

THE INITIAL MANAGEMENT OF OCULAR CHEMICAL BURNS IN AN ACADEMIC HOSPITAL

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in Ophthalmology.

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Declaration

I, Bayanda Nothemba Mbambisa, declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in Ophthalmology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Signed.....

On this.....day of.....2013

Dedication

To my parents, Zweli and Pinkie, for their unending love and support

To my siblings, Yolisa and Chuma, for being there when I needed you

To my son, Mila, the wind beneath my wings

Publications and presentations arising from this study

1. Oral presentation at the Ophthalmological Society of South Africa (OSSA) congress at the Sandton Convention Centre, Johannesburg, South Africa, February 2012
2. Oral presentation at the Chemical Safety Seminar (Department of Labour, South Africa) at Emerald Resort and Casino, 20 September 2011 - The initial management of chemical burns
3. Mbambisa BN, Carmichael TR. The initial management of ocular chemical burns in an academic hospital. Occupational Health Southern Africa May/ June 2011, pg 10-11
4. Carmichael TR, Mbambisa BN, Welsh ND. Management of eye injuries in the workplace. Occupational Health Southern Africa May/ June 2011, pg 8-9

Abstract

Study aim: to assess the role of pH measurement and the need for neutralising agents (Diphoterine®) in the initial management of chemical burns in an academic hospital

Method: prospective, interventional study

Results: The conjunctival pH of 18 eyes was checked and 5 eyes with an abnormal pH required irrigation with Diphoterine®. The pH using urine dipstick was equivalent to universal indicator paper. Most of the patients were young males who had been involved in domestic or occupational accidents. The majority of patients presented with mild (Grade 1) burns and had a delayed presentation to hospital

Conclusion: Neutralising agents are a first aid rinsing solution and most effective immediately after injury. The use of urine dipsticks to measure the conjunctival pH of patients with chemical burns can assist in identifying patients who require irrigation and was equivalent to universal indicator paper. Of the eyes irrigated, Diphoterine® was effective in neutralising the conjunctival pH 80% of eyes.

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Chapter 1: Literature review

Introduction

Chemical burns of the eye form a small fraction of ocular trauma but represent an ophthalmological emergency. The prevalence of ocular chemical injuries worldwide ranges from 1.1 – 6,1%, with an incidence in the UK of 0,02 per 100 000. ¹⁻³ The majority of these injuries are occupational. Because of their more frequent presence in household cleaning agents and industrial and building materials, alkali injuries are more common than acid injuries. ⁴⁻⁶

Immediate and effective irrigation is the most important intervention affecting the prognosis and outcome of ocular chemical burns. ^{5,7,8} Water or saline is commonly the initial irrigating fluid used as it is readily available but it may not be the most effective fluid to use. ^{5,9} New agents have been developed which effectively remove the chemical from the eye and neutralise both the acid and alkali. ^{5,8-10}

Pathophysiology of ocular chemical burns

The injuries caused by chemical burns to the eye can range from mild unilateral conjunctival or corneal epithelial damage to sight threatening bilateral burns. The severity of the injury is related to the surface area of contact, the degree of penetration and the concentration and nature of the agent involved. ¹¹ Injuries caused by alkalis are more common than those caused by acids and are usually more severe. ^{4,6} Alkalis tend to penetrate the cornea more effectively than acids. ⁶ The hydroxyl ion (OH^-) of the alkali saponifies the fatty acid components of cell membranes and results in cell disruption and

death. The associated cation is responsible for the penetration of the alkali into the deeper structures of the eye. Depending on the degree of penetration there may be damage to structures such as the corneal and conjunctival epithelium, the different layers of the cornea, lens epithelium, episclera, iris and ciliary body. Penetration into the anterior chamber can be rapid.

Acids, on the other hand, penetrate the eye less readily.⁶ The hydrogen ion (H^+) alters the surface pH while the associated anion produces protein precipitation and denaturation in the corneal epithelium and superficial stroma. The coagulated proteins function as a barrier to further penetration and this limits further intraocular injury. If penetration into the stroma does occur, tissue alterations similar to those seen in alkali injury may occur.

Classification of ocular burns

Roper Hall¹² in 1965 proposed a classification of ocular chemical burns that is widely used in clinical practice. It correlates the initial corneal clarity and limbal ischaemia with final visual prognosis. The initial grade of the injury guides treatment decisions.

Table 1.1 Classification of severity of chemical burns by Roper Hall¹²

Grade	Cornea	Conjunctiva	Prognosis
I	Epithelial damage	No ischaemia	Good
II	Hazy, but iris details seen	Ischaemia less than ½ at limbus	Good
III	Total epithelial loss Stromal haze Iris details obscured	Ischaemia affects ⅓ to ½ at limbus	Doubtful Vision reduced Perforation rare
IV	Opaque. No view of iris or pupil	Ischaemia affects more than ½ at limbus	Poor Prolonged convalescence

Since the classification by Roper Hall our understanding of the role of limbal stem cells has improved. Lost corneal epithelial cells are replaced by stem cells located at the limbus.^{13,14} With this improved understanding, limbal stem cell transplantation and amniotic membrane transplantation has resulted in an improved visual prognosis for patients with Grade IV injuries.¹⁴⁻¹⁶ Dua et al¹⁴ proposed a new classification that correlates more favourably with final prognosis with current improved surgical options.

