

Eyecare for Patients in Critical Care Units

Darren G. Gregory, MD

University of Colorado Health Sciences Center

Department of Ophthalmology — Rocky Mountain Lions Eye Institute

Introduction

Patients in critical care areas are at increased risk for developing ocular complications, most commonly as a result of excessive exposure and drying of the surface of the eye. A number of factors that contribute to this problem will be discussed. Proper, simple eyecare measures can decrease the incidence of sight-threatening infections and scarring that can yield long-term problems for a patient who was otherwise successfully treated during their time in the critical care Unit. Additionally, for patients who are terminally ill, proper eyecare will help maintain the health of the corneal tissue and preserve the option of eye donation for the patient or the patient's family members.

Ocular Anatomy and Immune Defense

Clear vision requires light to be precisely focused on the nerve layer (retina) that lines the internal aspect of the posterior eye wall. Approximately 70% of this focusing is accomplished by the cornea — the clear dome over the central portion of the front of the eye. Any scarring or distortion of the central cornea, or the tear film coating the cornea will yield blurring of the vision. Any significant disruption of the tear film not only blurs vision, but also places the underlying corneal tissue at risk for infection and subsequent permanent scarring.

The cornea is an avascular structure composed mainly of precisely arranged collagen fibers and glycosaminoglycans. It depends on the constant turnover of the tear film via blinking to protect it from infection. Tears contain a number of substances that have antimicrobial properties, such as lysozyme and immunoglobulins. Additionally, the thin layer of epithelium covering the cornea provides a potent barrier to microbial invasion. The health of this avascular epithelium is dependent on the supply of oxygen and nutrients provided by tears. A stagnant tear film and drying of the corneal surface decrease the antimicrobial effect, weaken the epithelial barrier and allow increased localized bacterial infection. Breaches in the epithelium expose the underlying corneal proteins to bacterial invasion, which can occur aggressively with devastating visual consequences.

Problems Specific to Critical Care Patients

Many critical care patients are sedated, both medically and as a result of their systemic illness. Sedation decreases the blink rate and predisposes the ocular surface to desiccation. At particular risk are patients receiving mechanical ventilation. These patients are often treated with muscle relaxants that impair closure of the eyelids. During sleep, the eyelids close via active, tonic contraction of the orbicularis oculi muscle. Paralysis of these muscles brings closure to the eyelids only via passive means (i.e. gravity) and this frequently yields incomplete closure known as "lagophthalmos."

Increased jugular venous pressure from mechanical ventilation can also lead to fluid buildup, known as chemosis, under the conjunctiva — a stretchy mucous membrane covering the white part of the eyeball (sclera). This chemosis can be quite pronounced, with conjunctiva protruding over the lower eyelid. This condition can yield further impairment of passive eyelid closure and increased drying of the ocular surface. Positive end expiratory pressure (PEEP) of 5 cm H₂O and above is thought to worsen conjunctival chemosis by decreasing venous outflow from the head and neck.

Corneal infections are most commonly caused by the patient's own bacterial flora. It is important that the patient's face is kept clean and that care be taken to protect the patient's eyes when suctioning gastrointestinal or respiratory secretions. Introduction of bacterial flora from these sites onto a compromised ocular surface can yield aggressive bacterial infections.

Nursing Assessment

Assessment of a critical care patient's eyes should routinely be done by each nursing shift. Checking the eyes of patients who are not sedated and ventilated will allow nurses to gain an appreciation of the normal appearance of the eye. Most ocular problems in critical care patients arise from lagophthalmos, which generally increases in severity with increased sedation. It is important that eyelid position be carefully assessed. Using a penlight or flashlight will help reveal poor lid closure, which might be masked by the eyelashes. Excessive exposure can lead to breakdown of the corneal epithelium, known as keratopathy. This can be recognized as an irregular reflection of light from a penlight off the corneal surface. Lubricating ointments can also disrupt this reflection, but a gentle rinse of the ocular surface with sterile saline will rinse the ointment away. This irregular reflection of light indicates an inadequate tear film and a breakdown in the integrity of the corneal epithelium. This places the cornea at risk for infection.

