JOINT TRAUMA SYSTEM K9 CLINICAL PRACTICE GUIDELINE

Ocular Injuries (K9 CPG: 15)

This CPG provides a step-by-step approach for the non-ophthalmologist in the initial evaluation and treatment of Military Working Dog (MWD) eye trauma injuries sustained in the combat theater or in remote and austere environments.

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Original publication date:19 Nov 2018 | Publication Date: 30 Dec 2025 | Supersedes: 19 Nov 2018

TABLE OF CONTENTS

SUMMARY OF CHANGES

1. Added background, eye history and teleophthalmology sections for evaluating MWDs with ocular injuries.
2. Elaborated on different ocular injury types (chemical injury, intraocular versus corneal or conjunctival foreign bodies) and added additional types of injuries (hyphema, orbital fracture, open globe injury, thermal burn) with expanded recommended treatment guidelines.
3. Added procedures section with information about continuous irrigation.
4. Added Performance Improvement Monitoring guidelines and Class VIII Appendix.
5. Updated and added new references.

BACKGROUND AND GOALS

Ocular injuries in MWDs in deployed settings will likely include irritant conjunctivitis, corneal ulceration, eyelid lacerations, and penetrating foreign objects. Clinical signs of ocular and periocular injury include eyelid lacerations, swelling of the periorbital tissues or conjunctiva, exudate in the conjunctival sac or on the eyelids, blepharospasm, intense redness of the conjunctiva, epiphora, photophobia, and rubbing the eye. Penetrating foreign objects may be present. Many MWD ocular injuries can be prevented with proper wear of eye protection.

This Clinical Practice Guideline (CPG) provides a framework for delivery of high-quality ophthalmology services in a deployed environment. It provides immediate and urgent care guidelines for MWD ocular injuries to veterinarians and human healthcare providers. Subsequent treatment may require secondary interventions involving veterinary ophthalmologists.

EYE HISTORY

Maintain a high index of suspicion for ocular injuries based on mechanism of injury.

- Blast injury.
- Direct facial and eye trauma.
- Cranial or brain injury.
- Metal on metal mechanisms (metallic fragments can penetrate without obvious signs on exam).
- Compressive blunt force trauma that may lead to a ruptured globe.
- Multisystem trauma that may cause unrecognized ocular trauma due to severity of other injuries.
- Thermal burns, especially to the face.
- Exposure to possible irritants such as smoke, aerosols, or burn pits.

Ask the handler if the MWD's ability to see in varying conditions has changed (i.e., night vision, day vision, stationary versus moving objects).

Ask the handler if the MWD was wearing eye protection at the time of injury.

EYE EXAM

The eye exam must be performed in a way that allows for a detailed but safe eye exam. Some situations will require MWD sedation. (See K9 Analgesia and Anesthesia CPG.)

The eye should be examined from outside to inside.

- External exam – face, bony orbit, eyelids, third eyelid.
- Eye – conjunctiva, cornea, anterior chamber, iris, lens.
- DO NOT attempt ultrasound of the injured eye at Role 1 or 2 (places pressure on the eye).

Additionally, DO NOT do the following:

- Bandage or cover the eye. Make every attempt to keep the MWD from scratching the eye. Consider e-collar or bucket (see K9 Normal Clinical Parameters CPG), improvised bucket or other cones as well as sedation if needed.
- Remove impaled or resistant foreign bodies.
- Repair, enucleate or debride tissue from the eye, if it is severely traumatized.

ASSESSMENT OF VISION

1. Observe the MWD from a distance noting attitude, overall facial symmetry, other wounds, and the ability to navigate in an unfamiliar environment. Presenting vision may be the best predictor of final visual outcome.
2. Minimal restraint should be used during an eye exam. If sedation is used, consider the effects of the pharmacologic agents on the eye exam. Some may decrease tear production or intraocular pressure (IOP), affect pupillary response (i.e., miosis) and may also cause the eye to roll downward with protrusion of the nictitating membrane (third eyelid).
3. Evaluation of ocular movement is achieved by turning the MWD's head from side to side and up and down. This may be done by the provider or handler or accomplished by using a high value reward to encourage the MWD to turn their eyes on their own while the head is held stable.
4. A menace test may be used as a rough assessment of vision. Perform this test by making a menacing gesture toward the eye, being cautious not to cause excessive air currents or touching the eyelashes. Use caution when conducting this test, taking the temperament of the MWD into account.