Table 1.2 Dua classification¹⁴

Grade	Prognosis	Clinical findings	Conjunctival involvement	Analogue scale
I	Very good	0 clock hours of limbal involvement	0%	0/0%
II	Good	≤ 3 clock hours of limbal involvement	≤ 30%	0.1-3/1-29.9%
III	Good	> 3-6 clock hours of limbal involvement	> 30-50%	3.1-6/31-50%
IV	Good to guarded	> 6-9 clock hours of limbal involvement	> 50 -75%	6.1-9/51-75%
V	Guarded to poor	> 9- < 12 clock hours of limbal involvement	>75-<100%	9.1-11.9/75.1-99.9%
VI	Very poor	Total limbus (12 clock hours) involvement	Total conjunctiva (100%) involved	12/100%

Management of ocular chemical burns

Immediate irrigation of the eye and removal of the chemical has the greatest influence on the prognosis and outcome of ocular burns.⁵ Patients commonly present to hospital having been irrigated at the point of initial injury. The irrigating agent used is often the most readily available liquid. There is often little information available to the clinician regarding the effectiveness of this initial lavage. The present management of patients

when they arrive at casualty in our academic hospitals is irrigation with Normal Saline for 30 minutes and further management depends on the severity of the injury. The pH in the conjunctival sac is not routinely checked and if it is, urine dipsticks are commonly used. Ideally irrigation should be continued until the pH in the conjunctival sac is neutral.^{5,17,18}

The nearest agent available for rinsing is the best choice for any kind of burn but there are differences in the efficacy of the rinsing solutions. If there is a choice, the most efficient and innocuous substance should be used.¹⁰ The osmolarity of a rinsing solution is an important factor in this, as it affects the direction of water and ion movement and therefore the movement of water and chemical through the cornea.⁹

Tap water is commonly used as an initial irrigation fluid as it is easily available and large amounts have a dilutive effect. It is hypotonic to corneal stroma and this can result in an increased uptake of additional water and diffusion of the corrosive into the deeper layers of the cornea.⁵ Despite this, tap water is safe and should be used in the emergency management of chemical burns if the accident occurs in a place where no therapeutic rinsing solutions are available.^{9,19} Large amounts need to be used however. The affected eye should be rinsed with at least 1 – 1, 5 litres of water for no less than 15 minutes.^{7,18}

Normal Saline also has a lower osmolarity than tear fluid and may not normalise the pH of the anterior chamber, even after prolonged irrigation.⁵ Due to its low osmolarity it can result in increased uptake of saline into the corneal stroma, as with tap water. It has also been found to be the least tolerated irrigation fluid when compared to Balanced Salt Solution and Ringer's Lactate.²⁰

Ringer's Lactate and Balanced Salt Solution (BSS) are solutions which have an osmolarity similar to that of aqueous humour and may be more effective than Normal Saline.⁵ BSS prevents the cornea from swelling and preserves the corneal endothelium. It is commonly used in ocular surgery but its expense is one of the factors that prohibits its routine use outside of theatre.²⁰

Buffers have been used to achieve chemical neutralisation. Phosphate buffers are used in some emergency irrigating solutions but their use has been associated with stromal calcification. This might be due to the exogenously applied phosphate reacting with endogenous calcium released from ruptured cells producing calcium-phosphate complexes.⁵ Phosphate buffers have been proposed for use in alkali burns and borate buffers in the use of acid burns but both have been found to be relatively ineffective.⁸

The ideal agent used for irrigation in chemical eye burns is one with high neutralising capacity and one that is safe for use in all types of burns.⁶ Diphoterine® has been used in Germany since 1995.¹⁰ It is an eye and skin chemical splash decontamination solution that contains a molecule that is slightly hypertonic, amphoteric and water soluble. It is a polyvalent substance that binds acids, bases, oxidising agents, reducing agents, solvents, irritants and alkylating agents.^{21,22} Diphoterine® can bind both acids and bases without altering the pH of the environment and without undergoing an exothermic reaction.²² It possesses a site for acids with a pK_1 of 5.1 and for bases with a pK_2 of 9.3.^{10,11} It has a pH of 7.4 and an osmolarity of 820 mosmol/l.^{11,21} Diphoterine® is hypertonic and creates a movement of water from the hypotonic anterior chamber to the surface of the hypertonic cornea.^{10,11} In comparative studies Diphoterine® was shown to be superior to Normal Saline in the initial and even delayed irrigation of the eye in chemical burns.¹¹ It

has been shown that as little as 500ml of Diphoterine® irrigated for 5 minutes can neutralize the pH of the ocular surface.^{5,11}

In patients presenting to Casualty the assessment of the pH of tear fluid is an objective measurement of assessing the presence of chemical in the eye. If the pH is neutral it is a good indication that the initial irrigation was adequate and no further irrigation is needed. If the pH is not neutral, this would indicate that there is still residual chemical in the eye which can cause ongoing damage. The routine measurement of conjunctival pH in this study will give an indication of whether present management in our setting is adequate or whether we should be routinely monitoring the conjunctival pH of patients with a delayed presentation of ocular chemical burns. At present we have urine dipsticks available to us in our casualties. These testing strips are made for testing urine and not tear fluid. It would be beneficial to know how well the results correlate with universal indicator paper and whether continued use of the urine dipsticks is advised.

