Ophthalmic Services Guidance

Eye Care in the Intensive Care Unit (ICU)

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Contents

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1 Summary

This document aims to provide advice and information for clinical staff who are involved in eye care in the ICU. It is primarily intended to help non-ophthalmic ICU staff to:

1. protect the eye in vulnerable patients, thus preventing ICU-related eye problems
2. identify disease affecting the eye in ICU patients, and specifically those which might need ophthalmic referral
3. deliver treatment to the eye when it is prescribed.

It concentrates primarily on the common problems of the eye surface but also touches on other less common conditions.

2 Introduction

The health of the front surface of the eye, particularly the cornea (the clear front window of the eye) depends on the ability to produce tears, to blink, and to close the eyes with rest or sleep. These can be impaired on the intensive care unit (ICU) whether by disease (e.g. facial oedema, reduced conscious level, peripheral or central neurological injury) or treatments (e.g. the drying effects of gas flows from CPAP or oxygen masks, muscle relaxants reducing the strength of lid closure, sedation reducing the blink reflex and the effects of prolonged prone positioning). Whatever the cause, those unable to close the eye for themselves, or in whom blinking rates are substantially reduced, are at increased risk of damage to the front of the eye, and this risk is higher in those mechanically ventilated, due to greater length of stay, use of sedative/paralysing drugs and the effects of positive pressure ventilation (see below).

The main possible problems affecting the front of the eye in ICU are:

- Direct injury to the cornea, most often a superficial corneal abrasion (scratch)[1]
- Exposure keratopathy
- Chemosis (conjunctival swelling)
- Microbial conjunctivitis and keratitis.

ICU eye care protocols are sometimes haphazardly followed, and documentation of eye care is often poor[3]. However, having a clear protocol for assessment and intervention, which is applied rigorously and correctly, will prevent the majority of corneal problems[4, 6, 10].

3 Protecting the eye

The eyelid closure and the appearance of the eye should be checked regularly with a bright light at least once per shift throughout the patient's stay.

If the eye is red, sticky, chemosed, or there are corneal abnormalities, the medical staff should be alerted (and consideration of referral for ophthalmological opinion given) and 2 hourly increased lubrication given.

Assessment of lid closure and risk of corneal damage

Incomplete closure of the eyelids is called lagophthalmos. If the eyes do not close properly the grade of severity must be assessed.

Grade 0: Lids completely closed	
Grade 1: Any conjunctival exposure (visible white of the eye) but no corneal exposure	
Grade 2: Any corneal exposure, even a very tiny amount	

Protective measures

The action required is based on the grading of exposure:

- Grade 0 exposure (i.e. no exposure) requires no action.
- Grade 1 exposure requires lubrication
- Grade 2 exposure needs lubrication and taping of the lids or other method of lid closure.

The methods to protect the eyes are:

- Lubrication.
    - Liberal use of ointment lubricants into the eye four times daily e.g. simple eye ointment, Lacrilube , Xailin Night, and VitA-POS). Drops do not last as long. This needs to be applied correctly into the eye and not, as is sometimes found, over closed eyelids. Such action is superior to manual eye closure alone[3].
    - If a patient is conscious an alternative is 2 hourly lubricant drops (e.g. Hylotears) and ointment before sleep.
- Closing the eyelids.
    - Manual closure of the eyes
    - Taping the eyes shut. Lid taping is not always necessary and can be distressing to relatives and to conscious patients, and repeated removal may lead to facial skin or eyelid injury or irritation. It should therefore only be undertaken when necessary. It is crucial when using taping that the lids are completely shut and the tape not touching the eye surface as more damage will be done than prevented.
    - Cling film can be used as a safe alternative to tape to protect the eye – it does not cause damage if in contact with the eyeball. Apply a 10x10cm square over each eye and change every shift. Never share a cling film roll between patients.
    - Hydrogel or silicone dressings or pads (eg Kerrapro, Gelliperm) may be used instead of taping, if oedema prevents manual lid closure. They should be changed once per shift and must not be allowed to dry out or position poorly as this can damage the eye. Only use with great care to avoid causing eye damage.

