) and also significantly between each time period and the pre-operative value. However, when comparing each time point to the one preceding it, the only statistically significant increase was between pre-op and one month.

Figure 1 summarises mean and 95% CI IOP over time.

Graft outcomes:

The Kaplan-Meier survival analysis was used to assess time to graft failure. The estimate was 11.7 months (mean time to graft failure) with a 95% CI from 11.4 to 12 months. The cumulative survival probability at one year was 86%.

The total number of patients diagnosed with graft failure at one-year was 13. Among these patients, the pre-operative indications included pre-existing corneal scar (46%), keratoconus (23%), regraft (15%) and pseudophakic bullous keratopathy (15%).

Early graft failure (occurring before six months) was seen in 30% of patients which had graft failure.

Complications which contributed to graft failure were graft rejection 30% (n = 4), persistent central epithelial defect 15% (n = 2), infective keratitis 15% (n = 2), graft dehiscence 7% (n = 1), post-avastin endophthalmitis 7% (n = 1) and poor compliance and follow up was seen in 23% (n = 3) patients. .

In our study 24% (n = 24) of patients experienced at least one episode of graft rejection over a follow-up period of one-year. Early graft rejection (occurring before six months) was detected in 18 patients and 83% (n = 15) of these episodes occurred most frequently in the one-month post-operative time period. The progression to graft failure following an episode of graft rejection was seen in 16% of patients.

Table IV summarises the complications seen at different follow up visits.

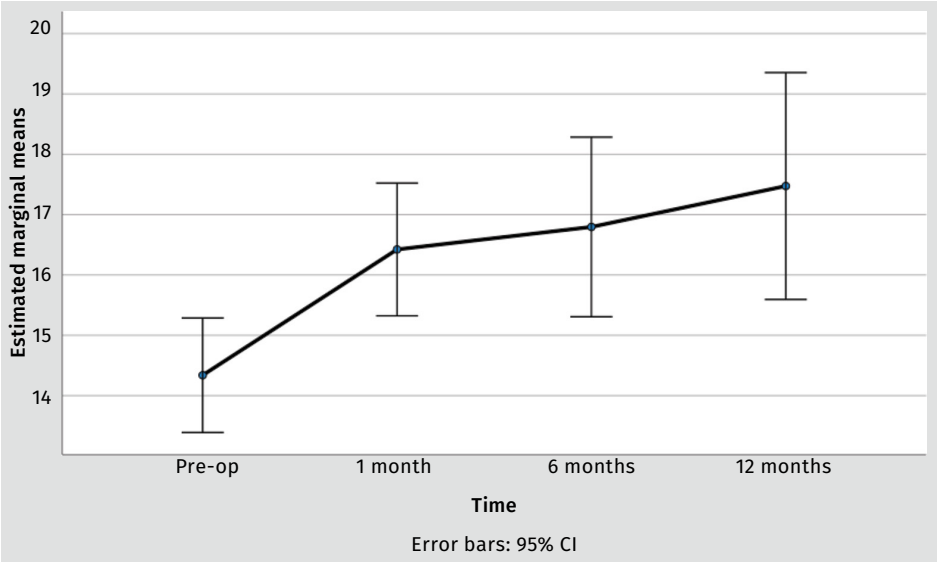

Figure 1 : Mean and 95% CI IOP over time

IOP = Intraocular pressure; CI = Confidence interval

Discussion

The overall graft survival at one-year was 86% in our study group. This is comparable to studies done in other low-income African countries. Chen *et al.* in Kenya reported one-year graft survival rate as 85.8%.[11] Ayalew *et al.* in Ethiopia and Yorston *et al.* in Kenya reported the two-year graft survival as 80% and 87% respectively. [10,13]

In high-income countries a comparable one-year graft survival rate was reported. The Corneal Transplant follow up study in the UK reported one-year graft survival as 88% and the Australian Corneal Graft registry reported it as 91%.[19]

The pre-operative indications for PKP greatly influence graft outcomes. Keratoconus most often has a higher graft survival rate as seen in a number of previous studies.[14,15]

In our study group, keratoconus made up the greatest proportion of patients (58%). This is comparable to studies done in other African and high-income Western countries.[15] Khan *et al.* (2015) reported the commonest indication for PKP in South Africa was keratoconus (64%).[2] Similar reports were noted by Chen *et al.* indicating the total percentage of patients with keratoconus in their study as 66.1%.[11]

In other low-income countries such as Pakistan and India, studies have reported their main indication for PKP to be corneal scarring. This generally influence graft survival which may explain the lower graft survival rates in these countries.[16,17] Dandona *et al.* in India reported graft survival rates at one-year as 79,6%.[18] Moin-ud-Din in Bangladesh reported the leading indication for PKP to be corneal scarring (41%).[17]

Looking at the different subgroups, the one-year graft survival rate for keratoconus in our study was 94%. This is comparable to other studies in low-income countries. In Kenya and India the graft survival rates for keratoconus at one-year was reported as 89,9% and 96,4% respectively.[11,18]

In our study, best corrected Snellen acuity in the category of 6/6-6/18 was seen in 59.2% of patients at one-year post-operatively. This was much higher compared to the percentage of patients in the same BCVA group pre-operatively.

The overall graft failure rate was 13% in our study group and the majority

Table IV: Complications at various time intervals			
		Count	Column %
Intra-op complications	Aqueous misdirection	2	2.0%
	Hyphaema	1	1.0%
	Leucoma adherens	1	1.0%
	None	88	88.8%
	Suture tract leak	2	2.0%
	Thin peripheral host corneal tissue	5	5.1%
	Total	99	100.0%

	1 month		6 months		1 year	
	Count	%	Count	%	Count	%
Non attendance	1	1.0%	4	4.0%		
Descemet folds	2	2.0%				
Graft dehiscence	3	3.0%				
Graft failure			4	4.0%	13	13.1%
Graft rejection	15	15.2%	4	4.0%	6	6.1%
Graft rupture: trauma	1	1.0%	3	3.0%	1	1.0%
Infective keratitis	1	1.0%	1	1.0%		
Loose sutures	1	1.0%	1	1.0%	1	1.0%
Non compliance	3	3.0%	1	1.0%		
None	65	65.7%	64	64.6%	68	68.7%
Ocular surface disease	1	1.0%	2	2.0%		
Other			4	4.0%	5	5.1%
Persistent CED	2	2.0%	2	2.0%		
Steroid induced ocular hypertension	4	4.0%	9	9.1%	6	6.1%
Total	99	100.0%	99	100.0%	99	100.0%

CED = Central epithelilal defect

of these patients had corneal scarring pre-operatively. The causes of corneal scarring were mostly due to infective keratitis, trauma and unspecified reasons respectively. Patients with previous herpes simplex keratitis were not selected for penetrating keratoplasty at Groote Schuur Hospital due to the high risk of graft failure in these patients.

In a multivariate analysis done by Yu *et al*., the postoperative risk factors strongly associated with graft failure were postoperative glaucoma medication, suture problems, infective keratitis, graft rejection, persistent epithelial defect and retinal surgery.[22]

Graft rejection is one the most common reasons for graft failure.[20] The time period that constitutes the highest risk for graft rejection is 150 days post-operatively as reported by the Corneal Transplant follow up Study.[19] This correlates to findings in our study where the majority of graft episodes occurred within the first six months. In contrast, Perera *et al*. reported that in their study group, 27% of patients experienced early graft rejection and 73% of patients had late graft rejection episodes.[20]

Rahman *et al.* in the UK reported that an endothelial graft rejection episode was seen in 21% of patients over a period of five years. Of these patients, 7.4% experienced graft failure.[21] In our study a higher percentage of patients (16%) that had a graft rejection episode progressed to graft failure.

In low-income countries, poor follow up and non-compliance with treatment remains a challenge.[23] In our study the non-attendance at one month, six month and one-year follow up was 1%, 4% and 13% respectively. Twenty three percent of graft failure cases failed to attend the six month follow up visit and therefore poor compliance and non-attendance were contributing factors. A study done in Kenya reported that 33% of patients that underwent PKP did not attend the one-year follow up visit and financial barriers were the main reason for non-attendance in 42% of these patients.[24] Dandona *et al.* reported that patients in poor socio-economic circumstances had a higher chance of graft failure – the relative risk was 1.28.[1]

It is important to note that good outcomes with penetrating keratoplasty were achievable despite using imported corneas travelling long distances from the USA.

Limitations to our study were the small number of patients included and the relative short follow up time. This was also a retrospective study based on the review of medical records and the information provided in patient's folders determined the quality of data.

Conclusion

In this study, the overall graft survival rate at one-year was 86%, with 59.2% of patients having BCVA of 6/6-6/18. Therefore, penetrating keratoplasty remains an effective long term treatment option to restore visual acuity in certain corneal disorders. This is comparable to other studies done in low-income and high-income countries. In South Africa, the lack of resources such as a shortage of donor corneas greatly impacts the number of PKP that can be performed.[2,25] Socio-economic challenges also influence the post-operative care. Despite these hurdles in our system, our study reports that an effective corneal graft outcome can be achieved. Although we didn't assess donor corneal graft availability, efforts in increasing the number of graft tissue remains a high priority to address the burden of corneal blindness. Further prospective studies are required to give more information on outcomes of penetrating keratoplasty in South Africa.

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13:35	Refractive and visual outcomes following implantation of the Rayner RayOne EMV	Dr Lourens van Zyl
13:45	The refractive outcome of Rayner RayOne EMV IOL even in a conservative approach	Dr JT de Lange
13:55	Analysis of the EMV toric lens' success in treating astigmatism	Dr Frikkie Hartog
14:05	Patient selection with today's IOL's and early EMV experience	Prof Ronald Yeoh
14:15	Discussion	
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A comparative year-on-year study into the change of patterns of Open Globe Injuries (OGI) in two South African academic eye Centres during the Covid-19 crisis

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The submission forms part of an MMed dissertation by publication

Abstract

Background: During the Covid-19 Pandemic, severe lockdown restrictions imposed on the public in South Africa to alleviate the strain in the already overloaded public healthcare system. Healthcare workers were reallocated to Covid-19 units. This study investigates the change in pattern of Open Globe Injuries (OGI) presenting at the McCord Provincial Eye Hospital and Inkosi Albert Luthuli Central Hospital, comparing it with the same period one year earlier.

Methods: A retrospective analysis of 143 cases of OGI's was performed by analysing patient files that was collected from the two Academic eye centres. A comparison was made between the periods of the Covid-19 Lockdown, and one year earlier, using the Ocular Trauma Score (OTS)[1] and Birmingham Eye Trauma Terminology (BETT).[2]

Results: Contrary to expectations, most metrics, including age, sex, race, mechanism of injury, surgical delay, alcohol intoxication and physical location where the trauma occurred, remained unchanged. During the Covid-19 lockdown, travel and alcohol restrictions did not reduce the number of Open Globe Injuries or change any other metrics other than a slightly higher Raw ocular trauma score (56 vs. 47, p = 0.038) indicating overall less severe injuries during lockdown. The Ocular Trauma Score remained unchanged in both groups.

Conclusion: Lockdown failed in lowering the number of Open Globe Injures. Instead, there was a statistically significant decrease in the severity of OGI's.

Key Words: Open Globe Injuries, Ocular Trauma Score, RAW score, Covid-19 Pandemic, lockdown restrictions.

Funding: No Funding was received for this study.

Conflict of Interest: The authors declare no conflict of interest for this article.

Introduction

On 5 March 2020, the South African Minister of Health, Zweli Mkhize, confirmed the spread of the coronavirus 2 (SARS-CoV-2) virus to South Africa. Ten days later President Cyril Ramaphosa declared a national state of disaster and announced initial containment measures such as immediate travel restrictions and closure of schools. On 23 March, a comprehensive Covid-19 pandemic national lockdown was announced, to be implemented on 27 March 2020.

From this date forth, the National Coronavirus Command Council was established to lead the nation's plan to contain the spread and mitigate the negative impact of the coronavirus. The Council would phase in various lockdown rules, including, but not limited to, a ban on alcohol and tobacco sales, social gatherings, curfews, and travel restrictions. The South African Government implemented these

Table I: Covid Lockdown restrictions in South Africa			
Alert level	**Period**	**Definition**	**Restrictions**
5	27 March 2020 to 30 April 2020	High Covid-19 spread with a low health system readiness	Severe restrictions in movement, only essential services allowed, ban on alcohol and cigarette sales
4	1 May 2020 to 31 May 2020	Moderate to a high Covid-19 spread with a low to moderate health system readiness	Less severe movement restrictions, certain industries opening, ban on alcohol and cigarette sales
3a	1 June 2020 to 11 June 2020	Moderate Covid-19 spread with a moderate health system readiness	Curfew from 22:00 to 4:00, more industries opening, alcohol ban was lifted
3b	12 June 2020 to 17 Aug 2020	Moderate Covid-19 spread with a moderate health system readiness	Curfew from 22:00 to 4:00, more industries opening, alcohol ban reinstated
2	18 Aug 2020 to 20 Sept 2020	Moderate Covid-19 spread with a high health system readiness	Curfew from 22:00 to 4:00, alcohol and cigarettes sales allowed with restricted sales hours
1	21 Sept 2020 to 28 Dec 2020	Low Covid-19 spread with a high health system readiness	Curfew 00:00 to 4:00, land, sea and air travel allowed with certain restrictions

https://www.gov.za/covid-19/about/about-alert-system

restrictions as per level 1 to 5 with level 5 implementing the most drastic measures to curb the spread of the virus (*Table I*).

McCord Provincial Eye Hospital (MPEH) and Inkosi Albert Luthuli Central Hospital (IALCH) are academic hospitals in the Greater Durban area. These hospital offers services at provincial and tertiary levels and thus are responsible for ocular trauma surgery referrals serving approximately 3 442 000[3] people.

A major part of trauma related eye injuries is considered to be a result of alcohol consumption/abuse, travel, work environment and social gatherings. It was widely speculated amongst healthcare workers that lockdown and the restrictions associated therewith would lead to a significant reduction in open globe injuries (OGI's).

The hypothesis was that restrictions on alcohol sales would lead to a reduction in alcohol abuse. This would in turn significantly lower alcohol associated OGI's. Another hypothesis was that the reduction in OGI's will also take place because of the implementation of curfews and travel restrictions. On the other hand, forced confinement to a home environment and isolation of individuals and families from social and financial support, might increase cases of family and gender-based violence and socio-economic injury. We hypothesized that there would thus be a direct correlation to above mentioned restrictions to OGI numbers as well as changes in patterns of presentation.

Although Open Globe Injury (OGI) is a common presentation in hospitals worldwide, the epidemiology seems to vary substantially.

Methodology

This study is a retrospective observational descriptive study including all patients, irrespective of gender and age, presenting at McCord Provincial Eye Hospital (MPEH) and Inkosi Albert Luthuli Central Hospitals (IALCH) with open globe injuries (OGI's). They are the two major referral hospitals in the eThekwini district in the coastal province of KwaZulu-Natal in South Africa.

Retrospective data was obtained by extracting patient information from theatre registers from both MPEH and IALCH. MPEH is still using physical paper-based files for record keeping and records were drawn from the filing room for evaluation on site. IALCH has an electronic health record system and retrieval of records was done by using the criteria presented to the IT team who extracted the data into a spreadsheet for ease of use. Intraoperative theatre notes were used to grade the injury using the Ocular Trauma Score (OTS).[1]

For this study, instruments used to analyse are limited to the Birmingham Eye Trauma Terminology (BETT)[2], and the Ocular Trauma Score (OTS)[1]. The most prominent and widely used description of ocular trauma has traditionally been BETT but this was further expanded in the OTS which was developed to specifically assess OGI and provide prognostic evaluation. The OTS uses the Raw score seen in *Table II*, which is a numerical number given to determine the degree of severity of an OGI. A high Raw score implies a more favourable prognosis than a lower score.