This study will investigate the effectiveness of irrigation with Diphoterine® in patients with an abnormal conjunctival pH following an ocular chemical burn.

Chapter 2: Methods

A prospective, interventional study of successive patients presenting to the Johannesburg academic hospitals (Charlotte Maxeke Academic Hospital, Helen Joseph Hospital and St John Eye Hospital) with ocular chemical burns between 1 December 2009 and 31 July 2011 was conducted.

The aim of this study was to assess the role of pH measurement and the need for neutralising agents in the initial management of chemical burns in the Johannesburg academic hospitals.

Study objectives

1. To assess the pH in the conjunctival sac of patients presenting to hospital with chemical burns. Eyes with an abnormal pH were irrigated with 500ml of the amphoteric rinsing solution, Diphoterine®.
2. To assess the efficacy of Diphoterine® in neutralising conjunctival pH after exposure to alkalis and acids.
3. To compare the pH obtained using universal indicator paper with a urine dipstick.
4. To describe the spectrum of chemical burns that presents to the Johannesburg academic hospitals as well as the circumstances surrounding these injuries.

Patient selection

Inclusion criteria

- Patients 18 years and older
- Patients with a history of chemical burns to the eyes who presented to St John Eye Hospital (part of Chris Hani Baragwanath Academic Hospital), Charlotte Maxeke Johannesburg Academic Hospital or Helen Joseph Hospital
- Injury must have occurred in the preceding 24 hours
- Grade I or higher chemical burns

Exclusion criteria

- Other causes of ocular burns (thermal, radioactivity, plants, etc)

On arrival in the Casualty, patients were briefly asked about the nature of the injury and the time that had elapsed since the chemical burn. The study was explained to them and verbal consent was obtained from the patients for inclusion in the study. Patients who declined were treated according to the current management protocol.

Intervention

The affected eye/s had a drop of topical anaesthetic eye drop, oxybuprocaine HCl 0,4% (Novesin Wander, Novartis) instilled. After 1 minute, the pH in the conjunctival sac was measured with a universal indicator strip (Universalindikator, Merck), followed by urine dipstick (UriCheck, Sekunjalo Healthcare) and the pH documented. If the pH was greater than or less than 7, on the universal indicator paper, the eye was irrigated with 500ml of

Diphoterine®. If the pH was 7, the eye was not irrigated. The pH was again measured after 2 minutes following irrigation with Diphoterine® and irrigation ceased once the pH was 7. Ongoing irrigation was not continued in cases where surgical debridement was required to prevent ongoing chemical burn. The pH was checked following surgery and irrigation was continued if the pH was still abnormal.



Figure 2.3 Urine dipsticks used to measure pH



Figure 4.2 Universal indicator paper used to measure pH



Figure 2.3 Irrigation of the eye with Diphoterine®

History

Once the affected eye/s had been irrigated and the patient was comfortable, written informed consent was obtained. For each patient the exact nature of the product causing the burn, the circumstances surrounding the injury and the time from the injury till initial irrigation and rinsing agent used was noted. The delay between the injury and initial irrigation with Diphoterine® was also noted.

Examination and management

The patients had a full ophthalmological examination including visual acuity, intraocular pressure measurement and fundoscopy after the eye/s had been irrigated. The ocular surface was stained with fluorescein (Flourets, Bausch & Lomb) and the injury was graded according to the new classification of ocular burns by Dua et al.¹⁴

Data collection

The data was collected on a data collection form (Appendix A) and the information tabulated on an Excel spreadsheet.

Table 2.1 Patient demographics and nature of the burn

Patient	Gender (M/F)	Age	Eyes injured	Circumstances of the accident	Nature of agent
1- 20					
Total	Males		Left	Assault	Acid
	Females		Right	Domestic	Alkali
			Both	Work	
				Other	

Table 2.2 Characteristics of ocular burns

Patient	Grade / Analogue scale	pH (universal indicator)	pH (urine dipstick)	Delay to initial irrigation	Initial irrigation fluid used	Delay to irrigation with Diphoterine®
1 -20						
Total						

Ethics

Ethics approval was received from the University of the Witwatersrand Human Research Ethics Committee (Medical) – clearance certificate M090813.

The study protocol was approved by the Postgraduate Committee of the Department of Neurosciences, Faculty of Health Sciences, University of the Witwatersrand.