INTRAOCULAR PRESSURE (IOP)

1. DO NOT put pressure on the eye with a suspected open globe injury. This may increase the risk of extrusion of intraocular contents.
2. DO NOT attempt to check IOP at Role 1 or Role 2 unless experienced with this technique.

PUPILS

Observe for asymmetry of the pupils in both light and dark settings. Test direct and consensual pupillary light reflex (PLR) with a focal light source or use a swinging flashlight test.

TELEOPHTHALMOLOGY

Management of MWD eye injuries is complex. Recommendation is to use the ADVISOR line (833-ADVSRLN [833-238-7756]) or other communication methods to consult with a veterinary clinical specialist (MOS 64F Veterinary Clinical Medicine Officer) as soon as possible. Further consultation may be completed with a veterinary ophthalmologist through the 64F.

Teleophthalmology improves and extends veterinary ophthalmic care to remote or deployed locations. Providing photos at the consultation, if possible, is strongly recommended. Other information that should be provided includes mechanism of injury, any history of eye protection and key examination findings including current visual acuity.

TYPES OF EYE INJURIES

With all types of eye injuries, assess and document vision as soon as possible. If teleophthalmology is possible, initiate consultation. Avoid any of the interventions listed as "DO NOT" perform in the Eye Exam section of this CPG.

Following the treatment protocols listed below, protect the MWD's eye from further injury, and prepare the MWD for medical evacuation (MEDEVAC) to a higher role of care, especially if surgical repair is indicated. Vision-threatening injuries should always be evacuated.

> ***IMPORTANT!*** *When protecting the MWD's eye, DO NOT attempt to bandage or cover the eye. Make every attempt to keep the MWD from scratching the eye and periorbital area. An Elizabethan collar (e-collar) or similar device (such as a bucket) should be used. (See K9 Normal Clinical Parameters CPG.)*

CHEMICAL INJURY

With this type of injury, epithelial defect(s) of the cornea or conjunctiva are typically noted. There may also be conjunctival hyperemia and chemosis.

Management

1. Begin irrigation immediately. Irrigate with normal saline or Lactated Ringer's Solution (LRS). It is acceptable to use water or any neutral irrigation solution if saline or LRS is not available. A Morgan lens can be used, if available, or a nasal cannula hooked to intravenous (IV) tubing for continuous irrigation. Use a minimum of two liters for irrigation if unable to check pH. Some chemical injuries require up to 10 liters.
2. Apply topical anesthesia with tetracaine, proparacaine or lidocaine as needed to maintain MWD comfort during irrigation.
3. DO NOT try to neutralize acid with base, or base with acid.
4. Remove visible acidic or basic foreign bodies with a cotton-tipped applicator (CTA). Inspect conjunctival fornices and behind the third eyelid for retained foreign bodies. Irrigate or sweep the fornices with a CTA.
5. Assess and document vision if possible.
6. Stain with fluorescein and illuminate with cobalt blue light if available.
7. If superficial corneal ulcer (fluorescein stain positive), start a first line topical antibiotic such as:
    - Neomycin/polymyxin B/bacitracin zinc ophthalmic ointment: ¼" strip into the affected eye(s) Q8 hours
    - Tobramycin solution: 2 drops in the affected eye(s) Q6 hours
8. If stromal corneal ulcer (fluorescein positive with signs of infection), start second line topical antibiotic such as:
    - Ofloxacin ophthalmic solution: 1 drop in the affected eye(s) Q6 hours
9. If no corneal ulcer is present (fluorescein stain negative), start topical lubricants:
    - Eye lubricant ointment (preservative free is preferred): ¼" strip into the affected eye(s) Q6-8 hours
10. Provide sedation and analgesia:
    - Trazodone (anti-anxiety): 3 – 7 mg/kg PO Q8-12 hours
    - Gabapentin (sedation and pain): 5 – 10 mg/kg PO Q8-12 hours
    - Carprofen (pain; NSAID): 2.2 mg/kg PO Q12 hours or 4.4 mg/kg PO Q24 hours
    - Only in patients without history of kidney disease, liver disease and gastric ulcers. Stop immediately if patients show gastrointestinal clinical signs (e.g. vomiting or diarrhea).
11. Protect the eye and MEDEVAC the MWD if indicated based on clinical signs and consultation.