Exposure keratopathy can lead to keratitis — a term for any corneal inflammation, infectious or otherwise. Bacterial keratitis in the critical care setting has an increased association with aggressive Gram(-) bacteria such as *Pseudomonas*. Once these bacteria gain entry into the subepithelial corneal collagen, rapid destruction of corneal tissue can occur. An infectious corneal ulcer will appear as a whitish area on the corneal surface. It is often accompanied by a purulent discharge. Severe dryness can also yield whitish opacities of the cornea. Therefore, an ophthalmology consultation is recommended for any new, white lesions noted on the cornea. Following infection, the orderly arrangement of corneal collagen fibers is disrupted and the resultant scar tissue yields permanent vision loss, which may require a cornea transplant for visual rehabilitation. The risk of this dire consequence may be greatly diminished if the early signs of lagophthalmos and exposure keratopathy are recognized and treated.

Nursing Interventions

Prevention of ocular complications in critical care areas begins with an awareness of the potentially devastating consequences of corneal infections. Both the evaluation and treatment of ocular surface exposure and dryness are relatively simple and minimally labor-intensive, but nevertheless effective.

Each assessment of the patients by the nursing staff should include and evaluation of the adequacy of blinking and eyelid closure. If the eyes appear closed, careful inspection with a penlight or flashlight should be performed to assure the lids are, in fact, completely closed. As mentioned before, the eyelids may hide the fact that the lids are not completely closed, allowing the ocular surface to dry out.

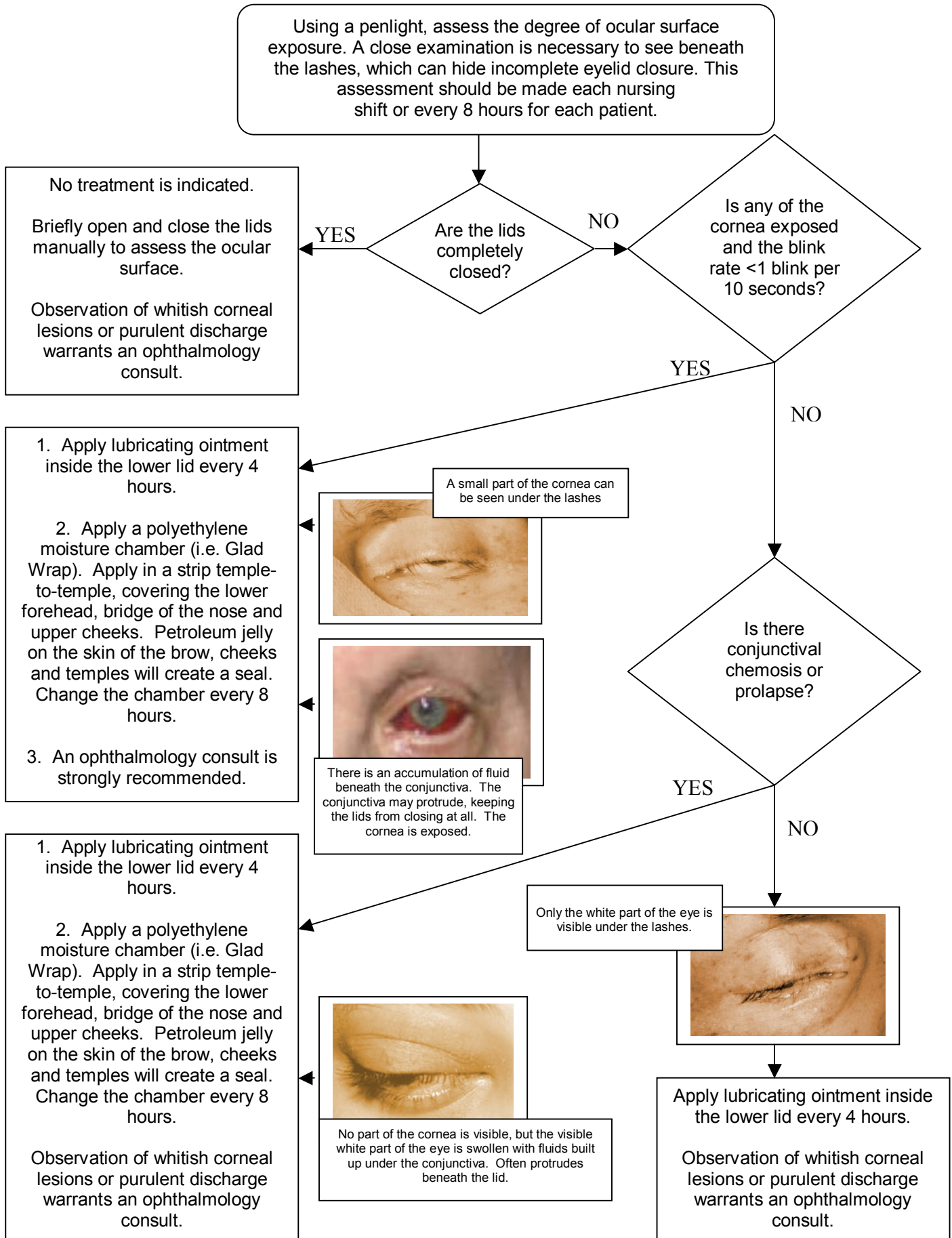
In a sedated patient with seemingly closed eyes, the upper eyelids should be manually elevated to allow inspection of the cornea. A piece of gauze helps with manual traction of the eyelids if they are oily. Does the tear film appear uniform or is the light reflection irregular? Sterile saline may be used to rinse away any mucous or lubricant ointment, thus allowing better assessment of the corneal surface. Any patient with signs of exposure keratopathy, lagophthalmos, or a decreased blink rate (normal blinking occurs every 5-10 seconds) should be treated every 4-6 hours with an ocular lubricating ointment such as Lacrilube. Ointments moisturize the ocular surface more effectively than drops. The ointment should be placed along the internal surface of the lower eyelid, which should then be manually closed to spread the ointment over the ocular surface. Once again, if any whitish corneal lesions or purulent discharge develops prompt ophthalmologic consultation is indicated to rule out corneal infection. A small amount of non-purulent mucous buildup is common in cases of exposure keratopathy.