Chapter 3: Results

Between 1 December 2009 and 31 July 2011, 18 eyes of 12 patients met the criteria for inclusion in the study.

Conjunctival pH

All of the patients had their conjunctival pH measured with urine dipstick as well as universal indicator paper. Nine eyes (50%) had acid burns and 9 eyes (50%) had alkali burns. Thirteen (72,2%) out of eighteen eyes had a pH of 7 and did not require irrigation with Diphoterine®. Five (27,8%) eyes had an abnormal pH. Of the acid injuries, 1 had an abnormal pH of 6. Four eyes which sustained alkali burns had an abnormal pH, 2 eyes had a pH of 9 and the other 2 had a pH of 8.

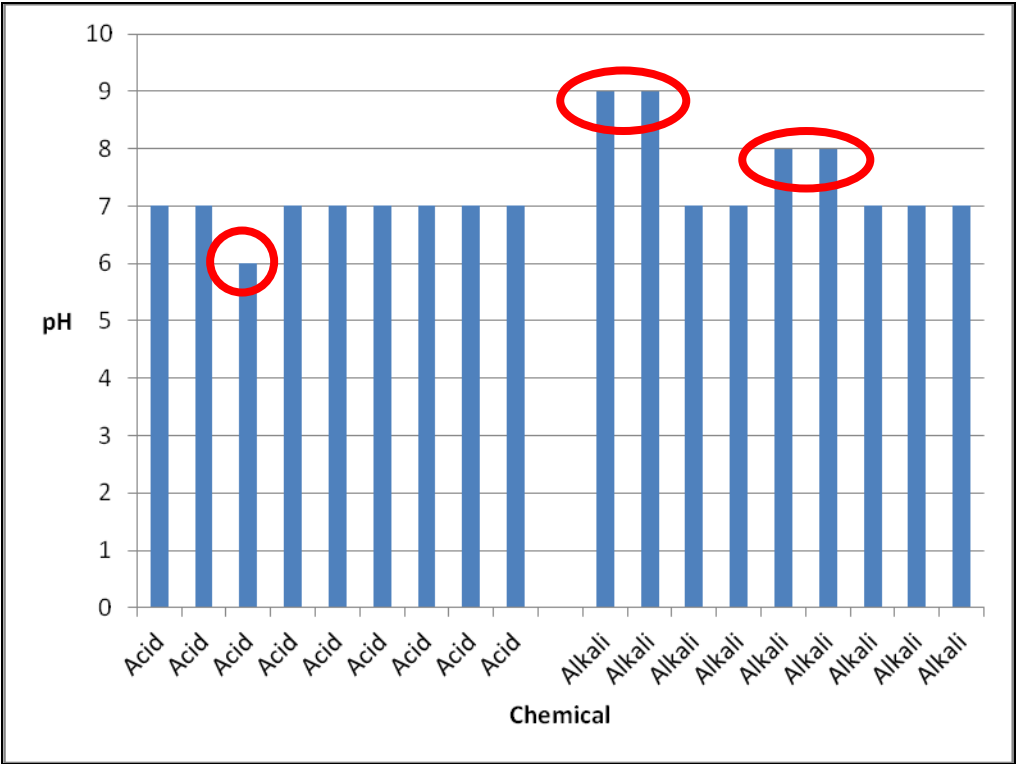


Figure 3.1 Conjunctival pH of patients on presentation to hospital

The 5 eyes with an abnormal pH were irrigated with Diphoterine®. Four of the 5 eyes had a pH of 7 following irrigation. In one eye the pH remained 9 following irrigation. The patient was found to have residual particles of chemical embedded in his conjunctiva which required surgical removal.