HYPHEMA

An MWD with this injury will have blood (can be clotted) in the anterior chamber. If the eye appears like an "8-ball" or "black ball," this is blood filling the anterior chamber of the eye.

Management

1. Rule out an open globe injury.
2. Assess and document vision if possible.
3. If superficial or stromal corneal ulcer noted, treated as outlined under Chemical Injury section.
4. If no corneal ulcer is present, start topical steroid - Prednisolone acetate 1%: 1 drop in the affected eye(s) Q6-8 hours
5. Provide sedation and analgesia as needed (as outlined under Chemical Injury section).
6. Cage rest the MWD with head elevated 30 degrees, if possible.
7. Protect the eye and MEDEVAC if indicated based on clinical signs and consultation.

EYELID LACERATION

Note if the laceration involves the eyelid margin or the nasolacrimal system.

Management

1. Assess and document vision if possible.
2. Assess and treat any identified corneal ulcers as noted under Chemical Injury section above.
3. If no corneal ulcer is present, and unable to fully close the eyelids to protect the cornea, start topical lubricants.
4. Provide sedation and analgesia as outlined in the Chemical Injury section.
5. Seek teleophthalmology consultation with veterinary ophthalmologist or veterinary surgeon if possible.
6. Unless experienced, delay definitive repair for laceration involving the eyelid margin for surgery by an experienced veterinarian or veterinary ophthalmologist. DO NOT repair in the presence of an open globe injury.
    a. If experienced, full thickness eyelid lacerations should be closed in two layers, with the MWD under deep sedation with local anesthesia or under general anesthesia. (See K9 Analgesia and Anesthesia CPG.)
    b. First, close the deep layer consisting of muscle and subcutaneous tissue with 5-0 or 6-0 braided absorbable suture in a simple continuous pattern.
    c. Next, close the skin. Monofilament absorbable or non-absorbable suture can be used, or the same suture that was used to close the deep layer can also be used. To align the eyelid margin, a figure-of-8 suture may be used to obtain correct apposition. If a simple interrupted suture is used at the eyelid margin, ensure that the suture tails do not rub the cornea.

        NOTE: *Larger suture sizes, such as 3-0 or 4-0, can be used in operational environments if smaller sizes are not available.*

ORBITAL FRACTURE

This injury often occurs with blunt force trauma to the head, or with exposure to a blast. Always stabilize the K9 first if there are signs of head trauma or systemic manifestations of blast injuries before addressing orbital fractures.

There may be a step defect in the orbital rim (defect palpated resulting from fracture of bony outer edges of the eye socket), restricted eye movements, enophthalmos (affected eye is further back in the orbit compared to the opposite eye), hypoglobus (the affected eye is lower compared to the opposite eye), or subcutaneous or conjunctival emphysema.

Maintain high suspicion for an open globe injury.

Management

1. Urgent repair is required when clinical evidence of extraocular muscle entrapment with non-resolving bradycardia, heart block, nausea, vomiting, or syncope (oculocardiac reflex).
2. Assess and document vision if possible.
3. If superficial or stromal corneal ulcers noted, treat as outlined in the Chemical Injury section above. If no ulcers, start topical lubricants. Provide sedation and analgesia.
4. Consider systemic antibiotics (amoxicillin-clavulanic acid 13.75 mg/kg PO Q12 hours) if sinusitis or dirty wound.
5. Protect the globe and evacuate the MWD.

CORNEAL ABRASION

An epithelial defect will be noted on the cornea. There should not be any infiltrate (whitish opacity on the cornea). White or yellow infiltrates and stromal loss indicate infection or inflammation of the cornea. The cornea will have positive fluorescein uptake when illuminated with cobalt blue light if available.

Management

1. Administer medications as indicated in the Chemical Injury section above if superficial or stromal corneal ulcers are identified, along with systemic sedation and analgesia.
2. DO NOT use topical corticosteroids.
3. The MWD must not be able to rub or scratch the eye. An e-collar or similar device can be used. (See K9 Normal Clinical Parameters CPG.)