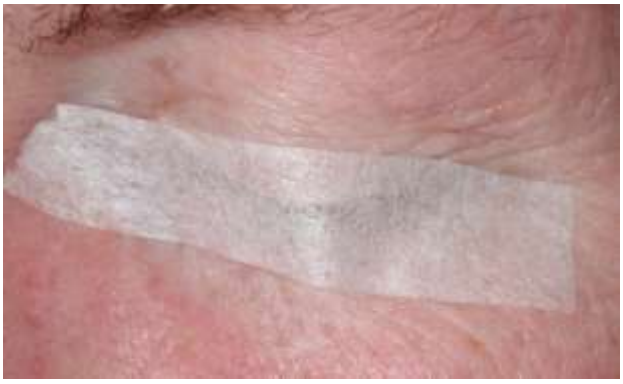
What order to do this:

Every 4 hours:

- Bathe the eyes with warm water first to remove dried ointment.
- Before the next lubricant application, examine the eye for abnormalities with a bright light.

- Apply new ointment to the eye surface: pull the lower eyelid down with a finger and insert the ointment over the top of the lower lid into the gap between the lid and the conjunctiva.

- If taping is also performed, ointment is put in first and the eyes are closed[7, 8, 9]. The position of the lashes is then checked as the lashes must be clear of the cornea if iatrogenic corneal abrasion is to be avoided). The outside of the eye must be free of the lubricant ointment for tape to stick properly. Micropore tape is then applied horizontally across the lids to seal them shut as below:



Prone unconscious patients. In those patients *nursed prone and unconscious*, the eyelids and face can become oedematous and conjunctival swelling (chemosis) is common. As in all ventilated patients, exposure keratopathy (a drying of the corneal surface, see below) can occur[10, 11]. Direct eye compression can occur and can be avoided using a 3-pin head holder as is used for prone spinal surgery[12], gel rings or similar devices. The eyes should always be re-lubricated every 4 hours, and taped or cling-filmed shut as above. Where there is severe oedema and the swollen conjunctiva prolapses through the closed eyelids, the medical staff should be contacted as the eyelids may need to be temporarily closed with sutures.

4 Identifying disease of the eye

Exposure keratopathy and corneal abrasion

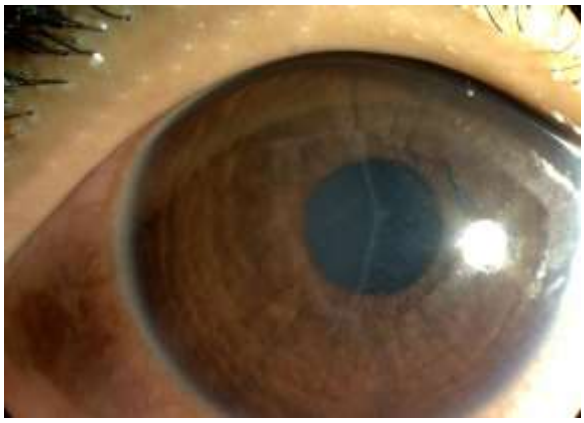
The corneal can be accidentally injured and nearly always in ICU this is in the form of *a corneal abrasion* (a superficial scratch removing the surface epithelium). It will cause the eye to become red and is best seen using fluorescein dye eye drops and a blue light, where the

epithelial defect glows bright yellow; a white light will also work but the injury is less obvious. *Exposure keratopathy* represents a dryness of the cornea due to incomplete lid closure allowing excessive tear evaporation and a consequent failure of the tears to spread adequately across the eye surface. It manifests as a red eye and fluorescein dye drops reveal smaller or larger epithelial defects which can look identical to corneal abrasions. It affects 20-42% of ICU patients[3], and 60% of those sedated for >48hours develop corneal epithelial defects (42% within the first week) as a result[1, 2]. Prolonged epithelial defects can cause scarring or even, in severe cases, perforation of the cornea. Secondary infection (microbial keratitis: see below) can occur.

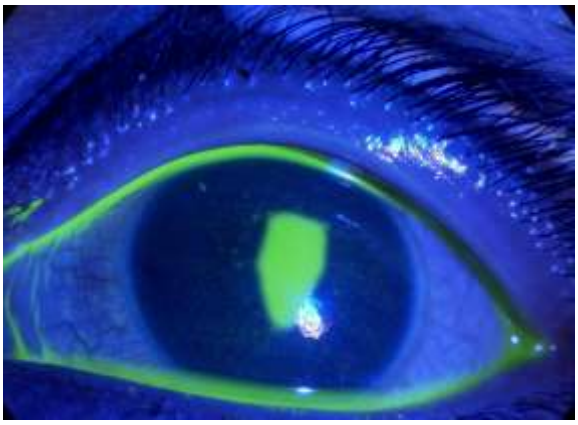
Treatment of a simple corneal abrasion without secondary infection can be with chloramphenicol ointment four times daily for 5 to 7 days and increased lubrication and lid taping if there is significant unwanted corneal exposure.