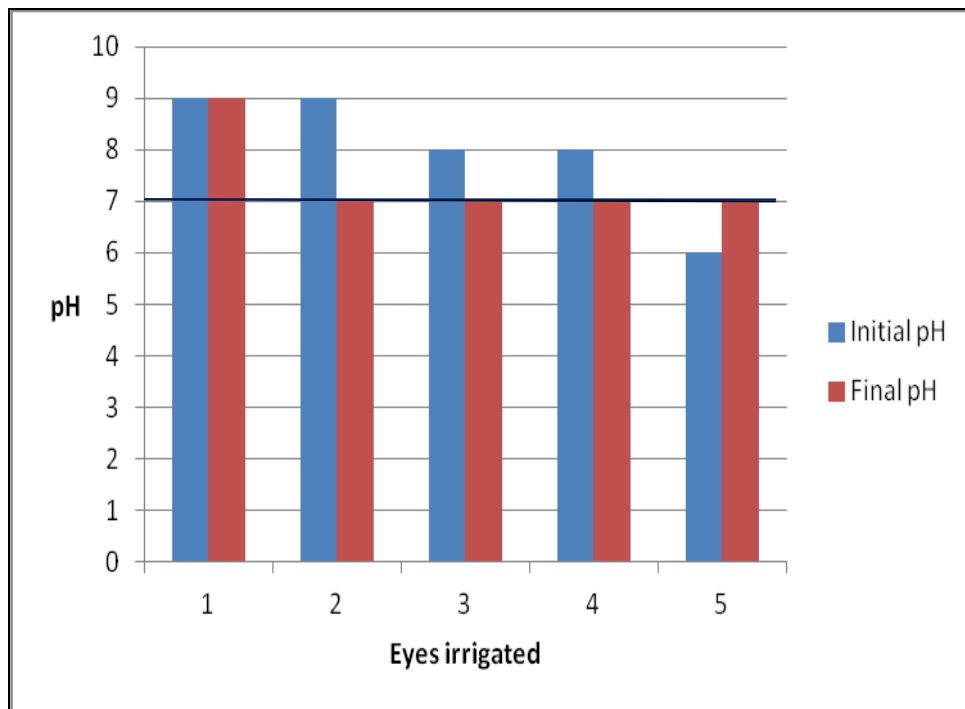


Figure 3.2 Initial and final conjunctival pH of eyes irrigated with Diphoterine®

Universal indicator paper vs urine dipstick

The pH values obtained using universal indicator paper were equivalent to those obtained using urine dipstick in all eyes tested.

Clinical description

Of the twelve patients included in the study, 10 (83,3%) were male and 2 (16,7%) were female. The age range was 24 – 50 years (mean 33 years). Of the 18 eyes which sustained chemical burns, five (27.8%) injuries were related to assault, six (33.3%) were following occupational accidents and seven (38.9%) followed domestic accidents. The most common agent implicated in acids burns was battery acid. This occurred as a domestic accident and was also used as an agent of assault. Household and industrial cleaning agents and cement were the cause of the alkali burns.

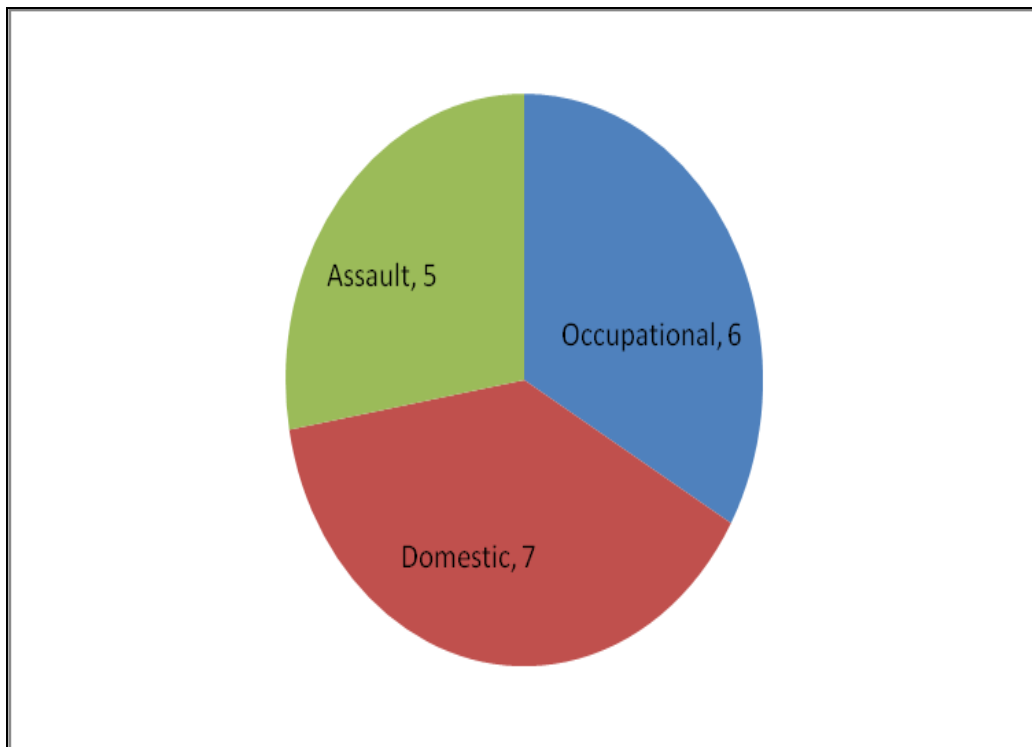


Figure 3.3 Circumstances surrounding the ocular injury

Grading of chemical burn

The severity of the injuries was graded according to the new classification of ocular burns by Dua et al.¹⁴ Fourteen eyes (77.78%) were Grade 1, one eye (5.55%) Grade 2, one eye (5.55%) Grade 3, one eye (5.55%) Grade 4 and one eye (5.55%) Grade 5. The eye that had a pH of 6 sustained a Grade 3 burn. The eye with the most severe injury, Grade 5, had a neutral pH on presentation to hospital but had a delayed presentation to a health care centre where initial irrigation was performed. The remaining patients with Grade 2 and 4 burns sustained alkali burns. The majority of the burns were Grade 1 burns where patients had mild ocular surface burns with no limbal or conjunctival involvement.