The Birmingham Eye Trauma Terminology[4] defines an open globe injury as a full thickness wound of the eye wall. A rupture is a full thickness injury to the eye wall caused by a blunt object, while a laceration is defined as a full thickness wound caused by a sharp item. A penetrating injury is described as an injury where an entrance wound is present in the globe, while a perforating injury has both an entrance and exit wound.

Inclusion criteria for patient eligibility were as follows: any patient of any age and any gender presenting at MPEH or IALCH with an OGI in need of ocular surgery severe enough to warrant general anaesthesia. The period for the study were during the Covid-19 Lockdown, 27 March 2020 to 21 October 2020 (study cases) and the same dates but exactly one year earlier, 27 March 2019 to 21 October 2019 as the control group.

Table II: RAW ocular trauma score features and calculation		
Initial visual factor	**Raw points**	
A. Initial raw score (based on initial visual acuity)	NPL =	60
	PL or HM =	70
	1/200 to 19/200 =	80
	20/200 to 20/50 =	90
	≥ 20/40 =	100
B. Globe rupture		-23
C. Endophthalmitis		-17
D. Perforating injury		-14
E. Retinal detachment		-11
F. Relative afferent pupillary defect (RAPD)		-10
Raw score = sum of raw points		

Patients were excluded from the study if they did not need surgical repair of their eyeball, or any open globe pathology caused by reasons other than trauma, for example perforations due to infections or malignancies.

Data collection was performed on site at MPEH using the theatre register for initial patient identification and then retrieving the files from the file-room for evaluation. At IALCH a digital search was done from the electronic medical records using search criteria including key words and from electronic registers of the specific theatre where all the eye trauma was treated. The data collection was done ensuring anonymity in accordance with the principles of the Declaration of Helsinki. This study received bioethics approval from the University of KwaZulu-Natal (BREC/00003104/2021) as well as hospital site consent.

Statistical analysis

Data were analysed with Jamovi® (Jamovi Project 1.6, R 4.0) to calculate appropriate summary statistics. Non-parametric paired sample t-tests were used to calculate reductions in injury numbers, severity, and other results. A p-value of <0.05 was considered statistically significant.

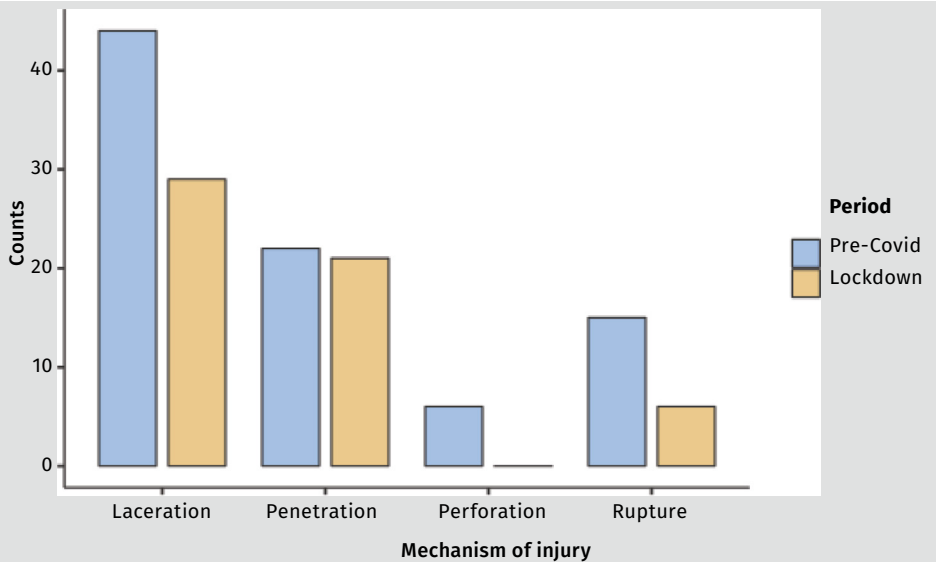

Figure 1: Injury mechanism classification

Results

As shown in *Table III*, a total of 143 open globe injuries (OGIs) were included in this study: 56 injuries during the Covid-19 lockdown period and 87 for the same time, but twelve months before the lockdown. During both periods, pre-pandemic and during the pandemic the vast majority of participants were of African descent (98% and 91% respectively (p = 0.28). The median age was 27 years pre-Covid and 28 years during lockdown, and lockdown had no influence in the male to female ratio of the incidence of OGI's which remained at 5:1.

Only four of the eyes had an eye pathology preceding the injury, so the effect of prior ocular disease on injury severity outcome was not significant (p = 0.655). Before the pandemic, the mechanism of most open globe injuries was by laceration, followed by penetration, rupture and perforations, respectively. As shown in *Figure 1*, this trend persisted during the lockdown period (p = 0.088).

The physical locations where the injury occurred were also unchanged during lockdown (p = 0.16), mostly occurring at home in both cohorts (*Figure 2*).

The total number of cases were not significantly different during lockdown (p = 0.250), but the median injury severity as indicated by the Raw score was slightly lower (*Table IV*: p = 0.038). There was, however, no significant difference

Table III: Demographics

		Period				
		Pre-Covid		Lockdown		p-value
n		87	100%	56	100%	p = 0.25
Race	African	85	98%	51	91%	p = 0.28
	Indian	2		3		
	White	0		2		
Median age (years)		27		28		p = 0.25
Males		69	79%	48	86%	p = 0.11
Females		18	21%	8	14%	

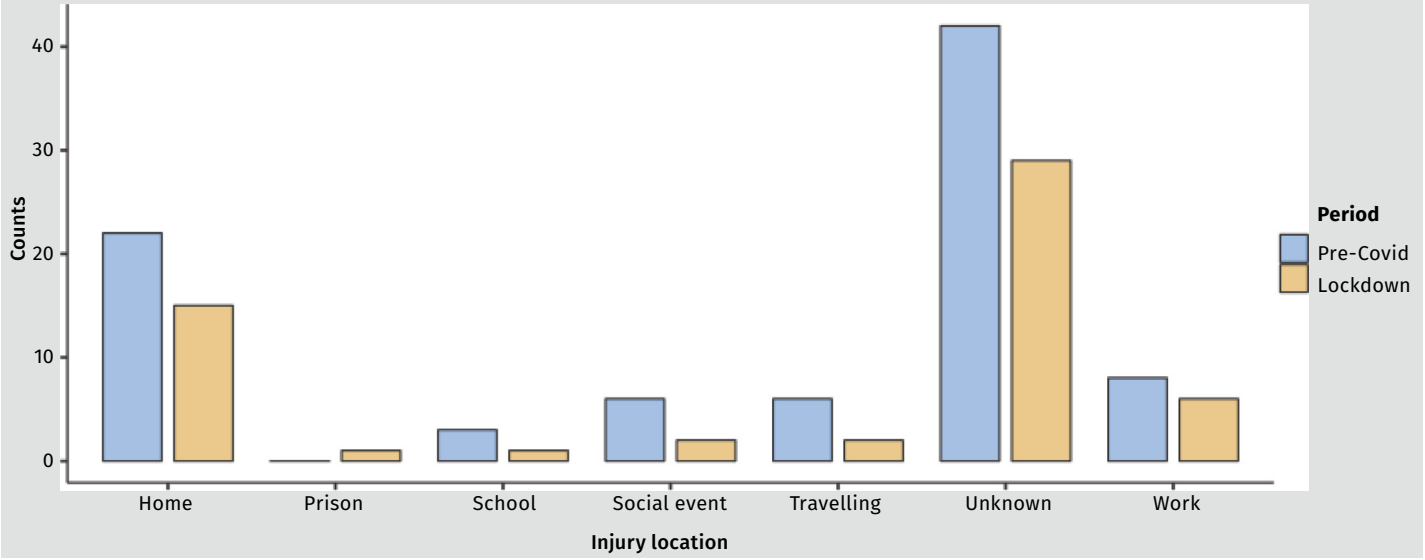

Figure 2: Physical location where the injuries occurred

Table IV: RAW ocular trauma severity score					
	Group	N	Median	SD	Mann-Whitney U
RAW Score	Pre-Covid	83	47	17.89	
	Lockdown	53	56	16.61	p = 0.038

in number or severity of injury when comparing the two lockdown groups, with and without alcohol restrictions (p = 0.078).

The number of patients who were intoxicated during injury were similar in both periods (P = 0.739). The surgical delay after injury was comparable, at four days before and three days during lockdown (p = 0.122) and had no bearing on the ocular trauma score.

Discussion

Studies in some countries show little correlation to alcohol abuse and OGI. In the city of Al-Ain in the Emirate of Abu Dhabi, a high-income but developing country, OGI was attributed mainly to occupational (50.4%) and home injuries (31.2%)[5] The mechanisms of injury are mainly from sharp objects (24.1%) and blunt trauma (16.3%), with no association with alcohol use. In Hong Kong the three major reasons for OGI are workplace injuries (36%), followed by falls (32%) and assaults (13%). In Turkey, penetrating OGI in children between the ages of 0 and 15 year were mostly accidental during play, while work related injuries were most frequent between the ages of 16 and 60 years.

In developed countries the incidence of OGI is generally lower than in developing countries but still produces a noteworthy burden on visual impairment. In Australia, accidental falls were the most common cause of OGI in the elderly, while assault (often alcohol-related) and work-related injuries were more common in the younger age groups.

On the contrary an Australian study done in the far north Queensland health districts concluded that there was a disproportionately high incidence of OGI associated with alcohol abuse, especially amongst the Aboriginal and Torres Strait Islander population. Several other studies showed that type and extent of ocular injury due to alcohol use by either the assailant or the injured was similar.

A strong relationship between alcohol use and OGI was also determined in South Africa by a study done at Groote Schuur Hospital where 66.1% of the victims sustaining an OGI admitted to using alcohol immediately prior to the injury. Assault had occurred in 73.5% of these cases and only 26.5% of these OGIs were claimed to have been accidental.

These findings supported the prediction that a ban on alcohol sales such as implemented in South Africa could result in a reduction in the presentation of OGI's to hospitals such as MPEH and IALCH. The most recent study published by Dorman *et al.* indicates a reduction in OGI in their population where alcohol management plans were implemented.

An initial study by Pellegrini *et al.* looked at all ocular trauma presenting to an Italian ophthalmology emergency unit during Covid-19 lockdown periods found a significant reduction in all types of ocular trauma during the pandemic. The author reasoned that these results could also be attributed to patients avoiding seeking help to reduce exposure to the SARS-CoV-2 virus. In contrast to our referral eye services, the Italian unit accepts relatively minor ocular trauma and severe eye trauma would probably preclude patients from opting to avoid medical care. A follow up study by Pelligrini *et al.*[15] further indicated a significant reduction in admissions due to ocular trauma. Surgery related conditions like retinal detachments were also reduced from 22 in 2019 to 11 during the Covid-19 period.

One of the main reasons given by the National Coronavirus Command Council for the strict lockdown periods from 27 March to 21 October 2020, was to reduce the amount of trauma presenting to health facilities in order to facilitate shifting of medical resources to patients with Covid-19. In the Durban Ophthalmology Complex, the total number of open globe injuries (OGIs) was expected to decrease substantially. Several health care workers at IALCH and MPEH were redeployed to assist facilities dedicated to the treatment of Covid-19 and its complications.

The total number of OGIs in our study did not decrease significantly, although the severity of these injuries (Raw score) was less than before Covid lockdown, these changes were only moderate. The median OTS score remained at 2 if calculated from the Raw score in both groups. Contrary to our study, Vural *et al.*[16] found in Turkey no change in the severity of the OGI's according to the OTS. They did however mention an increase in OGI's referred to their hospital due to the restriction countrywide put on secondary hospitals to reduce surgery. The study from You-Mei Xu *et al.*[17] from China indicated a significant increase in the number of open-globe injuries and a significant increase in the severity if the injuries sustained but an overall decrease in ocular trauma patients.

A large part of the lockdown included a ban on travelling, attending school, social events, and non-essential employment, it was also reasonable to expect other variances between the two periods. Changes in demographic results were also expected as more men than women are employed in South Africa[18] so a decrease in male work-related accidents was expected. In Korea Woong-Joo Whang[19] found a significant decrease in male and increase in female incidences but in our setting we had no changes in the male to female injury ratio. A possible increase in gender-based violence at home were also expected as suggested by Huiyu Liang *et al.* [20]. In this study, location of injury and gender showed no differences between before and during the lockdowns.

Contrary to this study, Stedman *et al.*[21] found a three times increase in serious ocular trauma cases during the Covid-19 pandemic than in the previous five years leading up to it. This was attributed to more DIY being done at home. It also showed a delay in presentation to hospitals for care suggesting a reluctance to seek medical support during the pandemic.

The shortcoming of this study is that it only included 143 patients. Increasing the study cohort to include more eye centres in South Africa might have shown more significant results. Despite the expectations and intentions of the lockdown during the Covid-19 pandemic in South Africa, a major reduction in open globe trauma was not realised.

The importance of knowing the impact of a global pandemic on health services in our developing country with its unique setting can assist in planning and reducing the impact of future outbreaks on the health system.

Conclusion

A total of 143 open globe injuries from public eye hospitals in a middle-income country were analysed in this study. Results showed that during lockdown the total number of open globe injuries did not decrease significantly but the median severity of the injuries decreased slightly from 47 (worse prognosis) to 56 (slightly better prognosis) as measured by Raw score. All other variables including age, sex, race, mechanism of injury, alcohol intoxication and physical location where the trauma occurred, remained unchanged.

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Diagnostic and treatment challenges in a patient with combined superior ophthalmic vein thrombosis and cavernous sinus thrombosis

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Abstract

Background: Superior ophthalmic vein thrombosis (SOVT) and cavernous sinus thrombosis (CST) are rare entities with potentially sight and life-threatening complications. The authors present a case of combined SOVT and CST with an overview of the clinical presentation, aetiology, diagnosis, and management options.

Case presentation: A 56-year-old female was referred with suspected right orbital cellulitis. She presented with a week history of headaches, a painful red right eye and vision loss. On examination she had marked right periorbital swelling, conjunctival injection, chemosis, ophthalmoplegia and proptosis. Neuroimaging showed a dilated right superior ophthalmic vein and right cavernous sinus. Laboratory investigations suggested an infective cause. Management included a combination of antibiotics, anticoagulants, steroids, and anti-glaucoma medication. After three months of treatment, she showed complete resolution of orbital congestion and marked improvement in vision, with only mild residual signs.

Conclusion: SOVT and CST are important differential diagnoses to consider in patients presenting with signs of orbital congestion. Although there is currently no standardised treatment protocol, our patient demonstrated a good visual outcome and showed no treatment complications after being managed with a combination of antibiotics, steroids, and anticoagulant medication.

Keywords: superior ophthalmic vein thrombosis, cavernous sinus thrombosis, orbital cellulitis, orbital congestion, dilated superior ophthalmic vein, neuroimaging in superior ophthalmic vein thrombosis, neuroimaging in cavernous sinus thrombosis.

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Introduction

Superior ophthalmic vein thrombosis (SOVT) is a rare entity, with approximately 100 cases reported in the English literature since 1975.[1-12] It can present in isolation, or in association with cavernous sinus thrombosis (CST) – a potentially life-threatening condition. Whilst infections are commonly implicated, these entities could also be due to a variety of non-infective systemic illnesses.[2,3,13] The clinical presentation includes non-specific features of orbital congestion such as proptosis, ophthalmoplegia, conjunctival congestion, chemosis and vision loss.[1-3,13] This can be difficult to distinguish clinically from orbital cellulitis – necessitating neuroimaging for diagnosis, and further investigations to establish the cause.[1-3,13] There is currently no standardised treatment protocol for SOVT or CST, due to their rarity and lack of clinical trials.[3,13] The management is mainly empirical and based on a combination of antibiotics, anticoagulants, steroids, and surgery. Although isolated SOVT seems to recover without serious sequelae, associated CST could prove life threatening.[2,13] Early appropriate management is crucial to avoid potentially devastating consequences.