Corneal abrasion: A) Eye without fluorescein B) stained with fluorescein with blue light showing abrasion on cornea

A

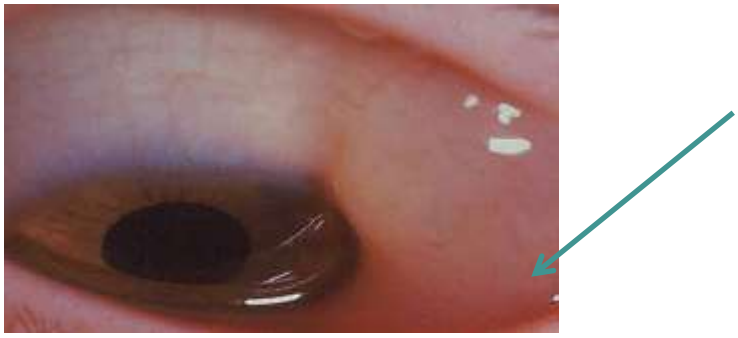


B



Chemosis

Conjunctival oedema which causes the conjunctiva to bulge out (chemosis) is common in ICU patients. Risk factors include those which compromise venous return from the ocular structures (positive pressure ventilation, escalating positive end expiratory pressures or tight endotracheal tube taping); those states associated with generalised oedema (such as fluid overload or hypalbuminaemia); gravitational causes of increased hydrostatic pressure (prolonged recumbency or prone ventilation); or states which increase capillary leak (such as systemic inflammatory response syndromes)[2]. Chemosis can cause impaired eyelid closure, whilst incomplete eyelid closure can also predispose to chemosis.



Swollen conjunctiva (chemosis)

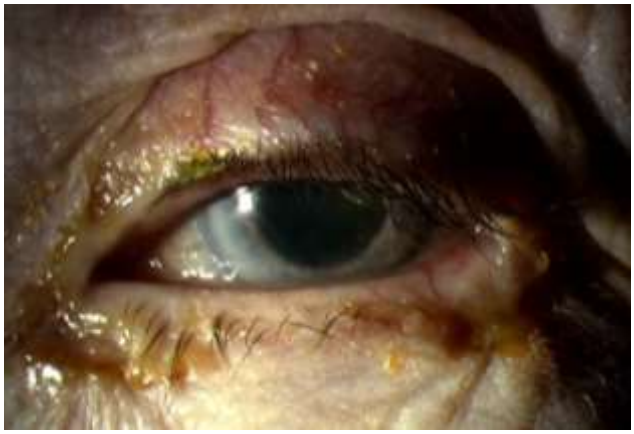
Microbial infections

The eye commonly becomes colonized with bacteria (in a time-dependent fashion) on ICU: as many as 77% of ventilated medical patients being colonised by at least one abnormal bacterial species in 7-42 days, 40% of those with prolonged ventilation and sedation with multiple bacteria. The most common isolated organisms are Pseudomonas aeruginosa, Acinetobacter spp. and Staphylococcus epidermidis[3].

Respiratory secretions are thought to be the major source of ocular surface infection, with aerosols from tracheal suctioning and direct contact from suction catheters both being implicated. Pseudomonas infection rates can thus be reduced if endotracheal suctioning is done from the side (rather than head) of the patient & with their eyes covered[4, 5, 6].

Conjunctivitis: ICU staff should look for a sticky eye which is usually (but not always in ICU) red. Note that if the eye is very red but not sticky, this might **not** be conjunctivitis and staff must seek expert ophthalmological help.

RED AND STICKY



RED BUT NOT STICKY

Conjunctivitis in this setting is usually bacterial and can be very infectious and virulent. Without due care it can be spread to other patients and staff.

***Management of conjunctivitis*:** It is wise to take a swab of the eye discharge and send it for microbial culture because of the increased possibility of infection with unusual organisms.

The discharge can be removed by bathing the eyelids with warm water, using separate gauze for each eye.