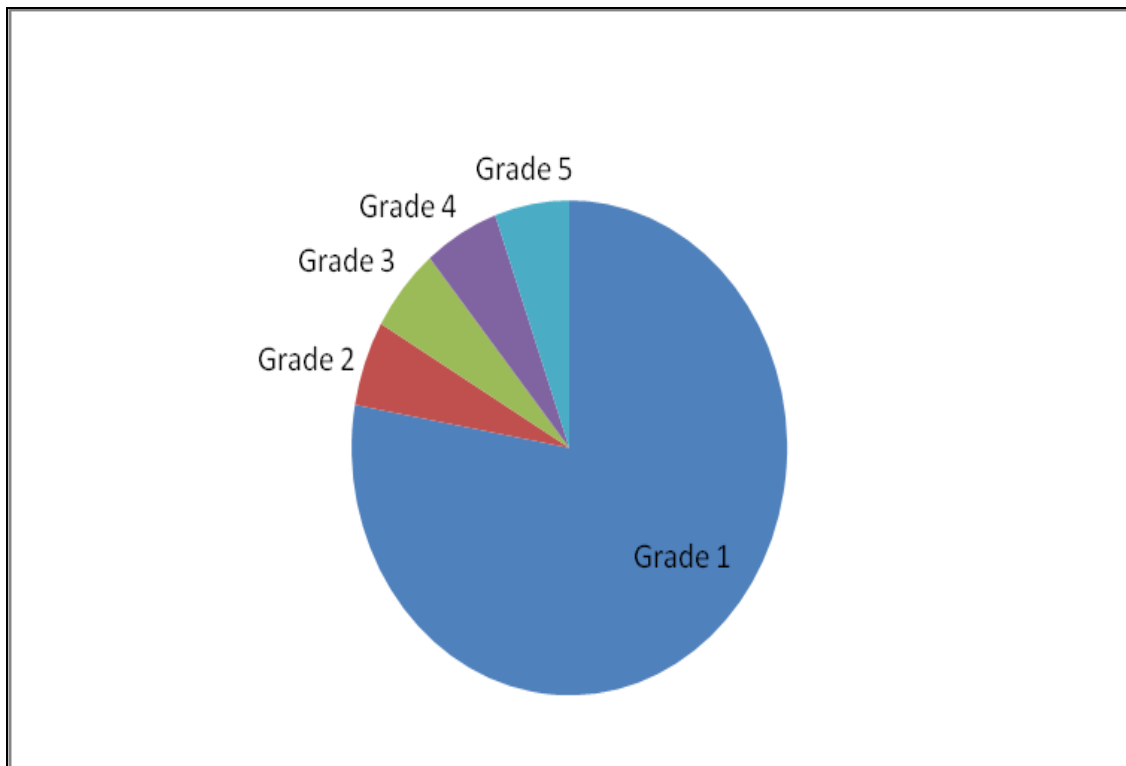


Figure 3.4 Grade of chemical burn¹⁴

Delay to irrigation

It was found that many patients did not present to hospital immediately after the chemical burn. Initial irrigation of the eyes was either done at the site of the injury or at a local clinic. The time taken from the injury to initial irrigation of the eyes ranged from less than 1 minute to 6.5 hours. Twelve (66.7%) eyes were irrigated within 0-5 minutes of the injury, 4 eyes (22.2%) 5 minutes to 1 hour after the injury and 2 eyes (11.1%) 6.5 hours after the injury. The delay from the initial injury to presentation at the hospital ranged from 4 to 23 hours (mean 13.5 hours).