Case report

We present the case of a 56-year-old female, referred with suspected right orbital cellulitis. She reported a week history of headaches and a painful red right eye with periorbital swelling and vision loss. There was no history of trauma and no symptoms of preceding sinusitis or dental pain. She denied previous thromboembolic events and had no history of cancer. The patient is postmenopausal, not on hormone replacement therapy. She received the COVID vaccination some months prior to presentation.

Examination of her right eye showed

a visual acuity of light perception with marked periorbital oedema (*Figure 1*). She had complete ophthalmoplegia and an 8 mm axial proptosis, with some resistance to retropulsion. Her right upper lid had complete ptosis with marked conjunctival injection and inferior chemosis. Her pupil was fixed and dilated (6 mm) with a RAPD and an intraocular pressure (IOP) of 27 mmHg on rebound tonometry. Fundoscopy revealed a hyperaemic optic disc with a large superotemporal disc bleed and peripapillary splinter haemorrhages. Her retinal vessels were tortuous, with a seemingly normal macula (an OCT was unobtainable given her ophthalmoplegia). Examination of her left eye was unremarkable with a pinhole vision of 6/9, nuclear sclerosis and an IOP of 14 mmHg. The rest of her systemic examination was normal with no other neurological fallout.

A contrast CT brain showed right globe proptosis with enlarged recti muscles, a markedly dilated right SOV and a full right cavernous sinus (*Figure 2*). Her paranasal sinuses were clear with no orbital collections.

Our working diagnosis was a right SOVT with right CST, as well as a subacute orbital compartment syndrome with compressive optic neuropathy. Since she did not have a tight orbit, her IOP was not markedly elevated (>40 mmHg), and her vision loss longstanding; a lateral canthotomy was not performed. Early physician and neurology consultation was sought, and she was started on combined intravenous antibiotics, steroids, anticoagulants, and IOP-lowering medication whilst further investigations were done to ascertain a cause.

Sepsis workup revealed a normal white cell count (8.43 x 10^9/L), with a neutrophilia (79.20%) and lymphopaenia (13.70%). The peripheral smear was reported as having features suggestive of infection – rouleaux formation, a left white cell count shift with toxic granulation and vacuolation of neutrophils, as well as numerous large platelets. Her CRP was raised (54 mg/dL) with a normal ESR. Unfortunately, no procalcitonin or blood culture was done. Neuroimaging showed no sino-orbital sepsis and her CXR was clear. Her D-dimer was elevated (0.41 mg/L), however further coagulopathy studies were rejected due to a laboratory technical problem.

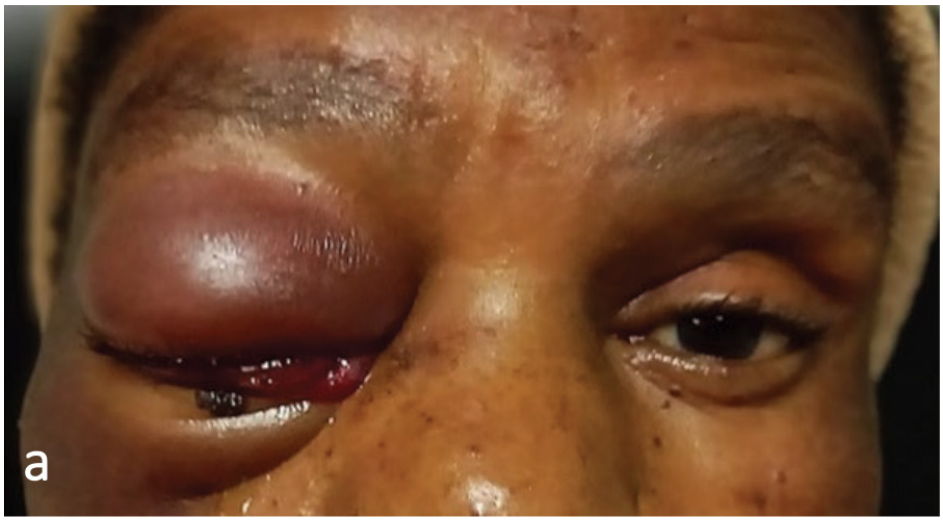
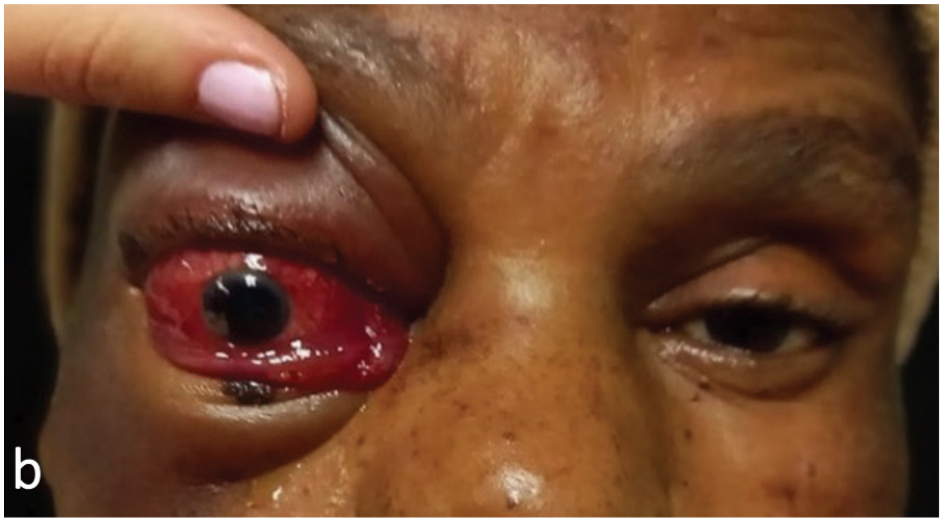


Figure 1. (a and b) Patient at initial presentation showing marked right periorbital oedema, ptosis, proptosis, conjunctival injection and chemosis.



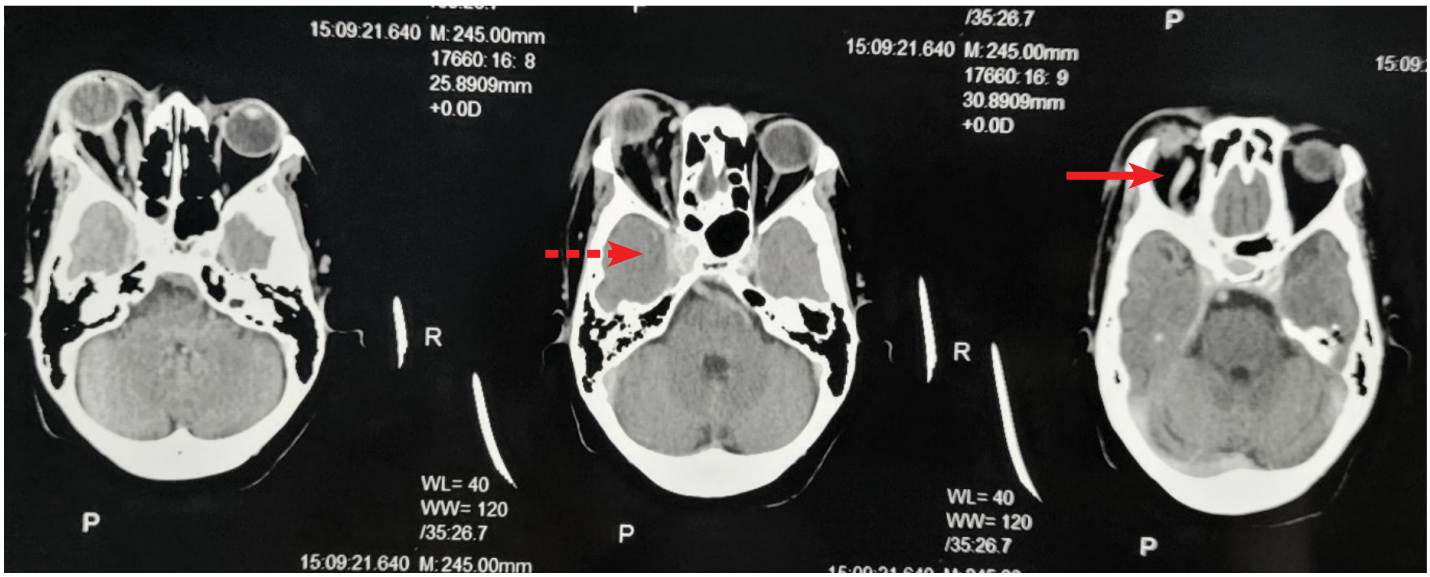


Figure 2. Contrast CT Brain showing right globe proptosis, enhancement and enlargement of medial rectus muscle, a prominently dilated right superior ophthalmic vein (arrow) and fullness of the right cavernous sinus (dashed arrow).

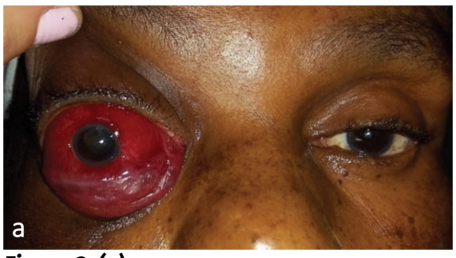


Figure 3. (a)
Two weeks after initiation of treatment; note her fixed dilated pupil on the right.

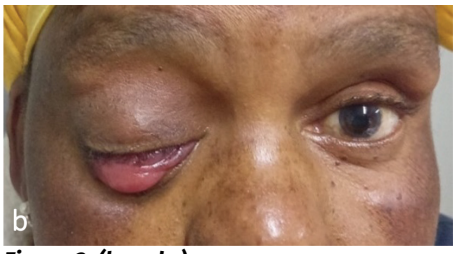
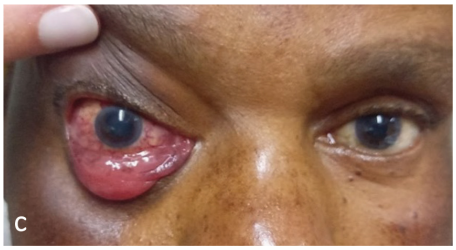


Figure 3. (b and c)
Two months after treatment, showing marked improvement in proptosis, conjunctival hyperaemia and chemosis.



Her rheumatoid factor was elevated (61IU/ml), however she had no clinical features of rheumatoid arthritis and testing for other auto-immune antibodies (anti-nuclear antibodies, anti-ds-DNA antibodies, ACCP-antibodies and B2-glycoprotein antibodies) were negative. She had normal thyroid function tests and immunoglobulin levels, which decreased the likelihood of an auto-immune disease, chronic infection or multiple myeloma. Sarcoidosis was ruled out by a normal serum ACE and CXR. Malignancy workup revealed a normal mammogram, and an abnormal PAP smear showing a precancerous lesion for which she was referred to gynaecology.

The patient received three weeks of antibiotics (1,2g IV amoxicillin/clavulanic-acid tds and metronidazole 400 mg po tds for two weeks, followed by oral amoxicillin/clavulanic acid), three weeks of anticoagulants (enoxaparin 60-80 mg subcutaneously daily and warfarin 2.5-7.5 mg daily), and ten days of intravenous steroids (dexamethasone 6 mg IV dly), the latter being started after she had completed one week of antibiotics. Anticoagulation was continued after discharge. Her IOP was controlled on oral acetazolamide (250 mg po tds) and topical brimonidine/timolol drops. The conjunctival exposure was treated with lubricants and wet chamber dressings.

She showed slow but steady clinical improvement (*Figure 3).* Within one week of treatment, she started regaining vision. After three months, her distance pinhole vision was 6/12. Despite complete resolution of her orbital congestion, she still had residual ptosis, impaired infraduction and adduction, a fixed dilated pupil and optic disc pallor (*Figure 4).*

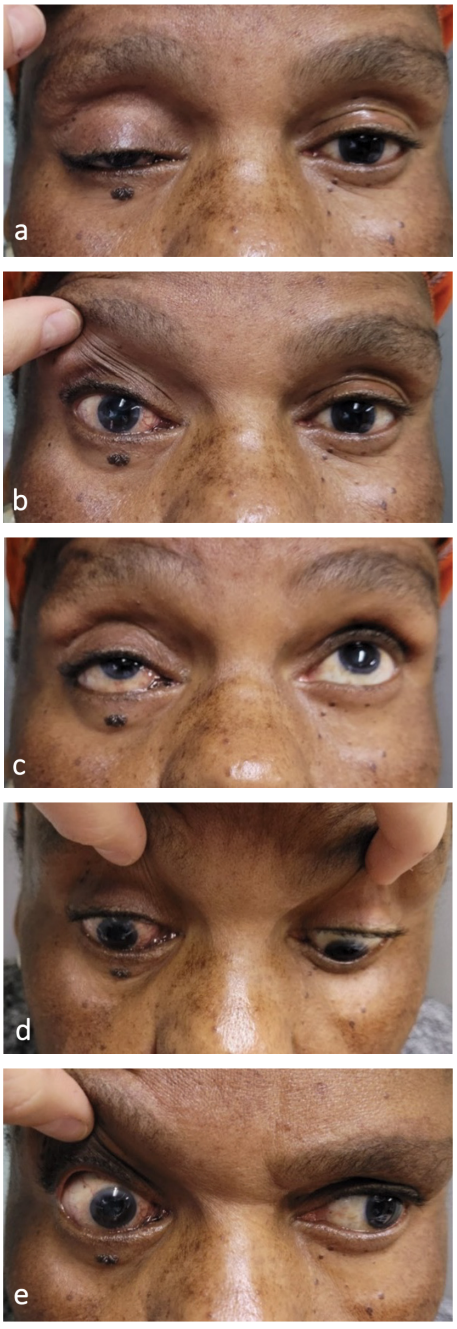


Figure 4. (a-e) Images three months after treatment, showing complete resolution of proptosis and conjunctival congestion. Note the residual ptosis, impaired infraduction and adduction, and fixed dilated pupil on the right.

Discussion

Anatomy

The SOV is the largest ophthalmic vein in the orbit[14] and responsible for draining most of its venous blood.[2] It is formed in the superomedial angle of the orbit after union of the supra-orbital, supra-trochlear and angular (facial) vein. It courses posteriorly, through the superior orbital fissure until finally draining into the cavernous sinus (*Figure 5*).[14,15] The cavernous sinuses are paired, interconnected, trabeculated venous structures found at the base of the skull (*Figure 6*).[13,16]

They transiently house many important structures, including the internal carotid artery with its sympathetic plexus, and cranial nerves III, IV, V_1 & V_2 and VI.[8] Neighbouring superiorly, is the pituitary gland. The clinical presentation and complications of cavernous sinus pathology is determined by the extent of involvement of these structures.