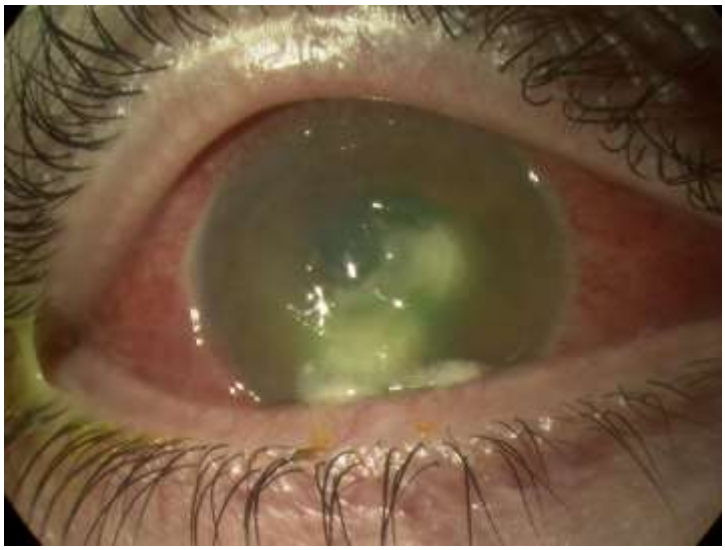
Chloramphenicol ointment (rather than drops to utilise the continued good lubrication from the ointment) is applied in the eye four times a day for 5-7 days.

- If the microbial results suggest that the organism is not sensitive to chloramphenicol, but the eye is better, leave alone and do not change this. If the eye is still sticky or red, then the ointment can be changed to one containing an antibiotic to which the organism is sensitive, or other antibiotic drops can be used in addition to simple lubricant ointment.
- If the discharge and redness have not markedly improved in 48 hours, the medical staff must be informed and ophthalmic help sought.
- If the cornea becomes dull or a white patch appears, ***an urgent ophthalmological opinion sought***.

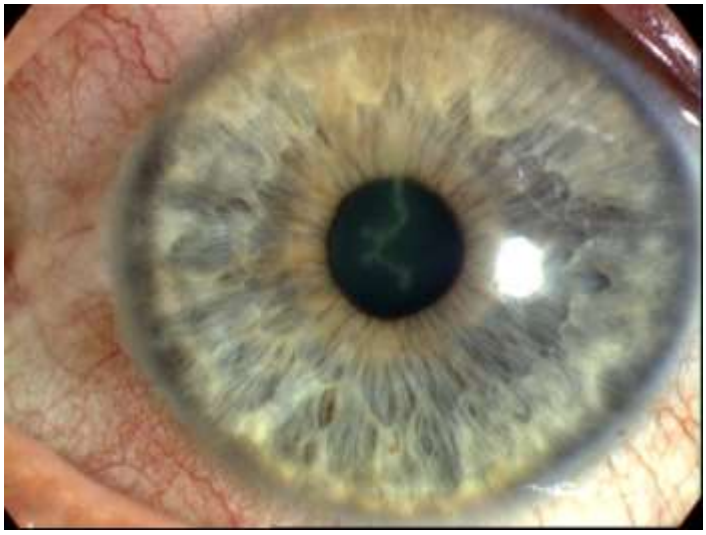
Microbial keratitis: The damaged cornea (for instance, that affected by exposure keratopathy) is especially vulnerable to bacterial invasion which can occur very rapidly. Whilst superficial infection can result, deeper infection can lead to permanent and severe damage, and loss of vision.

Most cases are due to bacteria and appear as a red eye, which may be watery or sticky, with a corneal ulcer (an epithelial defect -which stains with fluorescein dye- on top of an underlying white/grey/yellowish opacity). Less commonly, debilitated patients may develop herpes simplex keratitis which takes the form of typical “dendrites” in the corneal epithelium and/or ulcers which stain yellow with fluorescein dye, but which can also appear as non-staining grey areas in the cornea. If any of these corneal problems are seen, urgent ophthalmic help must be sought.