In cases of significant exposure, whether from decreased blinking or poor lid closure, lubricant ointment should be applied every 4 hours. Prolapsed, chemotic conjunctiva can further worsen the exposure problems. In addition to lubricant ointment, polyethylene cling wrap (i.e. Saran Wrap) may be placed over the skin in a strip from temple to temple, wide enough to cover the lower forehead, bridge of the nose, and upper cheeks. This will create a "moisture chamber" over the eyes. A small amount of petroleum jelly on the skin of the brow, temples and cheeks will create a tighter seal by the cling wrap, but still allow easy removal for inspection and application of ointment. The cling wrap should be changed each shift to lessen the risk of infection. Additionally, visitors to the patient should be briefed on the need for the cling wrap to avoid any undue alarm.

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Eye Care Decision Tree for Unconscious / Sedated Patients on a Ventilator



Application of a Polyethylene Moisture Chamber

Make sure the patient's face is clean and that lubricating ointments have been instilled prior to application of a moisture chamber.



1. Apply a small amount of petroleum jelly to your fingertip.

2. Apply the petroleum jelly from temple to temple, across the forehead, bridge of the nose and upper cheekbones. (indicated by the red line in the photo)



3. Apply a 4-6 inch wide strip of polyethylene (Glad Wrap, Saran Wrap, Clingwrap) over the area. Press film into the petroleum jelly at the forehead, then smooth around the petroleum jelly line. The chamber should not be tight over the eyes.



4. The chamber should be changed every 8 hours. It may be easily lifted or removed for eye examination and for family visits in cases where the chamber causes family members increased anxiety. Every effort should be made to explain the role of the moisture chamber in preserving the patient's sight.





Ocular Health of Patients in Critical Care Units

Patients in critical care settings are at increased risk for developing ocular complications, most commonly as a result of excessive exposure and drying of the surface of the eye. A number of factors contribute to this problem.