Until recently, the ophthalmic and facial veins were considered valveless – similar to that of the dural venous sinus system.[13] This was thought to provide an uninterrupted channel of communication between septic blood draining the face, orbit and cavernous sinuses.[17] Subsequently SOVT, CST and orbital cellulitis often co-exist.[2] Further intracranial extension of septic thrombi can lead to life-threatening complications. Recent evidence, however, demonstrates the presence of valves in both the ophthalmic and facial veins.[18] It is therefore more likely the direction of blood flow, presence of collaterals, and proximity of these structures that propagates the spread of infection.[18]

Aetiology

SOVT can occur in isolation, or in association with CST. The aetiology for both can be categorised into infective and noninfective causes (*Table I*).[2,3] CST is more often due to an infective cause[8] and SOVT often coincides with CST in septic aetiologies.[1,3] When infection is the culprit, the source is predominantly from local spread of adjacent infected structures,[2,3] although cases of distal infection (anorectal abscess, IV-drug use) causing septic CST have been mentioned in the literature.[19] The most common cause for septic SOVT and CST is paranasal sinusitis (especially sphenoid)[2,19] and orbital cellulitis,[3] with the most common organisms being *Staphylococcus aureus* (MSSA/MRSA), followed by other staphylococci, various streptococci, anaerobes, gram negative organisms (especially *Pseudomonas aeruginosa*) and fungal aetiology (Mucormycosis and Aspergillosis).[3,19,2] One case report describes SOVT secondary to COVID-19 infection.[12] The non-infective causes can be remembered

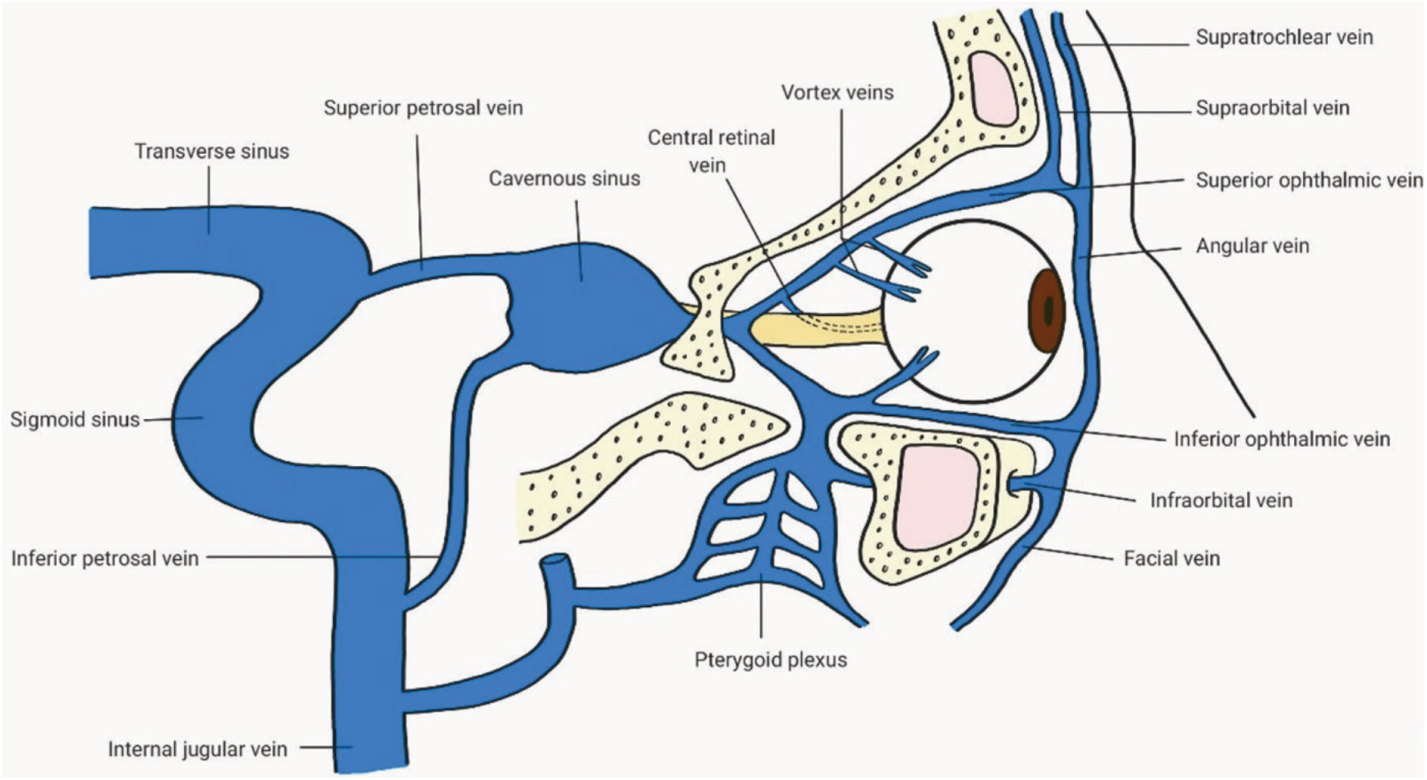


Figure 5. Lateral view of the orbital venous drainage system.

by considering the risk factors for vascular thrombosis as proposed by Virchow's triad[1]: hypercoagulability, altered blood flow or stasis, and vessel wall injury (*Table I*).

In our case, the aetiology was either infective or inflammatory in nature – supported by the neutrophilia, left sided white cell shift and elevated CRP. Distinguishing between these two causes is challenging given the major drawback of our case report – lack of a septic source. The finding of toxic granulation and vacuolation of neutrophils on the peripheral smear has a high sensitivity for predicting infection (80%)[21] but is not diagnostic. In spite of our investigative blind spots, our case highlights an often-encountered challenge in the literature – despite the wide variety of causes, the aetiology of SOVT often remains unknown.[2]

Clinical presentation

The ocular features of SOVT and CST are due to the resultant impaired venous drainage and orbital congestion. Patients commonly present with painful periorbital swelling, proptosis, ophthalmoplegia, conjunctival injection, chemosis, diplopia and vision loss. Examination may further reveal ocular hypertension, a relative afferent pupil defect, tortuous retinal vessels, retinal haemorrhages, macular oedema and optic nerve swelling.[1,2,3,13,20]

Multiple mechanisms could explain the visual impairment. Severe orbital congestion (with orbital compartment syndrome at the extreme) can cause an ischaemic or compressive optic neuropathy.[22] Given that the central retinal vein drains into either the SOV or cavernous sinus, thrombosis of either could lead to central retinal venous occlusion with macular oedema.[23]

The onset of SOVT is usually unilaterally, however when associated with CST this can rapidly develop into bilateral clinical features.[2] When the cavernous sinus is affected additional signs may occur depending on the structures involved: CNV_1 and V_2 involvement can lead to altered facial sensation or loss of corneal blink reflex; pupillary abnormalities can result from CN III and autonomic nerve fibre compression. Complications from intracranial involvement can present with seizures, hemiparesis or an altered mental status.[13]

In addition to having a similar clinical presentation, SOVT often occurs together with orbital cellulitis and CST (especially in septic aetiologies), making clinical distinction between these entities difficult, and necessitating further special investigations.[1,2,3]

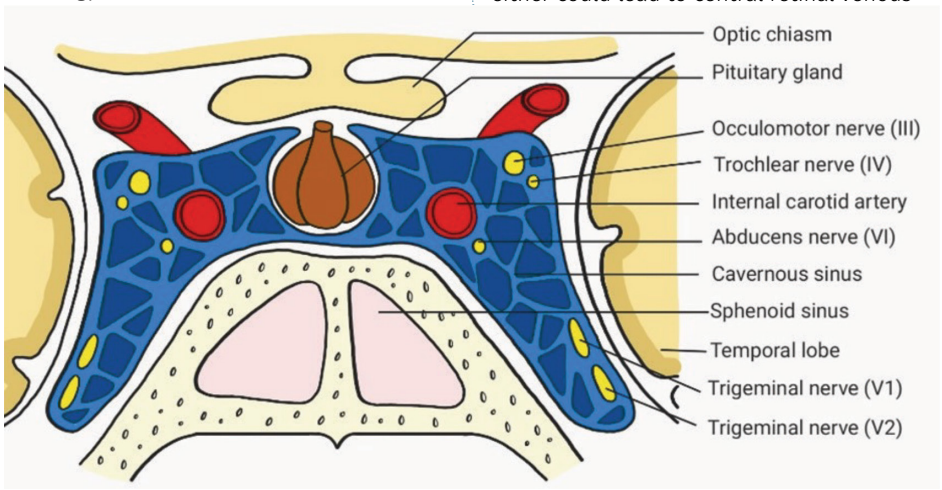


Figure 6. Anteroposterior view of the cavernous sinus and its contents.

Diagnosis

SOVT and CST are clinical and radiological diagnoses.[2,13] Neuroimaging helps to recognise thrombosis, but also assists in identifying certain aetiologies (like sino-orbital sepsis) and potential complications such as cerebral infarction and intracranial extension of infection.[13,24] While non-contrast scans show subtle signs (such as SOV dilatation, bulging of the lateral margins of the cavernous sinus, proptosis), preferred imaging is a contrast-enhanced CT or MRI, with CTV/MRV being highly sensitive for thrombus detection.[13]

Table I: Approach to the causes of SOVT/CST (as mentioned in the literature)

Infective		Non-infective	
Source	**Common organisms**	**Hypercoagulable states**	
Paranasal sinusitis (particularly sphenoid sinus)	• Staphylococcus aureus (MSSA/ MRSA) • Staphylococci • Streptococci • Anaerobes • Gram negative organisms (Pseudomonas aeruginosa) • Fungi • (Mucormycosis and Aspergillosis)	Haematological disorders	• Sickle cell trait • Haemolytic anaemias • Hereditary haemorrhagic telangiectasia • Acquired thrombophilias (e.g. antiphospholipid syndrome) • Inherited thrombophilias
Orbital cellulitis		Autoimmune/ systemic inflammatory disorders	• Systemic lupus erythematosus • Rheumatoid arthritis • Thyroid eye disease • Vasculitides • Sarcoidosis • Ulcerative colitis
Dental infections		Malignancies (local and systemic)	• Orbital neoplasm • Cavernous sinus meningioma • Leukaemia • Lymphoma • Multiple myeloma • Lung cancer
Facial infections		Medication related	• Combined oral contraceptives • Hormone replacement therapy • Cessation of anticoagulants
Distal infections	• COVID-19 • Anorectal abscess • IV drug use	vaccine-induced	• ChAdOx1 nCoV-19 vaccine
		Vessel wall injury	
		Trauma	• Severe facial trauma • Post traumatic carotid-cavernous fistula
		Altered venous blood flow	
		Cerebral vascular malformations	• Dural arteriovenous fistulae • Carotid cavernous fistulae
		Other	
		• Idiopathic • Tolosa Hunt syndrome	

The main radiological features of SOVT are a dilated SOV with internal filling defects.[2,3] SOV dilatation alone is not diagnostic – only about 10% of dilated SOVs are due to thrombosis.[3] Direct signs of CST include convex bulging of the normally concave lateral wall, sinus asymmetry, altered signal enhancement and irregular filling defects on post-contrast scans. Since the SOV drains into the cavernous sinus, thrombosis of the latter will invariably lead to engorgement of the SOV with subsequent orbital congestion.[24] Therefore, indirect signs of CST include SOV dilatation, proptosis, enlargement of extraocular muscles and enhancement of intra-orbital fat. In fact, according to the study *MR Imaging in cavernous sinus thrombosis* by Bhatia in 2019, amongst the most sensitive and specific indicators for CST was a dilated SOV of >2.9 mm and a cavernous sinus of >10 mm.[24]

Determining the underlying aetiology often requires additional laboratory investigations.

Management

Due to its rarity, there is no standardised treatment protocol for SOVT and CST.[3,13] Treatment is targeted at the underlying cause (if found), but generally consists of a combination of antibiotics, anticoagulants, steroids and surgery.[3,19,20]

Antibiotics

Antibiotic therapy should cover the most common organisms while awaiting culture results. For CST, recommended antibiotics include an anti-staphylococcal agent (Vancomycin if MRSA), a third-generation cephalosporin, anaerobic cover (metronidazole), and an antifungal agent (Amphotericin B).[13] This protocol could feasibly be applied to septic SOVT, since it commonly overlaps with septic CST and the entities share a similar aetiology and micro-organism profile. There is no consensus on the duration of treatment in SOVT[3] but for CST it is recommended to continue parenteral antibiotics for at least 2-4 weeks after resolution of clinical features.[13,25] Although our patient was not treated with an antifungal, she showed marked clinical and biochemical improvement on a combination of amoxicillin/clavulanic-acid and metronidazole. In retrospect, an antifungal could have been considered earlier particularly if she was immunocompromised or if her condition deteriorated.

Anticoagulants (ACT)

The use of anticoagulants in isolated SOVT is still unclear,[20] and even in CST is controversial.[13] The advantages include preventing clot progression, and improving antibiotic penetration of septic thrombi.[20] The potential risks include intracranial and systemic haemorrhage and septic emboli dissemination.[13] There is some evidence in retrospective reviews suggesting a decreased mortality in patients with septic CST treated with anticoagulants.[19] In contrast, a review by Levine *et al* in 1988 found no evidence of reduced mortality, but did show reduced residual morbidity in patients with CST when ACT was initiated early in combination with antibiotics.[19]

Currently, in the absence of contra-indications, most experts recommend the use of ACT in CST, and suggest either bodyweight-adjusted subcutaneous low-molecular-weight-heparin or dose-adjusted intravenous (IV) heparin for several weeks to months.[13,26]

Steroids

There is currently no evidence for the use of steroids in SOVT or CST.[3,13,19] Steroids might reduce orbital inflammation and alleviate compression on important structures, such as the optic nerve and other cranial nerves.[13,20] Additionally, steroids may be indicated for the management of underlying aetiologies, like SLE.[13,19] A recommended management strategy for steroids in non-infective SOVT, is to use it in high doses in the acute phase, followed by slow tapering over several weeks. In infective cases, steroids are typically withheld in the acute phase while treating the patient with antibiotics and anticoagulants[20] – as practiced in our case.

Surgery

Surgical intervention is not indicated for SOVT or CST per se, but it has a role in treating underlying causes or complications such as orbital abscess drainage, orbital decompression, sinus surgery or management of carotid cavernous fistulae.[3,13,20]

Complications/prognosis

Isolated non-infective SOVT mostly resolves without dire consequences.[2] Reported complications include varying degrees of vision loss and proptosis.[2] The literature seems to suggest a higher rate of concomitant CST in SOVT caused by infection, with more serious complications in this septic group.[3] These include residual cranial nerve palsies (commonly the abducens nerve), intracranial extension of infection, septic thrombosis of the internal jugular vein, and even mortality.[3]

Isolated SOVT may have a relatively benign outcome, however CST often has a more sinister course. Since the introduction of antibiotics, the mortality rate of CST has dropped from 80% to less than 13%.[13] Half of patients who had CST suffer long term sequelae, most frequently 6th or 3rd cranial nerve palsy.[13] Visual impairment occurs in 7-22% of patients with CST, with blindness resulting in 8-15% of cases.[13] Our patient fortunately showed a favourable outcome with marked visual recovery and residual signs of an occulomotor nerve palsy.

Conclusion

Even though SOVT and CST are rare entities, they are important differential diagnoses to consider for patients presenting with orbital congestion. It is probable that SOVT and CST are part of a continuum – the one progressing into or heralding the presence of the other. Although there is no standardised treatment protocol, our patient demonstrated good visual outcome and showed no complications after being managed with the recommended combination of antibiotics, steroids, and anticoagulant medication.

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From a BCVA of 0.1 to 1.0 – Refractive correction after radial keratotomy and arcuate keratotomy procedures

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Abstract

Purpose: To report a challenging case of a patient presenting with a refractive error following radial keratotomy and arcuate keratotomy procedures. He was left with significant astigmatism and a high degree of myopia.

Methods: Initially, a lasso suture was placed, and the arcuate scars were sutures. These were found to improve vision but not adequately, so the sutures were removed and phacoemulsification surgery with a PCIOL was done. Again the vision was improved but not found to be satisfactory. He underwent a two-stage laser procedure. The initial procedure was a phototherapeutic keratectomy laser to regularise the superficial cornea. This was followed by photorefractive keratotomy. The final step of his management plan was to implant a secondary IOL to improve his vision without spectacles.

Results: The BCVA improved from 0.1 to 1.0. Both the patient and refractive surgeon were satisfied with his visual outcome.

Conclusion: There is no one size fits all solution when it comes to correcting the vision of someone who previously had a radial keratotomy procedure. However, by taking into account the patient's BCVA and refraction, a good treatment plan can be devised, and good visual outcomes can be achieved.

Patient consent: Written consent was obtained from the patient.

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Introduction
Case Report

Here we present a 65-year-old male who had previous refractive surgery. He had a radial keratotomy (RK) in his right eye to correct for myopia as well as arcuate keratotomy (AK) in the same eye for his astigmatism in 2001. His main complaint on presentation was progressively worsening vision that could not be corrected with spectacles. His best corrected visual acuity (BCVA) was 0.1. On examination, he was noted to have eight cut radial keratotomy scars and two arcuate keratotomy scars in the cornea. Nuclear sclerosis and a posterior subcapsular cataract in his right eye were present. The rest of the anterior segment and fundus exam was unremarkable.