RED EYE WITH WHITE PATCH ON CORNEA - LIKELY MICROBIAL KERATITIS



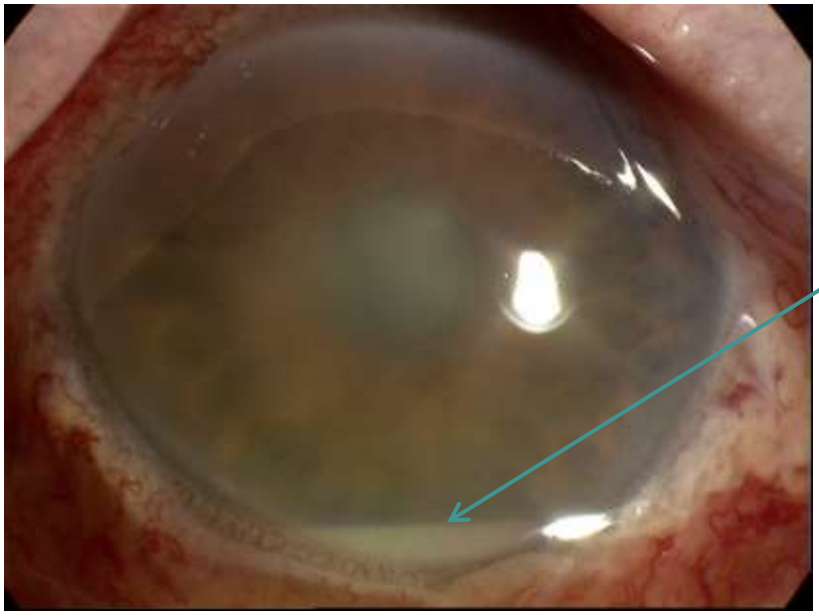
RED EYE STAINED WITH FLUORECEIN DYE SHOWING DENDRITE ON CORNEA – LIKELY HERPES SIMPLEX KERATITIS



5 Rare eye conditions in ICU

Red eye in a septic patient: possible endogenous endophthalmitis

This is a very serious problem caused by spread of systemic infection in the blood stream to the inside of the eye. The eye may be red, although sometimes much less red than might be expected. Endophthalmitis is to be suspected if a white line is visible in the eye in front of the iris, which represents a level of pus in the chamber of the eye (hypopyon). ***Immediate*** ophthalmic help needs to be sought as this is a sight threatening emergency and it also indicates systemic active sepsis.



Hypopyon – pus in the eye

Other eye problems can complicate ICU care. Severe or recurrent hypotension can cause blindness from ischaemic optic neuropathy[12,13]. In those ventilated prone, increased intra-ocular pressures or intraorbital pressure with marked periocular swelling can decrease ocular perfusion pressures (worse with concurrent systemic hypotension), leading to ischaemic optic neuropathy, central retinal artery occlusion and permanent visual loss[12].

Rarely, those nursed prone can develop bilateral acute glaucoma in which there is a sudden rise in intraocular pressure which can causes visual loss very quickly because of retinal or optic nerve ischaemia. In this condition, the cornea becomes cloudy and grey and the pupil becomes fixed at a mid-dilated position and unresponsive to light. This needs ***immediate*** ophthalmic treatment.

6 Delivering treatment to the eye when it is prescribed

This is usually given in the form of drops or ointment. Sometimes several different drops are required.

- When giving several different drops, do not give them at the same time as one drop may wash out another, thereby reducing its effectiveness. Allow ideally 5 minutes and at least 1 minute between each medication

- Always put drops in before ointment. The ointment is water repellent and prevents the drops from getting into the eye tissues.
- When putting in ointment in poor lid closure, after instilling ointment manually shut eyelids to ensure ointment is spread over whole eye surface.

7. Systemic fungal infection and the eye

It is important to recognise that the eye may be involved in any patient who has a systemic fungal infection. This is of concern in ICU where the patient is unlikely to be able to report any problems with their eyesight and not all systemic antifungal agents penetrate the eye sufficiently to treat intraocular disease. Previously, many guidelines recommended referral of all patients with a positive blood culture or line tip for candida, aspergillus or any other fungal organism should be referred for urgent ophthalmological assessment. More recent evidence has emerged that the prevalence of eye involvement and intraocular disease requiring or amenable to treatment, or requiring extra intraocular treatment or vitrectomy, is very low and routine screening of all culture positive patients is not indicated[14, 15]. We recommend screening of fungal culture positive patients is done as an exception on a case by case basis, taking into account risks for that patient, symptoms and abnormal appearance of the eye taking these principles into account:

- No examination:
  - Awake and asymptomatic
- May need examination:
  - Awake and symptomatic
  - Unable to report symptoms
- Must be examined:
  - Very abnormal eye appearance e.g. hypopyon, cloudy pupil, possible ocular perforation etc.

Case by case assessment for both decision to examine and timing of examination based on factors such as:

- Risk
- Prognosis
- Microbiology results
- Ability of current/planned treatment to penetrate eye
- Patient position
- Ability to examine.