- Sedation and muscle relaxants decrease the blink rate and predispose the ocular surface to desiccation. At particular risk are patients receiving mechanical ventilation. During sleep the eyelids close via active, tonic contraction of the orbicularis oculi muscle. Paralysis of these muscles leads to eyelid closure only by passive means (i.e. gravity) and this frequently means incomplete closure of the eyelids known as “lagophthalmos.”
- Increased jugular venous pressure from mechanical ventilation can also lead to fluid buildup, known as chemosis, under the conjunctiva. The conjunctiva is a stretchy mucous membrane covering the white part of the eye (sclera). This chemosis can be quite pronounced, with conjunctiva protruding over the lower eyelid. This condition can lead to further impairment of passive eyelid closure and increased drying of the ocular surface. Positive end expiratory pressure (PEEP) of 5 cm H₂O and above is thought to worsen conjunctival chemosis by decreasing venous outflow from the head and neck.
- Proper, simple eye care measures can decrease the incidence of sight-threatening infections and scarring that can yield long-term problems for a patient who was otherwise successfully treated during their time in the critical care unit.
- Additionally, for patients who are terminally ill, proper eye care will help maintain the health of the corneal tissue and preserve the option of eye donation for the patient or the patient’s family members.

Nursing Interventions

- **Keep the patient’s face clean.** Corneal infections are most commonly caused by the patient’s own bacterial flora.
- **Protect the patient’s eyes with a towel while suctioning** gastrointestinal or respiratory secretions—even in closed systems. Introduction of bacteria from these sites onto a compromised cornea can lead to very aggressive infections.
- **Follow the eye care protocol.** See the reverse side for instructions on administering lubricating ointments.

How to Apply Eye Lubricating Ointments



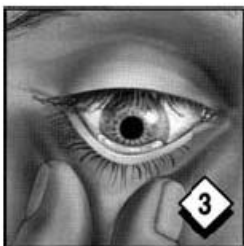
Wash hands thoroughly with soap and water!



Gently pull the lower lid downward to expose the conjunctival sac and form a pocket. You may use a cotton-tipped swab to roll the upper lid open to access the lower lid if necessary.



Squeeze a ribbon of ointment into the pocket just inside the lower lid. Avoid touching the tip of the medication bottle or tube to the eye to avoid the transfer of micro-organisms to the medication and injury to the eye. Do not push on the eyeball or touch the eye. Use the cheekbone and/or forehead to steady your hands.



Very gently, pinch the lower lid and move gently upward to disperse some of the ointment onto the cornea.



Close the eyes completely. A cotton swab can be helpful to roll the upper lid downward. Do not pull on the edge of the lid. Do not tape closed. Ensure that no part of the cornea is visible beneath the eye lid. Repeat every 8 hours.

Post-mortem Eye Care for the Potential Eye Donor

Tear production stops at the time of death, so it doesn't take long for the cornea to dry out. Another problem is that lubricating ointments used prior to death tend to congeal. This can pull the delicate epithelial covering of the cornea away.

For all deaths that are potential eye donors, the following eye care regimen should be performed. A common question is "How long do we have to do this eye care after death?" It's a difficult question to answer. The Rocky Mountain Lions Eye Bank is sensitive to the needs of the donor's family, so their needs must come first. A saline rinse prior to giving the family time with their loved one is a good idea to keep some moisture in the eye. After the family is finished, another rinse followed by the remaining steps should be performed.



Rinse both eyes with sterile saline or balanced salt solution. This will help remove any residue from lubricating ointments used prior to death. This step can be done prior to family viewing and then repeated before proceeding after the family has finished its bedside rituals.



Close both eyelids using your fingers. Do not use forceps or other instruments, as they can easily damage the lids.



Cover both closed eyes with a compress (2x2 or 4x4 gauze) soaked in saline. The compress should be dripping wet if possible. Do not press the gauze hard onto the eyes, just set it firmly on top of the lids ensuring it covers the lid line.



Elevate the head using a pillow or head block. This helps fluids to drain from the head, minimizing the chance of bleeding or bruising during the eye tissue recovery procedure.