Management

A lasso suture was performed at the 9mm optical zone, and the AK wounds were sutured. Postoperatively he had an overcorrection with significant myopia and stigmatism. His reaction was -8.00/-8.75x92 and his BCVA was 0.12. Due to induced myopia and astigmatism, the lasso suture was removed. One of the sutures of the AK wound was also removed. His refraction was then +2.50/-5.50x108 with a BCVA of 0.32. It was decided to place the lasso suture in the 7 mm optical zone. The AK sutures were also revised. Following this, his refraction was: +1.50/-4.75x156 with a BCVA of 0.40.

Phacoemulsification was done and a Zeiss Asphina intra-ocular lens (IOL) was implanted. Six weeks post phacoemulsification his refraction was +4.25/-5.00x168 with a BCVA of 0.40. Six months later his refraction was +9.75/-10.25x162 with a BCVA of 0.50.

Table I: Summary of procedures

	Refraction	UCVA	BCVA
Initital presentation	Refractive error	0.1	No improvement
After lasso suture (initial)	-8.00/-8.25x92	0.05	0.12
6 weeks afrer initial lasso suture	+2.50/-5.50x108	0.12	0.32
After 2nd lasso suture and suturing of AK	+1.50/-4.75x156	0.32	0.40
After phaco surgery	+4.25/-5.00x168	0,1	0.5
Two step laser procedure PTK followed by PRK	+6.00/-1.45x140	0.32	0.8
Sulcoflex lens combined with OCCI	0.00/-1.50x164	0.8	1.0

He then underwent a two-stage procedure: phototherapeutic keratectomy (PTK) followed by photorefractive keratectomy three months later. After these two procedures, his refraction was +6.00/-1.45x140 with a BCVA of 0.80. A piggyback lens (Sulcoflex) combined with an opposite clear corneal incision (OCCI) was his final procedure. Six weeks after this procedure and at his most recent visit at the time of writing this report his refraction in his right eye was, 0.00/-1.50x164 with a BCVA of 1.0 and an uncorrected visual acuity (UCVA) of 0.8.

Table I is a summary of the procedures the patient underwent, and the resultant visual outcomes achieved with each procedure.

Discussion

Radial keratotomy (RK) is a procedure that corrects myopia by inducing central corneal flattening. Radial incisions are made on the clear cornea at a predetermined depth. Multiple studies have been done to determine the optimum depth and placement of the incisions to optimise the refractive outcomes and provide the most stable results.[1-4] RK at one point in time was the most commonly performed procedure by refractive surgeons.[1,5] It is estimated that between 1980 and 1990 around 250 000 RK procedures were performed annually.[6,7] RKs and AKs have largely fallen out of favour. They have given way to newer procedures such as Laser in situ keratomileusis, photorefractive keratotomy, small incision lenticule extraction, and phakic intra-ocular lenses. Knowing how to treat the complications of RKs remains relevant today.

Based on refraction, biomicroscopy, and histology of the cornea it has been found that the wounds made during an RK procedure heal very slowly over a long period of time (up to 66 months).[1,5,8,9] For this reason the RK procedure became obsolete as this slow healing resulted in an unpredictable refractive result and a subsequent hyperopic shift over time. According to the PERK trial: after 10 years a hyperopic shift had occurred in 44% of all patients who had undergone the procedure.[1] Thus the predictability of outcomes was poor. Even if a patient had a good outcome one year after surgery the longevity of this visual outcome was not guaranteed. Proposed hypotheses for why a hyperopic shift occurs post-operatively include: an increase in intra ocular pressure (IOP) and changes to the corneal rigidity.[10] Long-term complications of RK may include: a reduction in best-corrected visual acuity, over or under-correction, irregular astigmatism, and hyperopic shift.[10,11]

Postoperatively patients have diurnal fluctuations of their refraction.[12] Spectacles or contact lenses that improve vision in the morning may not provide the same improvement in the evening. This fluctuation creates difficulties in calculating treatment profiles for laser vision correction or selecting IOL powers.

One of the earliest surgical interventions to treat hyperopia, following RKs, was the Greene Lasso suture. This is a procedure where a suture is placed circumferentially in the corneal stroma. The suture should be placed at the 7 mm or 9 mm optical zones in an over-and-under technique. Between the cuts, the sutures go deeper into the stroma while the sutures placed through cuts are superficial.[13,14] The suture material selected may be mersilene, prolene, or nylon. Mersiliene will erode over time but will not stretch as it is multi-filamentous. Prolene may last longer but will stretch over time. Nylon acts as an intermediate between the two as it's less prone to eroding than mersilene and will not stretch as much as prolene. Patients with a higher degree of hyperopia can be considered for two circumferential sutures at both 7 and 9 mm.[15] There have been several case series published all of which report that the procedure is safe and does provide immediate symptom relief by steepening the cornea thereby correcting hyperopia.[13-15]

Initially, as seen with this patient, there may be an over-reaction of the cornea. This results in significant myopia which regresses. Surgeons should not be too quick to remove the suture post-operatively and rather allow time for the cornea to stabilise over six months. The lasso suture's effectiveness over time does decrease and although there is limited evidence in the literature to support this, anecdotally, surgeons do report regression over time.[16] This may be due to the suture degrading or due to the cheese wire effect through the patient's stroma. More long-term studies are needed to support this.

Another factor impacting this patient's vision was nuclear sclerosis and a posterior subcapsular cataract. It was decided that he required cataract surgery but selecting an IOL power in patients who have previously had an RK procedure can pose a significant challenge. Traditional calculators often resulted in hyperopic results postoperatively.[5,17] An online calculator created by the American Society of Cataract and Refractive Surgery was used to calculate his IOL power.[18] This multi-formulae calculator is specific for patients who had prior RK surgery. We aimed for slight myopia to counter the continued regression over time. He was counselled extensively on the need for further treatment after the surgery as measurements for the IOL were not guaranteed to be accurate. There is currently no gold standard formula for calculating IOL powers in a post-RK patient.[18,19] There are several factors that make it difficult to calculate the correct IOL power namely: corneal irregularities influencing the true refractive power of the cornea,[12] ongoing hyperopic shift[1] and the inability to determine the effective lens position.

Phototherapeutic keratectomy (PTK) is the use of high-energy radiation (wavelength 193 nm) to regularise the corneal surface.[20] After an RK procedure, a patient has irregularities of the cornea due to irregular corneal flattening, slits, and epithelial plugs with an increase in higher-order aberrations.[21,22] Compensatory corneal epithelial thickening occurs masking these irregularities. Topography measurements will not be an accurate reflection of the stroma. Measurements and treatment planning will therefore be inaccurate.[23,24] Ideally the epithelium needs to be regularised to achieve accurate measurements. PTK removes a uniform percentage of the cornea (removing both epithelium and stroma indiscriminately) at a set depth. The depth is determined by the thickest portion of the epithelium in the 6 mm zone. The resultant cornea can be measured without the epithelium masking the irregularities of the surface. PTK has the added advantage of increasing the optical zone which is typically reduced after an RK procedure. It is important to note that this step is to allow the next step to be more precise and that an improvement of vision is not the goal. The patient's expectations during this step of the process should be managed as they are unlikely to notice an improvement in their vision.

The second step was to use photorefractive keratotomy. This corrects both the hyperopia and astigmatism with a customised ablation profile created by software using the patient's refraction and corneal topography.[25,26] Now that his cornea was regularised and an accurate topography could be measured topoguided TransPRK could be performed more accurately.[27] Some trials have shown that PRK can be done as a single-step procedure after an RK procedure with good outcomes but have acknowledged that longer follow-up is needed to comment on

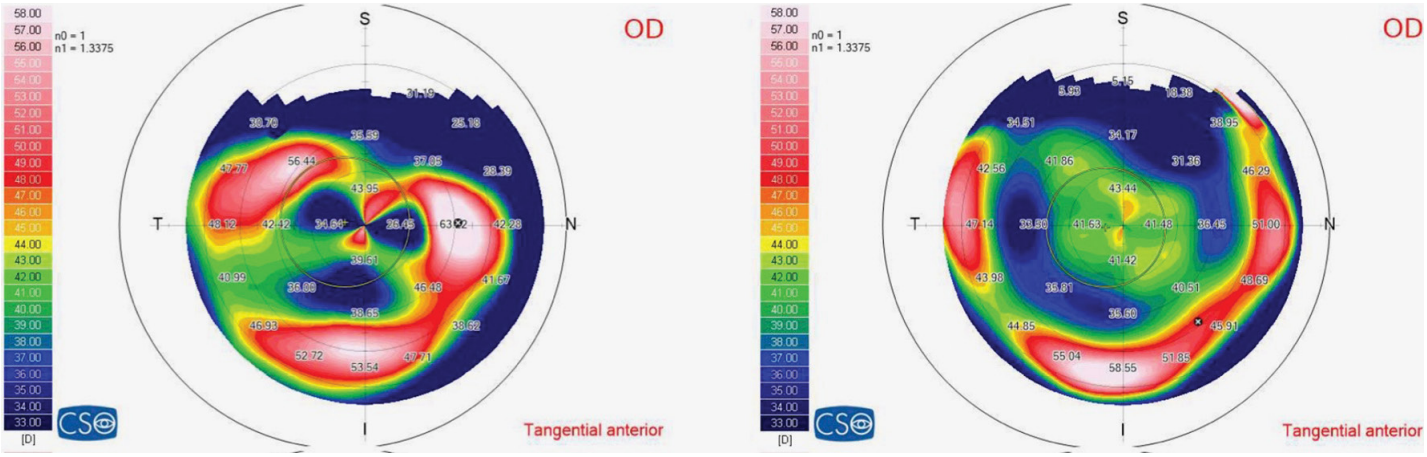

Figure 1 shows the corneal topography before (left) and after (right). It shows significant decrease in irregularity of the cornea especially in the optical zone.

the stability of the treatment profiles.[28,29] The biggest priority for PRK in this patient was to reduce astigmatism and control the high-order aberrations. To spare corneal tissue the patient was left with a residual hyperopic result which would later be managed with a secondary IOL. In a patient who has not already undergone cataract surgery a lens replacement or lens-based procedure could be considered to correct for hyperopia.

The final step for this patient was the use of a piggyback IOL to correct the residual refractive error. Cataract surgery was performed with a lasso suture in situ. The lasso sutures created a prolate shape of the cornea. Once the sutures were removed and PRK was done our patient was left with a hyperopic result. The advantage of using a secondary IOL is that it is a procedure that is reversible and has predictable and stable long-term outcomes.[30] The risks associated with an IOL exchange are capsular rupture, vitreous loss, IOL decentration, and lens capsule phimosis. This risk is further amplified by the patient's previous YAG capsulotomy.[31] The risks of a lens exchange outweighed the perceived benefits and so a secondary IOL was chosen. The secondary IOL also provided a solution that would preserve corneal tissue, unlike another laser procedure. After inserting the secondary IOL the patient was happy with a BCVA of 1.0.

Figure 1 shows the corneal topography before (left) and after (right). It shows significant decrease in irregularity of the cornea especially in the optical zone.

Figure 2 shows the wave front of the cornea before (top) and after (bottom) all procedures. This figure shows a significant reduction in higher order aberrations, and this is largely responsible for the patient having an improved UCVA and BCVA.

Table II below shows a breakdown of the

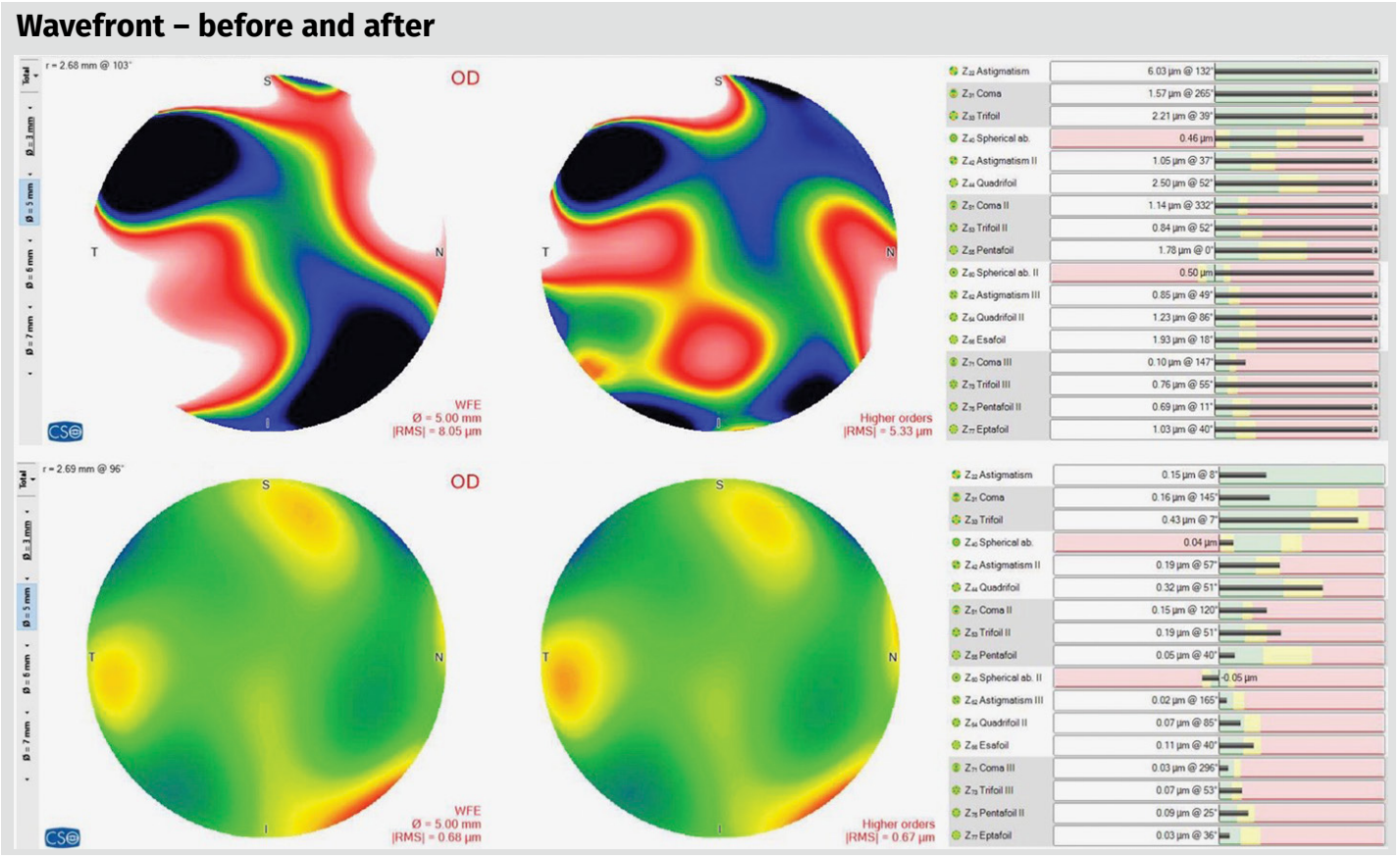

Figure 2 shows the wave front of the cornea before (top) and after (bottom) all procedures. This figure shows a significant reduction in higher order aberrations, and this is largely responsible for the patient having an improved UCVA and BCVA.

procedure we performed for our patient as well as an explanation of the results we achieved.

Conclusion

The takeaway message from this case presentation is that not one given procedure can be applied to manage the hyperopic shift and irregular astigmatism post RK. Procedures need to be individualised.

In our practice, we have come up with the following algorithm to guide us and take the guesswork out of choosing the correct procedure for managing the long-term complications of RKs.

The algorithm uses both the best corrected visual acuity and degree of hyperopia to divide patients into three groups.