If there is intraocular infection, liaise with microbiologists and ophthalmologists to ensure an appropriate antifungal which has good ocular penetration is used.

8. Tips for ophthalmologists seeing patients in ICU

1. If **corneal exposure and taping requested**, ensure taping done correctly to avoid lashes rubbing on the cornea.
2. If **keratitis** present, it is most likely to be virulent bacteria – especially pseudomonas. Therefore, do a corneal scape and start appropriate intensive topical fluoroquinolone

antibiotic therapy immediately. Try to avoid lid taping (which can encourage bacterial growth) and keep lubricated with plenty of ointment.

3. **Dilating** the eyes: it is safe to use G tropicamide 1% and G. phenylephrine 2.5%, but write clearly in the notes that the pupils have been dilated, stating the time drops were given and the time over which pupils are likely to be unresponsive to light (about 4 hours).
4. **Endogenous bacterial endophthalmitis** – most likely if a hypopyon is present. Be guided by systemic infection if known, otherwise urgently tap and inject using protocol of amikacin and vancomycin. If platelet count is low (<30,000), there is a risk of vitreous haemorrhage, so ask for platelets to be given before you do the procedure.
5. **If patient has cystic fibrosis, always think of aspergillus first as the cause of endophthalmitis** as patients are usually colonised with this. Use voriconazole as first line therapy.
6. **Patients on voriconazole may get visual aura** because it is a cytochrome P450 inhibitor and this is present in the retinal pigment epithelium. These aura are totally reversible when the drug is stopped and are NOT an indication to stop the drug.
7. **Patients nursed prone** may suffer direct pressure on eyes or raised orbital/ophthalmic pressure due to gravitational effects or periocular swelling. This can cause acute primary angle closure glaucoma, ischaemic optic neuropathy, vascular occlusion and, rarely, orbital apex syndrome (visual loss from optic neuropathy with ophthalmoplegia involving multiple cranial nerves). Pressure needs to be taken off the eyes where possible[16].
8. **Patients who are profoundly hypotensive** for extended periods of time may get ischaemic optic neuropathy or cortical blindness causing visual loss.

9. Authors

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Approved by:

- The Royal College of Ophthalmologists' Quality and Safety Group
- The Intensive Care Society and the Faculty of Intensive Care

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Patient nursed supine and unconscious	
Grade	**Action**
Grade 0 – eyelids close well	No action required
Grade 1 – some conjunctival exposure 	**EYES NEED LUBRICATING EVERY 4 HOURS** • Check corneal clarity with bright light: **IF NOT CLEAR – ALERT MEDICAL STAFF** • Clean off old ointment before putting in new • Pull lower lid down and instil ointment onto eye between lower lid and conjunctiva
Grade 2 – conjunctival and some corneal exposure – MAJOR RISK 	**EYES NEED LUBRICATING AND LID TAPING/CLING FILM** • Check corneal clarity with bright light: **IF NOT CLEAR – ALERT MEDICAL STAFF** • Apply ointment as for Grade 1 • Close lids, ensure lashes outside eye and lids free of ointment • Tape upper lid down with micropore tape horizontally or use 10x10cm clingfilm

Patient nursed prone and unconscious: **Major risk to eye in all cases**
EYES NEED LUBRICATING AND LIDS TAPING • Check corneal clarity with bright light: **IF NOT CLEAR – ALERT MEDICAL STAFF** • Apply ointment as for Grade 2 • Close lids, ensures lashes outside eye and lids free of ointment • Apply micropore tape horizontally

Red sticky eye	*Red not sticky eye*
• Take swab • Use chloramphenicol ointment X 4/DAY to eye • Condition is contagious and can be transmitted to other patients IF NO BETTER IN 24 HOURS **– ALERT MEDICAL STAFF**	• Is the cornea clear or does it stain with fluorescein? • If clear cornea, or simple abrasion, check lubrication schedule and consider lid taping If there is a corneal opacity, or abrasion does not improve in 24hrs, or unsure of cause **– ALERT MEDICAL STAFF**

Eye opacities on or inside eye: ALERT MEDICAL STAFF IMMEDIATELY
• Exclude harmless adherent mucus by rinsing gently with saline. Mucus will move. Any corneal opacity which does not move on rinsing, or a white line at the bottom of the iris: suspect sight-threatening infection. **ALERT MEDICAL STAFF IMMEDIATELY**