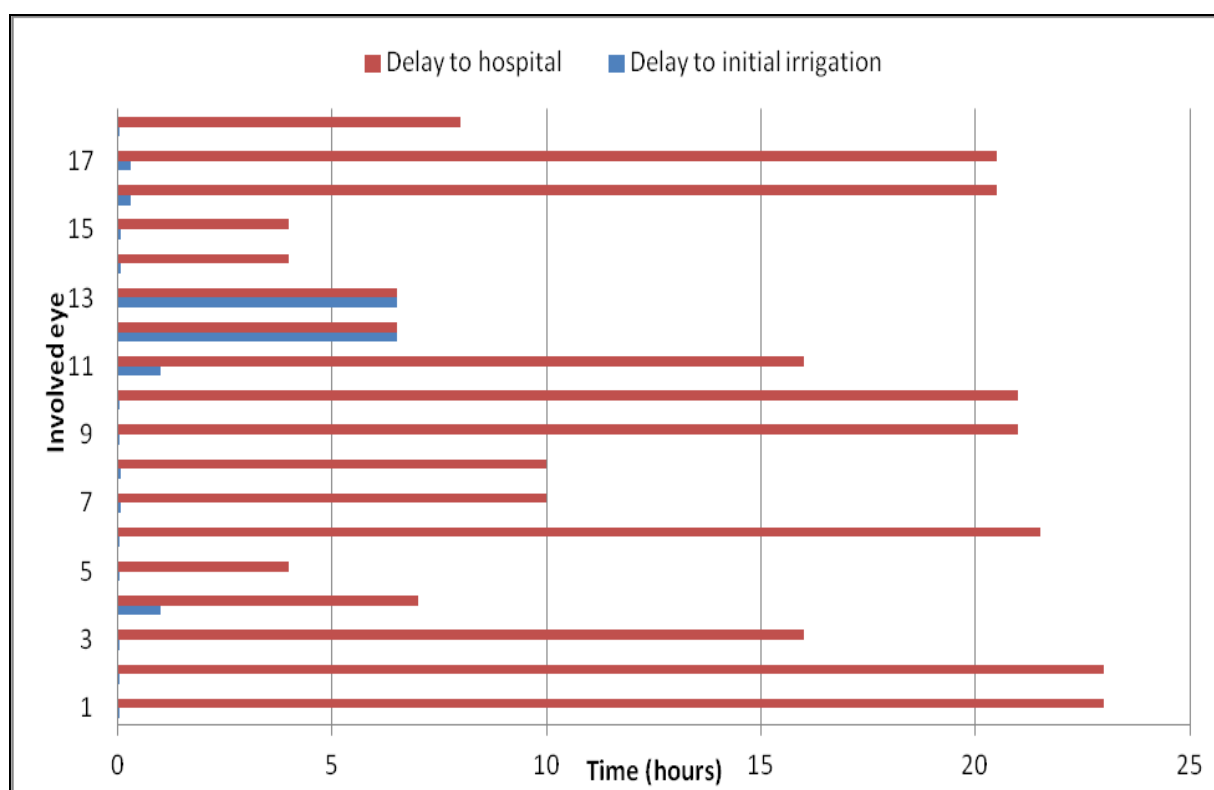


Figure 3.5 Time from injury to initial irrigation and subsequent presentation to hospital

Chapter 4: Discussion

Chemical burns to the eye require immediate and effective management to reduce the risk of severe ocular damage. The most important intervention in the acute period is irrigation of the eyes. This should be done within seconds of the injury.⁷ On arrival at the hospital patients may require ongoing irrigation if there is still evidence of chemical in the eyes. Medical and surgical management would depend on the clinical findings.

Of the 18 eyes of 12 patients included in the study, only 5 (27,8%) had an abnormal pH. There were an equal amount of acid and alkali burns. Adepoju et al¹ also found that 11 out of their 23 injuries were due to acids. In contrast, Morgan⁴ and Kuckelkorn et al⁵ found more alkali burns than acid burns, as alkalis are more common in industrial and building materials as well as household cleaning agents. The majority of patients in our study were involved in assault and domestic incidents, particularly with battery acid, which may explain why our study showed more acid injuries than is found in the literature.

Thirteen eyes (72,2%) had a neutral pH on presentation to hospital and only the 5 eyes with an abnormal pH required irrigation with Diphoterine®. Of the 5 whose eyes were irrigated, 4 (80%) had a neutral pH following irrigation with 500ml Diphoterine®. The only patient whose eye did not have a neutral pH following irrigation was found to have cement particles embedded in his conjunctiva. Diphoterine® was found to be effective in neutralising the conjunctival pH in 80% of the patients who required irrigation.

When compared to universal indicator paper, the conjunctival pH measured with urine dipstick was the same in all our patients. The routine use of urine dipstick strips to

measure conjunctival pH should be encouraged as it correlates well with universal indicator paper. Urine dipstick strips are commonly available in most outpatient and casualty units.

Most of the patients were young males (83,3%), which has also been found by other investigators^{1,4,11} ranging in age from 24-50 years. The injuries were mainly sustained in a domestic setting. Five (28%) ocular burns were due to assault with bleach and battery acid. Occupation related injuries were the cause of 6 (33%) of the corneal burns. These ranged from cement to cleaning and industrial related substances. The final 7 (39%) were domestic accidents from car batteries exploding.

The injuries were graded according the new classification by Dua et al.¹⁴ Fourteen (78%) of the 18 eyes had Grade 1 burns. Of the remainder, one patient each had Grade 2, 3, 4 and 5 burns. The severity of the burns was not found to be related to the type of chemical. The eyes which sustained Grade 3 and Grade 5 injury were from acid burns and the Grade 2 and Grade 4 injuries were from alkali burns. The Grade 1 injuries were evenly spread among acids and alkalis. We also found no correlation with the time taken to initial attempts at irrigation on site or at a health care centre.

Effective initial irrigation is important in the prognosis of patients with ocular chemical burns. The initial irrigation fluid used for most patients prior to presentation at the hospital was tap water. Some patients also described the use of milk and sugar water as irrigation fluid. None of the patients who sustained occupational related injuries had access to eye wash stations.