Figure 3 is the algorithm for treatment for refractive errors in a patient who has previously undergone radial keratometry

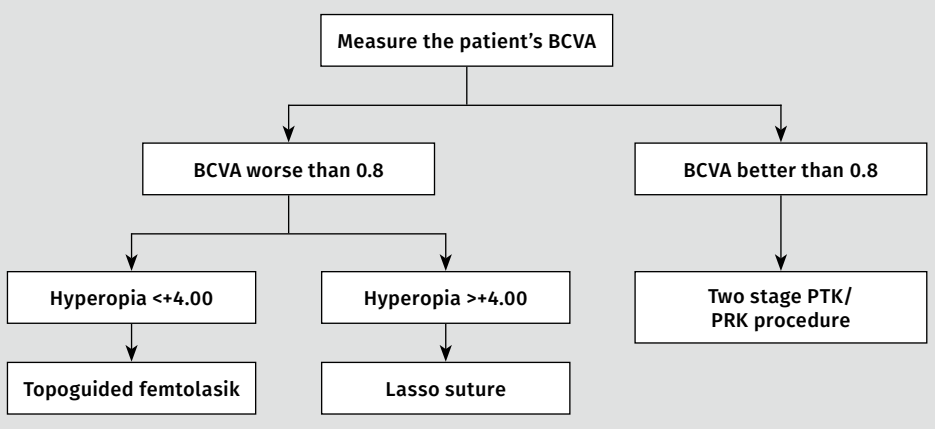

Figure 3: Treatment for refractive errors.

It should be noted that lens-based surgery can be used at any time if the expected BCVA after surgery is adequate and higher-order aberrations are controlled. Toric IOLs is best avoided. It is advisable to aim for slight myopia as RK has a progressive flattening effect with an increase in hyperopia which should be accounted for.

Table II: Breakdown of procedure

Procedure	Result	Learning outcome
Spectacles	Poor BCVA	Radial keratotomy fell out of favour due to: • fluctuations in refraction • unpredictable refractive outcomes
Lasso suture and sutures of the AK wounds	Initial improvement to correct his resultant hyperopia with regression after a few months No improvement of his astigmatism	• Lasso sutures cannot correct for higher order aberrations or asigmatism therefore BCVA will not improve • There will be an over reaction to the procedure initially resulting in significant myopia – this will regress
Phacoemulsification surgery	Post op hyperopia with signifiant astimatism. After six weeks regresssion occurs	• Phacoemulsification should wait until the final stage after the cornea has been regularised. This will allow for more accurate IOL calculation • Toric IOLs are best to be avoided • Aim for slight myopia (-0.50 to -1.00) to compensate for regression
Two step laser procedure: PTK followed by PRK	PTK – created regularised corneal surface that allowed for accuate topography measurement and planning of PRK PRK – improved script with reduction in both sphere and cylinder Improved higher order aberrations	• Correcting higher order aberrations improves BCVA
Sulcoflex lens combined with an OCCI	Eye became plano with a small amount of residual astigmatism UCVA: 0.9 BCVA: 1.0	• A relatively simple procedure • Fine tune the patient's uncorrected visual acuity and may provide spectacle independence

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A turning point in post-cataract surgical care[1]

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* Many ophthalmologists implement treatment for 2 or more weeks with dose tapering to prevent adverse reactions and clinical relapse. A follow-up, after 1 week, for a decision about whether to stop or continue treatment in patients still experiencing symptoms or inflammation is recommended. [1] Levofloxacin/dexamethasone for 1 week, followed by another week of dexamethasone alone was not inferior to 2 weeks of tobramycin/dexamethasone in preventing or reducing inflammation and in preventing infections. [3]

** FDC - Fixed-dose combination

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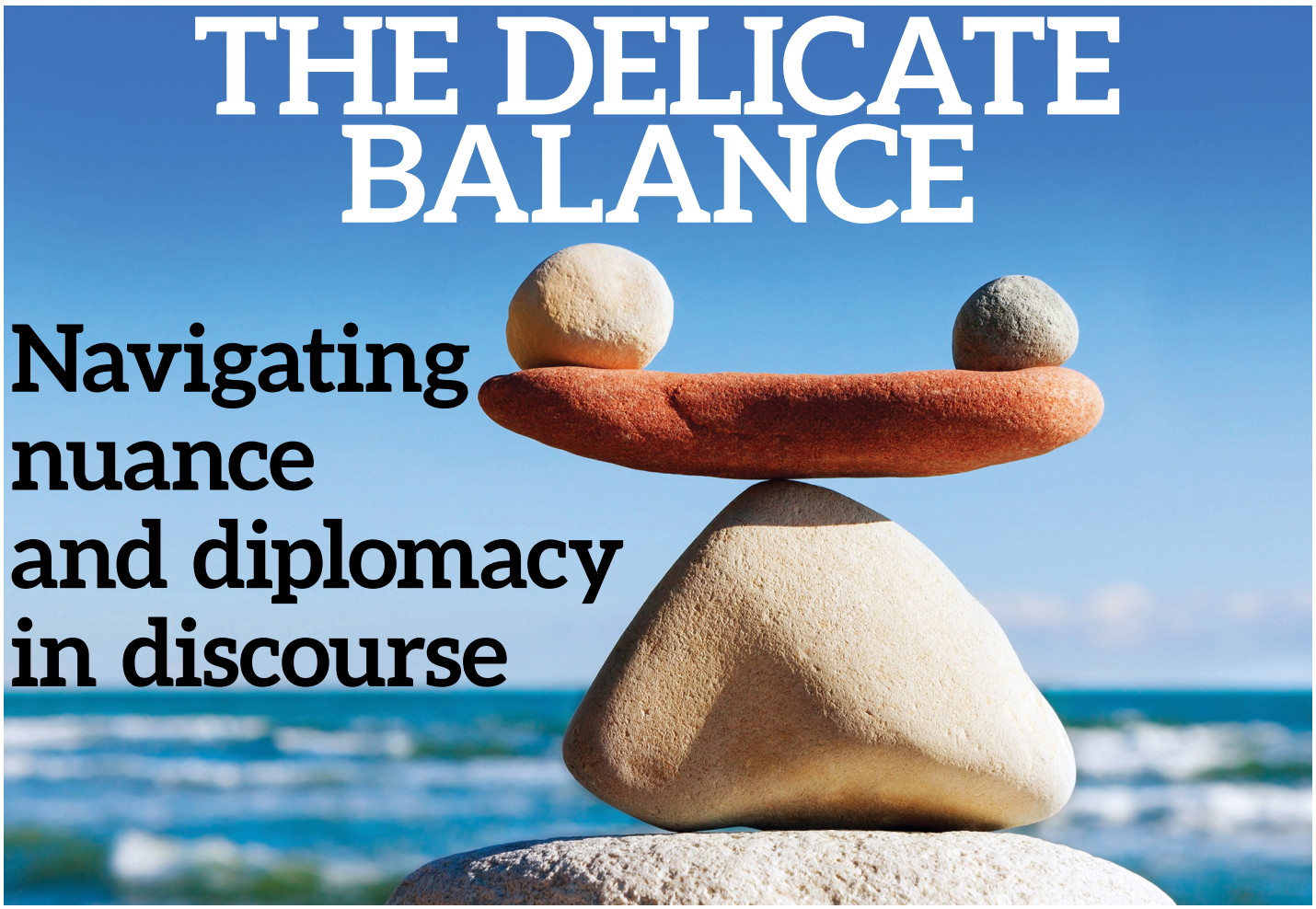
THE DELICATE BALANCE

Navigating nuance and diplomacy in discourse



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In the realm of communication and dialogue, the interplay between nuance and diplomacy is a complex and nuanced topic. Nuance, the subtle shades of meaning or expression, is often lauded for its ability to capture the intricacies of a subject. However, there exists a contention that nuance can sometimes serve as a veil for evasiveness, particularly when employed in diplomatic discourse.

Nuance, in its essence, is the art of conveying ideas with precision and depth. It allows for a more comprehensive understanding of complex issues by acknowledging and addressing subtle variations within a given context. Nuance permits individuals to articulate thoughts with subtlety, providing a richer tapestry of meaning that goes beyond the surface. In various intellectual, cultural, and diplomatic discussions, the ability to appreciate and communicate nuance is often considered a mark of sophistication.

However, nuance can sometimes be misconstrued as a tool for evasiveness. In diplomatic circles, where clear communication is crucial, excessive nuance might lead to ambiguity and misinterpretation and much frustration. The deliberate use of subtle distinctions and carefully crafted language can create a smokescreen that obscures the true intent or position of a speaker. This opacity raises concerns about the authenticity and transparency of diplomatic engagements, potentially undermining the trust between parties.

Diplomacy, as a discipline, requires a balance between nuance and clarity. While nuance can enhance the depth of understanding, diplomacy demands a level of transparency that ensures mutual comprehension among parties involved. The diplomatic process necessitates clear communication to build trust, foster cooperation, and resolve conflicts. When nuance transforms into evasion, it challenges the very foundation of diplomatic endeavours, as the sincerity and openness required for effective dialogue may be compromised.

The challenge lies in delineating the thin line between skilful nuance and evasive tactics. Diplomats must navigate this fine balance, ensuring that nuanced expressions enhance understanding without sacrificing the clarity and sincerity essential for diplomatic success. Striking this balance requires a commitment to truthfulness and a recognition of the responsibility that comes with diplomatic discourse.

The interplay between nuance and diplomacy is a multifaceted challenge that demands careful consideration. While nuance adds depth and complexity to communication, its misuse as a cover for evasiveness in diplomatic contexts can hinder the effectiveness of dialogue. Diplomacy, at its core, thrives on transparency and clear communication. Striking the right balance between nuance and clarity is essential for fostering trust, cooperation, and genuine understanding in the intricate world of work-related relations. As we navigate the complexities of diplomatic discourse, it is imperative to view nuance not as a mask for evasion but as a tool that, when wielded responsibly, can enrich conversations and promote authentic engagement.

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Website: https://samaconference.org/programme-at-a-glance/

OSSA Congress 2024 (Ophthalmology Society of South Africa Congress)

Date: 29 February-02 March 2024
Venue: Boardwalk Convention Centre, Gqeberha (PE)
Website: https://2024.ossacongress.co.za

APRIL

International Conference on Retinoblastoma and Retinal Disorders (ICRRD)

Date: 15 April 2024
Venue: Cape Town, South Africa
Website: https://waset.org/

International Conference on Surgical Ophthalmology (ICSO)

Date: 15-16 April 2024
Venue: Cape Town, South Africa
Website: https://waset.org/

MAY

South African Glaucoma Society (SAGS) Congress 2024

Date: 24-26 May 2024
Venue: Zimbali Resort, KwaZulu-Natal
Website: https://www.sags.co.za

JUNE

South African Vitreoretinal Society (SAVRS) Congress

Date: 14-17 June 2024
Venue: Kwa-Maritane Lodge, Pilanesberg National Park, North West Province
Website: https://www.savrs.co.za

JULY

International conference on Ophthalmology and Retinal Disease treatments

Date: 19 Jul 2024
Venue: Durban, South Africa
Website: https://www.iirst.com/event/index.php?id=2390415

NOVEMBER

International Conference on Retinoblastoma and Retinal Disorders

Date: 04-05 November 2024
Venue: Cape Town, South Africa
Website: https://waset.org/

2024 International congresses and meetings

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MARCH

5th World Congress Ophthalmology and Vision Science

Date: 18-19 March 2024
Venue: Zurich, Switzerland
Website: https://opthalmologycongress.insightconferences.com

APRIL

International Conference on Retinoblastoma and Retinal Disorders (ICRRD)

Date: 05 April 2024
Venue: Cancún, Mexico
Website: https://waset.org/retinoblastoma-and-retinal-disorders-conference-in-april-2024-in-cancun

MAY

Retina World Congress

Date: 9-12 May 2024
Venue: Marriott Harbor Beach, Fort Lauderdale, Florida
Website: https://retinaworldcongress.org/congress-information/2024-retina-world-congress/

JUNE

33rd International Conference on Insights in Ophthalmology

Date: June 20-21 2024
Eye to the Future: Ophthalmology Compensation Trends
Venue: Dublin, Ireland
Website: https://ophthalmology.insightconferences.com/speaker-guidelines.php

JULY

International Conference on Retinoblastoma and Retinal Disorders

Date: July 08-09, 2024
Venue: Corfu, Greece
Website: https://waset.org/retinoblastoma-and-retinal-disorders-conference-in-july-2024-in-corfu

AUGUST

International Conference on Corneal Diseases and Ophthalmology Practice

Date: 30-13 August 2024
Venue: Sydney, Australia
Website: https://waset.org/conferences-in-august-2024-in-sydney/program

SEPTEMBER

International Conference on Advances in Ophthalmology Surgery ICAOS

Date: 09-10 September 2024
Venue: Singapore
Website: https://waset.org/advances-in-ophthalmology-surgery-conference-in-september-2024-in-singapore

OCTOBER

International Conference on Orbital Trauma and Retinal Detachment

Date: 21-22 October 2024
Venue: London, United Kingdom
Website: https://waset.org/orbital-trauma-and-retinal-detachment-conference-in-october-2024-in-london

NOVEMBER

International Conference on Vision and Ophthalmology

Date: 11-12 November 2024
Venue: Rome, Italy
Website: https://waset.org/vision-and-ophthalmology-conference-in-november-2024-in-rome

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References: **1.** Clareon® IOL Directions for Use. **2.** Lane S, Collins S, Das KK, Maass S, Thatthamla I, Schatz H, Van Noy S, Jain R. Evaluation of intraocular lens mechanical stability. J Cataract Refract Surg. 2019 Apr;45(4):501-506. **3.** Alcon Data on File, 2017. **4.** Lehmann R, Maxwell A, Lubeck DM, Fong R, Walters TR, Fakadej A. Effectiveness and Safety of the Clareon Monofocal Intraocular Lens: Outcomes from a 12-Month Single-Arm Clinical Study in a Large Sample. Clin Ophthalmol. 2021;15:1647-1657. **5.** Oshika T, Fujita Y, Inamura M, Miyata K. Mid-term and long-term clinical assessments of a new 1-piece hydrophobic acrylic IOL with hydroxyethyl methacrylate. J Cataract Refract Surg. 2020 May;46(5):682-687. **6.** AcrySof® IQ Vivity® Extended Vision IOL Directions for Use. **7.** Bala, Chandra, et al. Multi-country clinical outcomes of a new nondiffractive presbyopia-correcting intraocular lens. Journal of Cataract and Refractive Surgery Publish Ahead of Print DOI:10.1097/j.jcrs.0000000000000712. **8.** Varma, Devesh, et al. Clinical Outcomes of a New Non-Diffractive Presbyopia-Correcting Intraocular Lens From Two Large Confirmatory Studies. American Academy of Ophthalmology. Abstract: PA005. **9.** Alcon Data on File, 2022. [A01970-REP-211731] - Optical Equivalency of Clareon Monofocal and AcrySof IQ IOL Version 1.2 REF-15172. Based on Studies with AcrySof®; Clareon® and AcrySof® are optically equivalent with the same -0.2µm aspheric design resulting in improved depth of focus.
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The role of metabolites in understanding GLAUCOMA

Glaucoma stands as a prevalent cause of vision impairment and blindness, significantly affecting the older population.

Detecting early signs of this condition, which can manifest as changes in optic nerve appearance or elevated eye pressure, remains critical. The challenge lies in its subtle progression, often leading to irreversible vision loss before detection. While efforts to comprehend the intricate processes underlying glaucoma are ongoing, research endeavours aim to intervene timely, halting or slowing its advancement and thereby minimising vision loss.

Despite more than 120 genetic factors linked to glaucoma, these genes only account for less than 10% of cases. Hence, scientists are exploring alternative methods to predict glaucoma, including investigating metabolites for potential insights. These small molecules, formed through metabolic processes such as nutrient breakdown during digestion or medication by-products, are under scrutiny to identify individuals at risk, providing an opportunity to intercept the disease before vision loss occurs.