Sample Eye Care Policy/Procedure
Provided by the Rocky Mountain Lions Eye Bank

Eye Care for Ventilated Patients

I. **Purpose:**

This protocol has been established to address the increased risk of ocular complications for patients who are unconscious or sedated and on mechanical ventilation.

II. **Definitions**

A. **Chemosis:** a condition in which the membranes that line the eyelids and surface of the eye (conjunctiva) are swollen. The outer surface covering appears to have fluid in it. Often, the conjunctiva becomes so swollen that the eyes cannot close properly.

B. **Cornea:** the clear dome-like tissue over the central portion of the front of the eye. The cornea accomplishes approximately 70% of the focusing power of the eye.

C. **Conjunctiva:** the thin, transparent tissue that covers the outer surface of the eye. It begins at the outer edge of the cornea, covering the visible part of the sclera, and lining the inside of the eyelids. It is nourished by tiny blood vessels that are nearly invisible to the naked eye. The conjunctiva also secretes oils and mucous that moisten and lubricate the eye.

D. **Lagophthalmos:** the inability to close, or poor closure, of the upper eyelid. Lagophthalmos is a form of facial paralysis affecting the orbicularis muscle in the eyelid. Complications associated with lagophthalmos include:

- Severe dry eye and discomfort
- Corneal ulceration (damage to the cornea-the clear tissue covering the front of your eye)
- Decrease or loss of vision
- Unsatisfactory appearance

E. **Sclera:** commonly known as "the white of the eye." It is the tough, opaque tissue that serves as the eye's protective outer coat. Six tiny muscles connect to it around the eye and control the eye's movements. The optic nerve is attached to the sclera at the very back of the eye.

III. **Policy**

A. All patients who are mechanically ventilated and who are unconscious or are sedated with neuromuscular blockers fall under this protocol.

IV. **Procedure**

A. Once per nursing shift, each eye should be checked for exposure keratopathy or keratitis. Using a penlight or strong flashlight, lift the lid of each eye and examine the cornea. *Note: the presence of lubricating ointments may cause irregular reflection of light from the cornea. Rinse ointments away with sterile saline prior to examination of the cornea.*

1. Notify the attending physician if any whitish corneal lesions or purulent discharge is observed.

2. Notify the attending physician if the reflection of the penlight beam is irregular or dull off the cornea surface, or if the cornea appears dull or opaque. Irregular reflection of the penlight beam off the surface of the cornea may be an indication of exposure keratopathy. *(Checking the eyes of patients who are not sedated and ventilated will allow nurses to gain appreciation of the normal appearance of the eye.)*

B. After examination of the corneal surface, the lids should be allowed to close. If the lids do not close, manually close them. Assess the degree of lagophthalmos as described in section C below.

C. Every 8 hours, each eye should be assessed for the degree of lagophthalmos using a penlight or strong flashlight. Close examination is necessary as eyelashes may mask poor lid closure.

1. If eyelids are fully apposed, no treatment is indicated.

2. If any portion of the cornea is visible and the blink rate is less than 1 blink every 10 seconds, instill ocular lubricating ointment (i.e.: Lacrilube[®]) every 4 hours. In addition, a polyethylene moisture chamber should be applied and changed every 8 hours. **See Appendix A and B for instructions for the proper instillation of ocular ointments and application of a polyethylene moisture chamber.** Inform the attending physician.

3. If no portion of the cornea is visible, but there is a presence of conjunctival chemosis, instill ocular lubricating ointment (i.e.: Lacrilube[®]) every 4 hours. In addition, a polyethylene moisture chamber should be applied and changed every

8 hours. See Appendix A and B for instructions for the proper instillation of ocular ointments and application of a polyethylene moisture chamber. Inform the attending physician.

4. If only a portion of the sclera is visible (no portion of the cornea is visible and there is no chemosis), instill ocular lubricating ointment (i.e.: Lacrilube[®]) every 4 hours.

APPENDIX A

Illustrated Instructions for Application of Lubricating Ointments

APPENDIX B

Illustrated Instructions for the Application of a Polyethylene Moisture Chamber