Most patients attempted some sort of eye irrigation within 5 minutes of the injury. The effectiveness of this irrigation is not known. The delay to presentation to hospital and subsequent management was prolonged. All patients presented to hospital over an hour from the initial injury and the earliest presentation was 4 hours from the injury. Patients who presented after 24 hours following a chemical injury were excluded from the study. A few factors could account for this delay. Many patients who attend academic or government hospitals rely on public transport. This is associated with delays during the day and is often non-existent at night. Secondly, because of the referral pathways in the public sector, patients have been encouraged to go to seek help at their local clinic first and from there get referred to the hospital.

Despite the delay to hospital and delayed initial irrigation in many patients, the majority of our patients did not suffer from severe ocular injury. Sharma et al¹⁷ found that their patients who sustained lower grade burns were younger and attributed their quick reflexes and immediate response as a factor. All our patients were young and this may have been one factor contributing to the low amount of severe injuries.

Case study

A 31 year old male patient presented to Chris Hani Baragwanath Hospital with a history of cement burns to both eyes. He was working as a casual labourer on a building site and while mixing cement some of the cement powder entered his eyes. He immediately put his head into a bucket filled with tap water to wash out the cement. He still had remnants of the cement in his eyes and when he went home he washed his eyes with sugar water. He presented to hospital 23 hours after the initial injury.

On initial assessment the pH of the conjunctiva in the inferior fornix was 9 in both eyes. Both eyes were irrigated with 500ml Diphoterine®, a first aid eye wash, and residual cement particles were removed from both conjunctivae. Most of the cement particles from his left eye were removed and the pH was 7 after irrigation. We were unable to remove all the cement particles in his right eye as they were embedded in the conjunctiva and his pH remained 9 after irrigation. Further irrigation was withheld as the patient needed surgical debridement.

On subsequent examination his visual acuity in the right eye was hand movements and 6/12 in his left eye which improved to 6/6 with pinhole occluder. His lids on the right eye were swollen but he had no burns of the skin. Both conjunctivae were injected and his right eye had cement particles adherent to the conjunctiva under his upper lid. He had more than 6 clock hours of limbal ischaemia superonasally in his right eye and no limbal ischaemia in his left eye. His entire right cornea had stromal haze with iris details poorly visible through the cornea. His left cornea was clear with an epithelial defect of a quarter of the corneal area inferonasally. The anterior chamber on the right could not be assessed due to the corneal haze but the anterior chamber in his left eye had no signs of inflammation. The intraocular pressure (IOP) in his right eye was 18mmHg and 10mmHg in his left eye. His hazy cornea prevented a view of the lens, vitreous and fundus of his right eye. The media were clear in his left eye and fundoscopy was normal. His injuries were graded according to severity.¹⁴ His right eye had a Grade 4 burn, which indicates 6 to 9 clock hours of limbal involvement and 50-75% conjunctival involvement. His left eye had a Grade 1 burn which has the best prognosis with only corneal involvement and no

limbal or conjunctival involvement. He was started on prednisolone acetate 1% drops 4 times a day, atropine sulphate 1% twice a day and Chloromycetin ointment 1% three times a day in both eyes. In addition he received oral doxycycline 100mg twice a day and oral ascorbic acid 2g four times a day. Due to the residual cement remnants in his right eye medical therapy alone was insufficient and he was taken to theatre for surgical debridement of the remaining cement particles. The pH following surgery was 7 and the patient did not require further irrigation of the eye with Diphoterine®.

Conclusion

Diphoterine® effectively neutralised the conjunctival pH of 4 out of 5 eyes in this study. Most patients sustained Grade 1 burns and had a neutral pH on arrival at the hospital. The conjunctival pH as measured with urine dipstick was the same as universal indicator paper. The routine use of urine dipstick in assessing conjunctival pH in patients with ocular burns in our hospitals should be encouraged. This will assist in assessing whether an eye requires ongoing irrigation. Urine dipsticks are readily available and easy to use.

The limitations of this study were the small number of patients and the absence of a control group. As there was no comparison with current standard of care, we cannot show that Diphoterine® is more effective than current management in our setting. Further comparative studies would be required.

As the case study indicates, current first aid management of patients with chemical burns is often not optimal. Communities and industry need to be educated on the importance of early and effective irrigation of the eyes in cases of chemical burns.

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Appendix A: Data capturing sheet

The initial management of ocular chemical burns in an academic hospital

Date:

Participant number:

Age:

Sex: Male Female

Eye injured: Right Left (circle if involved)

Nature of agent

Composition (if known)

Acid
Alkali

Circumstances surrounding the accident

Details

Assault
Domestic accident
Occupational accident
Other

Time of injury:

Delay to initial irrigation (minutes):

Initial irrigation fluid used:

Delay to irrigation with Diphoterine® (minutes):

Volume of Diphoterine® used (ml):

pH measurements

	Universal indicator	Urine dipstick
At presentation		
Final pH		

Appendix A (continued)

Clinical examination

VA (unaided)

VA (aided/ pinhole)

Lids

Conjunctiva

Cornea

Anterior chamber

Pupil

Lens

IOP

Fundoscopy

pH

Grading of ocular burn: Grade I Grade II Grade III Grade IV Grade V Grade VI
(Circle applicable grade)

Summary

Management
