

CHEMICAL INJURIES TO THE EYE

DATE: 8/8/2016

ANATOMY

- Corneo-scleral junction
- Limbus – pluripotent stem cells

INTRODUCTION

- Ocular emergency: potential cause of permanent visual impairment
- Age group: young people
- Sites: home, industries, assault

CLASSIFICATION

- **Acids:**
 - Sulphuric acid (car batteries)
 - HCl
 - Acetic acid (Vinegar)
 - HF: glass polishing, silicon production
 - H₂SO₃: Bleach
- **Alkalis:**
 - Ammonium and Ammonia: fertilizer
 - NaOH: drain cleaners
 - Calcium hydroxide: cement and whitewash
 - Magnesium hydroxide: fireworks
- **Organic solvents:**
 - pH neutral; benzene, acetone, ketones
 - Liquids, gases, solids
 - E.g. paint thinners, nail polish removers, perfumes, petrol, dry cleaning agents
 - Take longer to cause significant ocular damage
 - Classified as ocular irritants
 - Worse when ingested orally, associated with cancers.

SEVERITY OF CHEMICAL INJURY

- Type of chemical (alkali > acid)
- Chemical concentration
- Contact time
- Surface area of contact
- Solution pH
- Others: heat, forceful contact (explosion)

PATHOPHYSIOLOGY: ACIDS

- Denature ocular surface proteins
- Coagulation of proteins
- Coagulum forms protective layer
- Limits depth of penetration

PATHOPHYSIOLOGY: ALKALI

- Alkali = lipophilic
- Saponification of cell membrane fatty acids = cell death
- Denatures collagen
- Damaged tissue stimulate inflammatory response, release proteolytic enzymes, more tissue damage (vicious cycle)
- Final result = liquefactive necrosis

CLINICAL FEATURES: SYMPTOMS

- Short history; usually seek medical attention immediately
- Swelling & difficulty opening the eye
- Pain
- Redness
- Tearing
- Cloudy vision

- **TO DO: STOP AND IRRIGATE THOROUGHLY FOR 0.5 – 1 HOUR.**
 - Tilt the head such that when washing one eye, the water does not trickle to the unaffected eye.
 - In a hospital setting use normal saline or ringer's lactate and administer it using a giving set.
 - Remove any particulate matter in every corner of the eye.

CLINICAL FEATURES: SIGNS

- Visual acuity: reduced
- Eye lids: blepharospasms, burns, edema
- Ocular surface/fornix: Particulate matter
- Conjunctiva: injection; limbal ischemia
- Cornea: epithelial defect, cloudy, opaque
- Anterior Chamber (AC): reaction (cells, flare), Raised IOP
- Lens: cataract
- Globe: perforated eye.

GRADING

GRADE	CORNEA	LIMBAL ISCHEMIA	IRIS DETAILS	PROGNOSIS
I	EPITHELIAL DAMAGE	NIL	CLEAR	GOOD
II	HAZY	< 1/3	SEEN	GOOD
III	TOTAL LOSS OF EPITHELIUM + STROMAL HAZE	<1/3 - < 1/2 (LIMBAL BLANCHING)	BLURRED	GUARDED
IV	OPAQUE	> 1/2	NOT SEEN	POOR

COMPLICATIONS

- Corneal scarring
- Conjunctivalization of the cornea (opaque) – when the limbus has been damaged and the cornea cannot regenerate
- Dry eye
- Cataract
- Symblepharon – the fornices are pulled up and attached to the surface of the cornea
- Glaucoma – raised IOP
- Cicatricial entropion & trichiasis

PRINCIPLES OF MANAGEMENT

- Reduce **contact time** of chemical with the eye
- Reduce any **inflammation**
- Enhance **repair/recovery** of tissue function
- Reduce rate of **complications**

MANAGEMENT

- Acute phase/immediate: 0 – 7 days
- Early reparative phase: 7-21 days
- Late reparative stage: 21 days - months

IMMEDIATE

- Most important! **Copious irrigation**
 - 15-30 minutes or until pH is neutral (litmus)
- Any water solution of neutral pH – tap water, soft drinks, coffee, tea
- Remove particulate matter – fornices
- Steroid and antibiotic eye drops

MANAGEMENT: ACUTE PHASE 1ST WEEK

- **Steroid** eye drops – reduce inflammation
- **Timolol** eye drops – Reduce IOP
- **Antibiotic** eye drops – prevent infection
- **Cycloplegics** – reduce pain
- +/- **bandage contact lens** enhance re-epithelialization
 - It is porous, doesn't improve one's eye sight and plays a protective role.

MANAGEMENT: 2ND & 3RD WEEK: EARLY REPARATIVE PHASE

- Stop steroid eye drops – replace with NSAIDs
- Timolol
- Antibiotics
- Cycloplegics
- +/- Bandage C.L.

MANAGEMENT: FROM 4TH WEEK – LATE REPARATIVE PHASE

- Re-introduce steroid drops
- Timolol
- Antibiotic
- +/- surgery

MANAGEMENT: OTHER DRUGS USED

- Preservative free artificial tears
- Oral or topical ascorbate:- enhances collagen production and promote epithelial healing
- Topical citrate:- neutrophil activity and limits stromal necrosis
- Topical and systemic tetracycline:- inhibit collagenase and neutrophil activity

SURGERY: EARLY

- Debridement of necrotic tissue
- Conjunctival flap
- Limbal stem cell transplant
- Amniotic membrane graft
- Glue

SURGERY: LATE

- Release of Symblepharon
- Mucus membrane/conjunctival grafts
- Corneal graft
- Keratoprosthesis (artificial cornea) – severely damaged eyes.

SUMMARY

- Serious ocular injury: ocular emergency
- Alkali burns are more severe than acid
- Immediate copious irrigation and removal of particles is crucial and a prognostic indicator
- Long term treatment and follow-up.

TYPED BY DR. E. NAILA