Metabolites serve as biomarkers aiding in disease diagnosis and risk assessment. One such tool is the comprehensive metabolic blood panel, a standard blood test employed by doctors to measure various circulating metabolites, including sugars like glucose, minerals like calcium, and proteins such as creatinine.

The metabolome encompasses the complete set of metabolites in your body. Recently, research funded by the National Eye Institute, spearheaded by Louis Pasquale from the Icahn School of Medicine at Mount Sinai in collaboration with Jae Hee Kang of Brigham and Women's Hospital, delved into 369 blood metabolites in a substantial study related to glaucoma.

Examining stored frozen blood samples from two extensive health professional studies, the team compared around 600 participants who developed glaucoma after study enrolment with a similar group who didn't. On average, those who developed glaucoma did so approximately a decade after their initial blood draw.

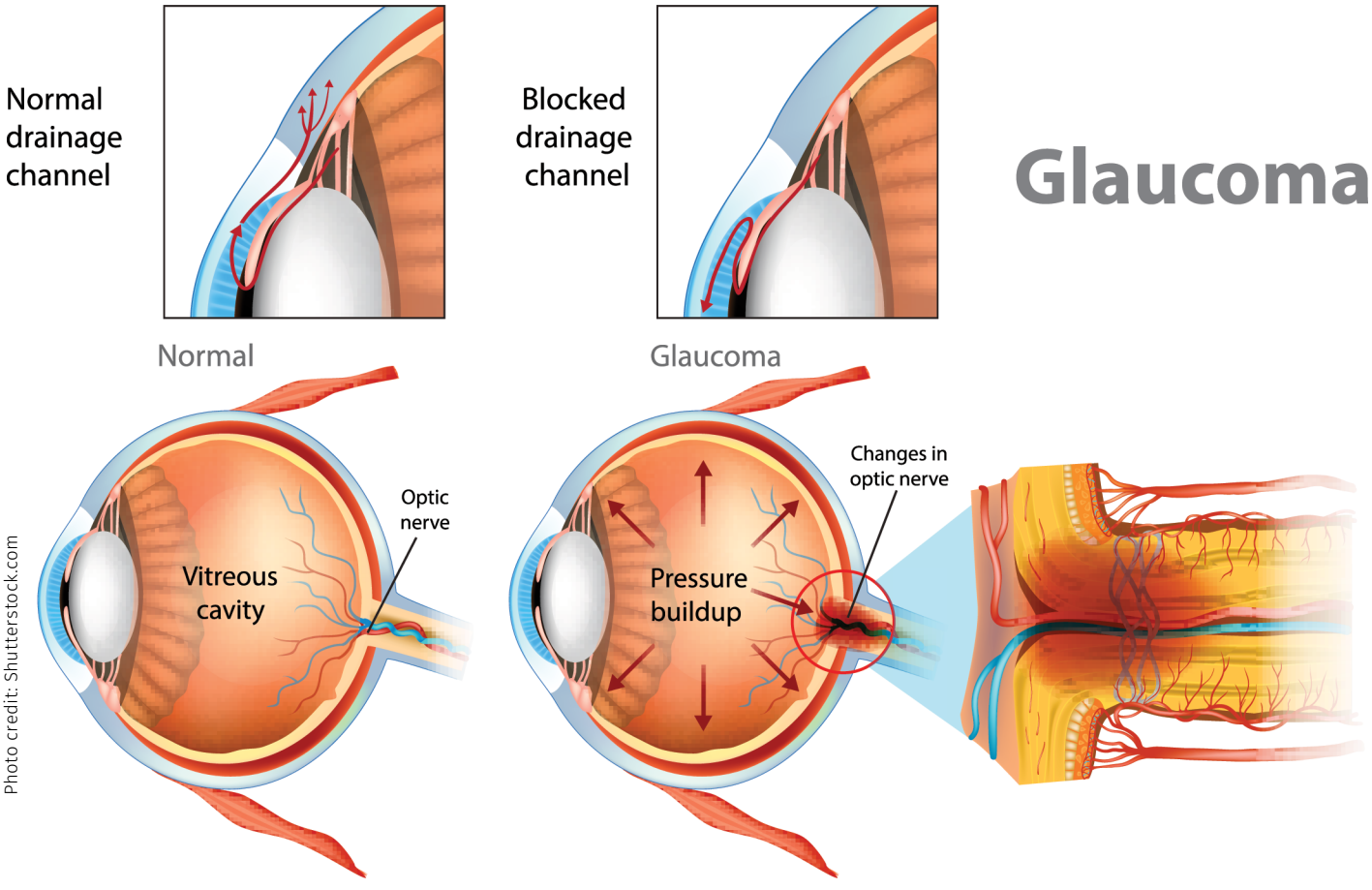
The researchers pinpointed a robust association between glaucoma and two lipid classes – triglycerides and diglycerides. Elevated levels of these fats correlated with a higher likelihood of developing glaucoma, especially in a subtype causing early central vision loss. These findings were confirmed through cross-sectional analysis using data from the UK Biobank.

Notably, heightened triglyceride levels have been linked to various health issues, including heart disease and stroke. Fortunately, existing treatments like statin drugs effectively regulate triglyceride levels. While studies on statin use and glaucoma risk have shown mixed results, further exploration may reveal the effectiveness of specific glaucoma subtypes' control with statins. Continued research is necessary to ascertain if current medications can prevent glaucoma.

Pasquale's work contributes to a growing body of evidence linking health status to metabolism. Similar associations have been drawn between various metabolites and conditions like kidney cancer, pregnancy complications, type 2 diabetes, and Alzheimer's disease. Researchers interested in investigating these associations can access the Metabolomics Workbench Metabolite Database, a repository for metabolomics data supported by the NIH Common Fund.

These findings hold promise in preventing and minimising the impact of glaucoma. We strongly encourage individuals in high-risk groups, especially those with a family history of glaucoma, to undergo regular comprehensive eye examinations for early detection and intervention.

Source: National Institutes of Health



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Ocular Allergy Study reveals preference

Ocular allergies, characterised by symptoms such as itching, redness, tearing, and swelling, significantly impact the quality of life for affected individuals.

Two commonly prescribed medications for allergic conjunctivitis are 0.1% olopatadine hydrochloride and 0.05% ketotifen fumarate. We look at the findings of two clinical studies, aiming to elucidate the comparative efficacy and patient preference between these two medications.

Clinical efficacy and tolerance

Aguilar *et al* studied 80 adult patients with allergic conjunctivitis symptoms. The patients were divided into two groups, one treated with olopatadine hydrochloride (OHC) (Group A) and the other with ketotifen fumarate (Group B). The results demonstrated that OHC exhibited faster, and more extensive control of allergic conjunctivitis symptoms compared to ketotifen.

In Group A, olopatadine achieved clinical improvement in 42% to 62% of patients within 30 minutes of the first dose, and this improvement increased to 80% to 87% after seven days. On the other hand, Group B, treated with ketotifen, showed lower percentages of improvement, ranging from 20% to 47% at 30 minutes and 60% to 75% after seven days.

Importantly, fewer cases of treatment failure and no local intolerance reactions were observed in the OHC group, while ketotifen triggered mild intolerance reactions in 23% of patients. Aguilar's study concluded that olopatadine hydrochloride was more effective in controlling allergic conjunctivitis symptoms than ketotifen fumarate.

Patient preference and comfort

Leonardi' *et al*'s study focused on patient preference and comfort, exploring the factors influencing patients' decisions in selecting an eye drop for allergic conjunctivitis treatment. One hundred patients were enrolled in a double-masked study, receiving both olopatadine and ketotifen over four weeks. Subsequently, patients evaluated and compared the medications in terms of efficacy, comfort, and preference.

The results revealed a significant preference for olopatadine, with 81% of patients choosing it over ketotifen. Patients cited olopatadine as more comfortable, more efficacious in symptom reduction, and the preferred choice for a doctor's visit. A substantial 76% of patients considered both efficacy and comfort when making their preference decisions.

Conclusion

In the treatment of ocular allergy, olopatadine hydrochloride emerges as a more effective option than ketotifen fumarate, as demonstrated by Aguilar's clinical study. Furthermore, Leonardi's study highlights that patient preference aligns with the superior efficacy of olopatadine, emphasising the importance of considering both factors in clinical practice.

These findings provide valuable insights for healthcare practitioners in selecting appropriate therapies for allergic conjunctivitis, aiming not only for clinical efficacy but also patient satisfaction and adherence to treatment plans. Olopatadine's rapid and extensive symptom control, coupled with favourable patient preference, positions it as a preferred choice in the management of ocular allergy.

References available on request.

Source: Medical Chronicle – www.medicalacademic.co.za

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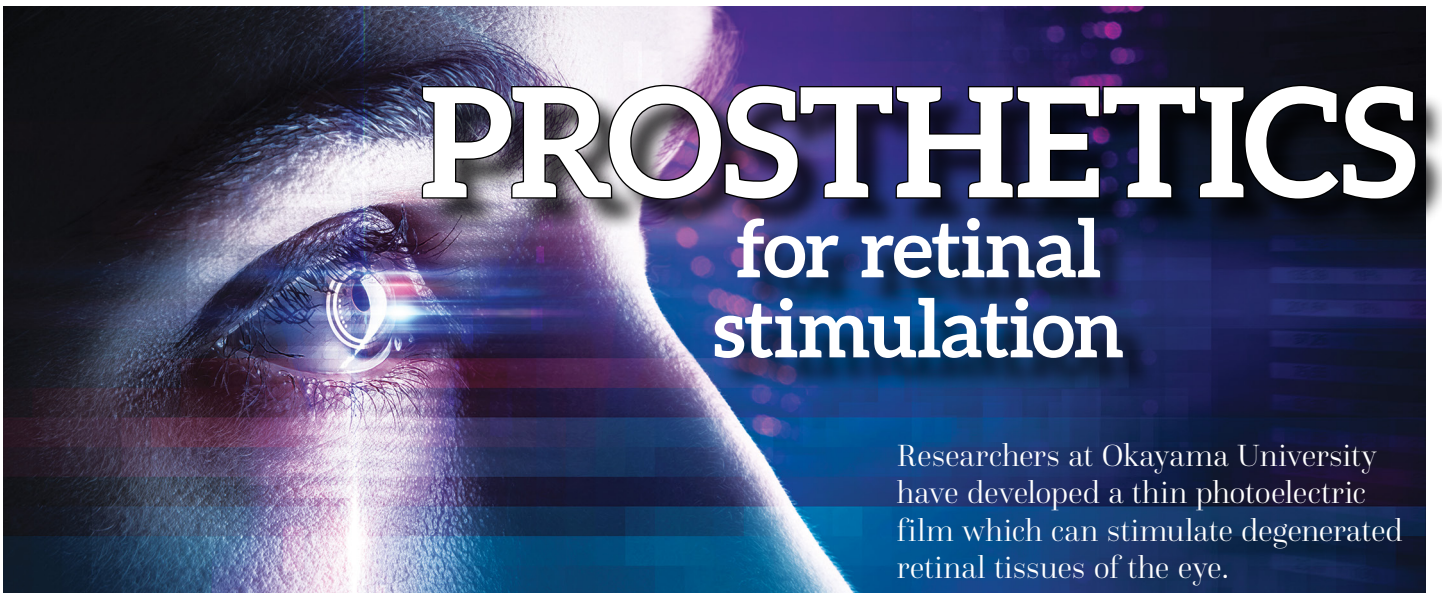


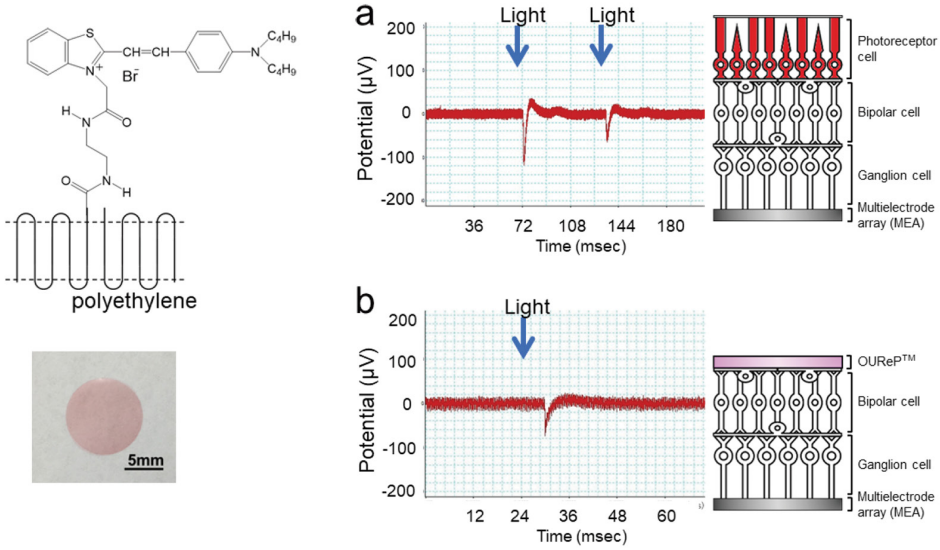
PROSTHETICS for retinal stimulation

Researchers at Okayama University have developed a thin photoelectric film which can stimulate degenerated retinal tissues of the eye.

Using electric signals to stimulate tissues is the basis of several medical devices such as pacemakers for the heart or neurostimulators used for patients suffering from epileptic fits.

A research team led by Dr Matsuo Toshihiko at Okayama University has developed OUReP, a photoelectric dye-coupled thin film device that generates electric potential changes when exposed to light. In their latest study, the research team reveals the ability of this device in stimulating degenerated retinal tissues.

OUReP is generated by placing polyethylene, a polymer, between two aluminum plates. When the polymer is melted, and a high pressure applied subsequently, a fine polyethylene film is created. The film then undergoes a chemical reaction wherein it is coupled to a photoelectric dye. The researchers first placed the photoelectric dye-coupled film on the electric potential-measuring device and exposed it to flashing light. As expected, waves of electric signals were observed on the film surface when light hit the film. To then test the ability of this film in stimulating nervous tissue, retinal tissues of rats with retinal dystrophy, a retinal degenerative disorder, were procured. When the retinal tissues of healthy rats were brought to close contact with a multielectrode array, a device used to measure electrical signals from biological tissues, and exposed to light, corresponding waves of electric signals were observed. However, no such signals were observed with the dystrophic retinal tissue. The photoelectric dye-coupled film was then placed on top of the dystrophic tissues, which resulted in the induction of electric signals in response to bouts of light. A control film, without the photoelectric dye did not induce electric signals in these tissues. To measure these electric signals more precisely, a nylon mesh was used to keep the dystrophic tissues and the multielectrode array detector in closer contact. This proximity revealed background electric impulses of weak amplitude with the dystrophic retinal tissues alone. In the background of weak amplitude of these signals, light induced remarkable action potential spikes in the dystrophic retinal tissues, in the presence of the photoelectric dye-coupled film. The photoelectric dye-coupled film was thus instrumental in boosting electrical impulses within the degenerated retina. "The current study provides direct evidence for the ability of the photoelectric dye-coupled polyethylene film to elicit electroretinogram-like response and action potential spikes in degenerative retina," conclude the researchers. Retinitis pigmentosa, is one such condition, wherein photoreceptors of the eye slowly die, leading to blindness. This study revealed the prosthetic value of OUReP in potentially replacing the lost photosensitivity of these cells. Implanting the device and testing visual enhancement in animals in their preceding studies have already given further insights.



The photoelectric dye-coupled film with its chemical structure (left). Direct exposure of light to the healthy retinal tissue resulted in corresponding electric signals (right; a) whereas an electric signal was observed with degenerated retinal tissues only when the film was placed directly on top of the tissues (right; b)

Background

Photoelectric dye: A photoelectric dye is an organic molecule that can absorb light and emit electric signals. The dye thus converts light energy into electrical energy. When these dye molecules are coupled to the surface of biological safe polymers such as polyethylene, they can be implanted onto tissue surfaces and used for their electrical impulse-generating properties to stimulate the surrounding tissues.

Reference

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DOI : https://doi.org/10.14326/abe.8.137
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References: 1. Simbrinza Professional Information. Novartis (Pty) Ltd. 06 February 2023. **2.** Rumelt S, Schreiber S. Why Do Patients with Controlled Glaucoma Continue to Lose Their Vision?. In: Rumelt S, editor. Causes and Coping with Visual Impairment and Blindness [Internet]. London: IntechOpen; 2018 [cited 2022 May 17]. Available from: https://www.intechopen.com/chapters/63311 doi: 10.5772/intechopen.797. **3.** IQVIA MAT Mar 2023 (ATC: S1E). **4.** Lerner SF, Oddone F, Lu D-W, *et al*. Maximum medical therapy: Brinzolamide/ brimonidine and travoprost/timolol fixed-dose combinations in glaucoma and ocular hypertension. *Clinical Ophthalmology* 2019; **13**: 2411–2419. For full prescribing information, refer to the Professional Information Approved by the South African Health Products Regulatory Authority (SAHPRA). S3 SIMBRINZA® 10 mg/ml + 2 mg/ml eye drops, suspension. Reg. No.: 50/15.4/0358. Each 1 ml of suspension contains 10 mg of brinzolamide and 2 mg of brimonidine tartrate. **Holder of Certificate of Registration:** Novartis South Africa (Pty) Ltd. Magwa Crescent West, Waterfall City, Jukskei View 2090. Tel. +27 11 347 6600. Co. Reg. No. 1946/020671/07. **Novartis Adverse Drug Reaction Reporting:** Email: patientsafety.sacg@novartis.com. Web: https://www.report.novartis.com/. Tel: 0861 929-929. **Marketed and Distributed by Adcock Ingram Limited.** Co. Reg. No. 1949/034385/06. Private Bag X69, Bryanston, 2021. Customer Care: 0860 ADCOCK / 232625. www.adcock.com ZA2305265947 Exp Date 05/2025

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RARE EYE DISEASES:
A glance at Stargardt disease and keratoconus

In this article we take a look at two rare eye diseases. Stargardt disease is a genetic disorder of the retina that typically causes vision loss during childhood or adolescence. Keratoconus occurs when the cornea thins and gradually bulges outward into a cone shape. This may result in blurry vision, double vision, nearsightedness, astigmatism, and light sensitivity.

The first ever clinical trial for a rare genetic eye disease - Stargardt Disease - has begun in South Africa. This condition affects the retina.

In Stargardt Disease [STGD] a genetic mutation in the ABCA4 gene, causes the death of cells in the central retina - the cone photoreceptors, which are responsible for fine focus vison such as reading, writing, face recognition and using electronic screens. The condition affects one in 10 000 in the population and is found in all racial groups. It is most commonly inherited from unaffected parents who are unknowing carriers of a single faulty gene. There is a 25% chance in each pregnancy that the child will inherit a copy of the faulty gene from both parents.

STGD is untreatable but this new clinical trial hopes to reverse the situation. The drug being tested blocks the accumulation of a toxic waste product called lipofuscin in the retina, caused by the gene mutation.

The trial is being conducted in South Africa, by Dr Liesl van Der Merwe. The recruitment of patients for the trial was done by the Division of Genetics at the University of Cape Town, among patients who were part of the research programme aimed at identifying the genetic basis of Stargardt disease, (headed by Prof Raj Ramesar), and Retina South Africa.

This is an international multi-centre study that could lead to a registered treatment within the next few years. South Africa is the leading trial site in the number of patients that finally fulfilled all the clinical and genetic criteria for inclusion in the trial.

Retina South Africa is the only NPO in South Africa dedicated to finding treatments for genetic retinal vision loss. They have been approached by another international company to recruit patients for a second genetic retinal condition.

Keratoconus

Keratoconus is an eye disorder characterised by progressive thinning and changes in the shape of the cornea. Slowly progressive thinning of the cornea causes a cone-shaped bulge to develop towards the centre of the cornea in the areas of greatest thinning. Affected individuals develop blurry or distorted vision, sensitivity to light (photophobia), and additional vision problems.

Keratoconus often begins at puberty and most often is seen in teenagers or young adults. The specific underlying cause is not fully understood and most likely the condition results from the interaction of multiple factors including genetic and environmental ones. One factor known to contribute to progression of keratoconus is eye rubbing. In some cases, keratoconus may occur as part of a larger disorder.

It is treated with glasses or contact lenses early in the condition. A small number of individuals may require surgery.

Symptoms

Signs and symptoms of keratoconus may change as the disease progresses. They include:

- Blurred or distorted vision
- Increased sensitivity to bright light and glare, which can cause problems with night driving
- A need for frequent changes in glasses prescriptions
- Sudden worsening or clouding of vision.

Causes

The specific underlying mechanism(s) responsible for keratoconus are not fully understood. Most cases appear to occur randomly and sporadically. However, a positive family history of keratoconus has been established in some cases. Most researchers believe that multiple, complex factors are required for the development of keratoconus including both genetic and environmental factors.

According to the National Organization for Rare Disorders, researchers believe that some individuals who develop keratoconus have a genetic predisposition to developing the disorder. A person who is genetically predisposed to a disorder carries a gene (or genes) for the disorder, but the condition may not be expressed unless it is triggered or "activated" under certain circumstances such as due to particular environmental factors. Research is underway to identify specific genes associated with keratoconus.

Environmental risk factors that may play a role in the development of keratoconus include contact lens use, repeated eye-rubbing, or atopy - hypersensitivity reactions such as allergic rhinitis, atopic dermatitis, sleep apnoea, or allergic asthma.

Traditionally, keratoconus has been considered a non-inflammatory disorder. In inflammatory disorders, there is an abnormal immune (inflammatory) response, which can lead to symptoms or specific disorders. Although keratoconus has been defined as a non-inflammatory disorder, recent evidence, including abnormally high levels of proteolytic enzymes, an association with free radicals and oxidative stress, or the presence of cytokines, specialised proteins secreted from certain immune system cells that either stimulate or inhibit the function of other immune system cells. More research is necessary to determine the complex, underlying causes of keratoconus.

The condition may also sometimes occur in association with certain underlying disorders, such as Down syndrome, sleep apnoea, asthma, Leber congenital amaurosis, and various connective tissue disorders including Ehlers-Danlos syndrome, Marfan syndrome, or brittle cornea syndrome. A direct cause-and-effect relationship between these disorders and keratoconus has not been established.

Risk factors

These factors can increase the chances of developing keratoconus:

- Having a family history of keratoconus
- Vigorous rubbing of eyes
- Having certain conditions, such as retinitis pigmentosa, Down syndrome, Ehlers-Danlos syndrome, hay fever and asthma.

Complications

In some situations, the cornea may swell quickly and cause sudden reduced vision and scarring of the cornea. This is caused by a condition in which the inside lining of the cornea breaks down, allowing fluid to enter the cornea (hydrops).

In advanced keratoconus, the cornea may become scarred, particularly where the cone forms. A scarred cornea causes worsening vision problems and may require corneal transplant surgery.

Sources: Retina SA, Mayo Clinic, National Organization for Rare Diseases, National Eye Institute.

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References:
1. Data on file.
2. Rizzo et al, A Review on a New Approach in Managing Patients After Cataract Surgery. Ophthalmol Ther. 2022 Feb;11(1) 101 -111.

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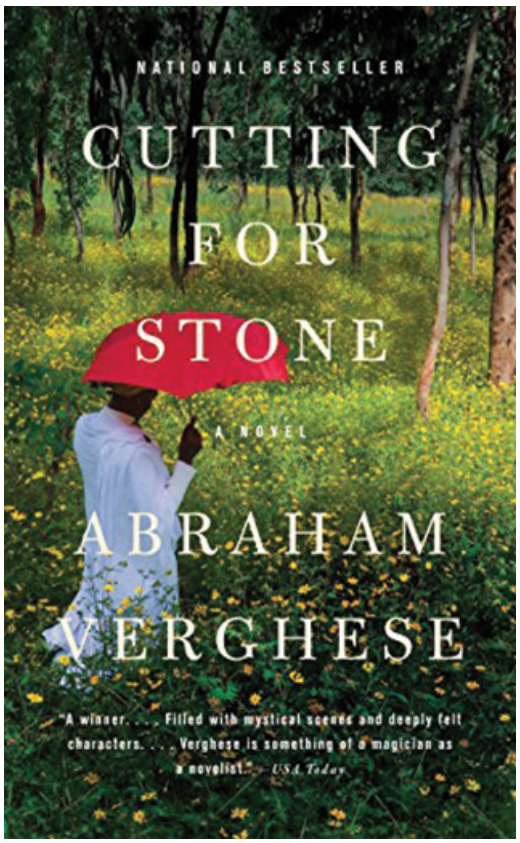
SA Ophthalmology Journal

CUTTING FOR STONE:

A gripping tale of twin brothers, medicine, and the enduring power of family



Title: Cutting for Stone

Author: Abraham Verghese

Publisher: Penguin Random House South Africa

Reviewer: René Bosman, Editor, *Specialist Forum*

Abraham Verghese's *Cutting for Stone* is set against the backdrop of dramatic political changes in Ethiopia, a time of great loss for the author, who, as an expatriate, had to leave the country of his birth. *Cutting for Stone* tells the story of the lives of Marion and Shiva Stone, twin brothers born to a British surgeon, Thomas Stone, and an Indian nun, Sister Mary Joseph Praise.

Tragically, their mother dies during childbirth, and their father flees the country, leaving them in the care of two Indian doctors, Hema and Ghosh, at the Missing Hospital in Addis Ababa. The hospital compound becomes the setting for the twins' upbringing, surrounded by a community of doctors and nurses.

Marion, the more introspective narrator, provides insight into the contrasting personalities of the brothers. Shiva, more daring and impulsive, deepens the narrative complexity when both brothers fall in love with Genet, a local girl working at the hospital.

As the story unfolds, the deep love and rivalry between the brothers surface, culminating in a betrayal that tears them apart. Shiva departs Ethiopia, while Marion stays behind, dedicating himself to the study of medicine.

Marion's journey leads him to America, where he completes his medical training, yet the haunting memories of the past, especially the loss of his brother, persist.

Simultaneously, Shiva's life takes a darker turn as he becomes a skilled surgeon entangled in a world of drugs and crime.

Despite the physical separation, the brothers' lives remain interwoven, exploring themes of family, identity, and the profound impact of choices made in moments of crisis.

Years later, Marion is compelled to confront his past when he receives a call from Genet, informing him of Shiva's critical condition. Returning to Ethiopia, Marion is reunited with his brother and the people from their shared past. The reunion is fraught with tension and unresolved emotions, but the brothers must set aside their differences to save Shiva's life.

As Marion and Shiva collaborate on a complex surgery, they embark on a journey of reconciliation, reflecting on the choices that led them to this critical point. The novel's climax delves into powerful themes of forgiveness, redemption, and the enduring bond between the brothers.

Inspired by Hippocratic oath

Verghese drew inspiration for the book from the ancient Hippocratic oath, specifically the phrase 'I will not cut for stone,' to weave a compelling saga that traverses three continents and spans five decades.

In antiquity, the act of 'cutting for stone' referred to removing bladder stones, which often led to fatal outcomes. Yet, even in those times, there existed a distinct group of individuals – the 'specialists in this art' – to whom physicians would defer.

Verghese's novel delves deeply into the contemplation of this unique breed: the surgeon, whose skill becomes a pivotal force upon which numerous lives hinge. Much of the narrative reflects on the profound responsibility borne by these practitioners and the intricate dynamics of dependence on their expertise in the world of medicine.

In a nutshell

Cutting for Stone is an emotionally charged saga that spans continents and decades. It delves into the intricacies of love and betrayal, exile and homecoming, and the enduring power of family.

Verghese's prose, vivid and poignant, coupled with his profound understanding of human nature, transforms the novel into a compelling exploration of the human experience.

Beyond the familial and emotional dimensions, Verghese employs medicine as a metaphor for life throughout the narrative. The novel is replete with detailed descriptions of surgical procedures, medical conditions, and the ethical challenges faced by doctors.

Marion's evolution as a physician mirrors his personal growth, encapsulating the complexity of human relationships and the confrontation of vulnerabilities. Cutting for Stone thus becomes not only a tale of familial bonds but also a profound reflection on the parallels between the practice of medicine and the intricate journey of life.

More about the author

Verghese is a Professor of the Theory and Practice of Medicine and Vice Chair of Education at Stanford University Medical School and the author of four best-selling memoirs and novels.

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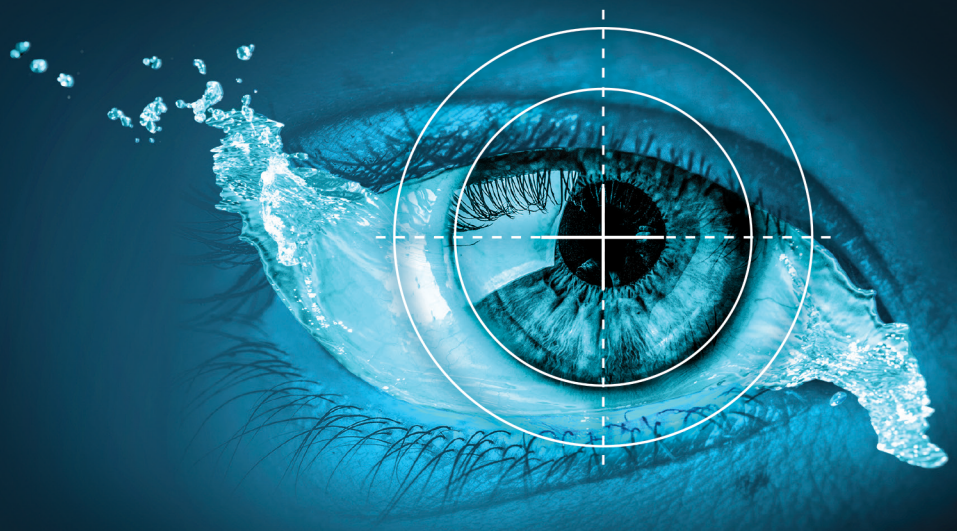

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8 weeks of usage

Available as a 5 ml solution, supplying at least 120 drops [5]

References: 1. VYZULTA™ Professional Information, 22 November 2022. **2.** Kaufman PL. Latanoprostene bunod ophthalmic solution 0.024% for IOP lowering in glaucoma and ocular hypertension. *Exp Opin Pharmacother.* 2017;**18**(4):433-4444. **3.** Wareham LK, Buys ES, Sappington RM. The Nitric Oxide-Guanylate Cyclase Pathway and Glaucoma. *Nitric Oxide* 2018;**77**:75-87. **4.** Addis VM, Miller-Ellis E. Latanoprostene bunod ophthalmic solution 0.024% in the treatment of open-angle glaucoma: design, development, and place in therapy. *Clin Ophthalmol* 2018;**12**:2649-2657. **5.** Data on file.

S4 **Proprietary name and dosage form: VYZULTA™ Latanoprostene bunod** 0,024 % eye drops, solution. **Composition:** Each 1 ml contains: Latanoprostene bunod 0,24 mg (0,024 % *m/v*) and Benzalkonium chloride (preservative) 0,02 % *m/v*. **Pharmacological classification:** A 15.4 Ophthalmic preparations- others. **Registration number:** 53/15.4/0226. For full prescribing information, refer to the professional information as approved by the South African Health Products Regulatory Authority (SAHPRA). **Soflens (Pty) Ltd. Reg. no.:** 1968/011787/07. 254 Hall Street, Centurion, 0157. **Tel:** +27 10 025 2100. www.bausch.co.za. BL664/23

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1. OPTIVE OMEGA™ UD DFU. *IQVIA Scripting dispensed data on Artificial Tears in South Africa latest MAT July 2021 – June 2022.
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