OPEN GLOBE INJURY

Mechanism

Lacerations from penetrating or perforating trauma, ruptured globe from blunt trauma.

Exam Findings

- Collapsed or severely distorted eye.
- Open wound, full-thickness corneal or scleral laceration.
- Shallow anterior chamber.
- Irregularly shaped or miotic pupil.
- Prolapse of intraocular contents outside the eye (dark tissue is iris or uveal tissue).
- Subconjunctival hemorrhage, especially if 360 degrees.

Management

1. Assess and document vision (specifically dazzle, and direct or indirect PLRs) when possible.
2. Early telemedicine consultation with 64F veterinarian or eye surgeon.
3. MEDEVAC the MWD for urgent surgical repair within 24 hours when possible.
4. Keep MWD fasted on cage rest. Elevate head 30 degrees if possible. Avoid any maneuvers that may increase IOP. Use caution with the use of collars or anything around the neck of an MWD that may cause an issue. Utilization of a harness is recommended, if available.
5. Start systemic antibiotics (amoxicillin-clavulanic acid 13.75 mg/kg PO Q12 hours).
6. Treat nausea and vomiting aggressively (ondansetron 1 mg/kg IV Q12).
7. Provide sedation and analgesia (see Chemical Injury section above). If additional pain management is needed, refer to the K9 Analgesia and Anesthesia CPG.
8. Remember, DO NOT:
    - Put pressure on the eye.
    - Attempt ultrasound of the eye.
    - Attempt to repair, enucleate the eye or debride tissue.

INTRAOCULAR FOREIGN BODY (IOFB)

Mechanism

Various, but have high index of suspicion if blast injury, shrapnel, or metal-on-metal injury.

Exam Findings

Penetrating or perforating site(s) in the sclera or cornea or a hole in the iris. Findings may be subtle. If there is an intraorbital foreign body, it may be visible on exam or identified on diagnostic imaging such as radiographs or CT.

Management

1. Assess and document vision if possible and seek telemedicine consultation.
2. Protect the globe and MEDEVAC for urgent surgical repair within 24 hours if possible.
3. Keep MWD fasted on cage rest. Elevate head 30 degrees if possible. Avoid any maneuvers that may increase IOP.
4. Start systemic antibiotics (amoxicillin-clavulanic acid 13.75 mg/kg PO Q12 hours).
5. Treat nausea and vomiting aggressively (ondansetron 1 mg/kg IV Q12).
6. Provide sedation and analgesia as needed to maintain patient comfort. (Refer to K9 Anesthesia and Analgesia CPG.)
7. Remember, DO NOT attempt to remove the IOFB or put pressure on the eye.
8. For intraorbital foreign bodies, DO NOT remove impaled or resistant foreign bodies.

CORNEAL & CONJUNCTIVAL FOREIGN BODIES

Will most likely see the corneal or conjunctival foreign body on exam (but not always). If the foreign body is metallic, may see a rust ring.

Management

1. Suspected foreign bodies may be irrigated away or removed with a moistened CTA under topical anesthesia (such as proparacaine or tetracaine drops).
    a. **NOTE:** Remember to inspect the conjunctival fornix and behind the third eyelid for retained foreign bodies. Irrigate or sweep with a CTA.
2. Start second line topical ophthalmic antibiotic: Ofloxacin ophthalmic solution: 1 drop in the affected eye(s) Q6 hours
3. DO NOT remove impaled or resistant foreign bodies.
4. Perform telemedicine consultation, protect the globe and MEDEVAC the MWD if foreign body cannot be removed easily with minor injury.

THERMAL BURN

- This injury is usually associated with a facial burn, eyelid burn, and eyelash loss.

Management

1. If unable to close the eyelids, start eye lubricant ointment to prevent eye exposure. Apply Q 2-4 hours.
2. Protect the eye and MEDEVAC the MWD if indicated based on telemedicine consultation.

PROCEDURES

CONTINUOUS IRRIGATION USING NASAL CANNULA

1. Instill topical anesthetic (0.5% proparacaine or 0.5% tetracaine) to traumatized eye(s).

2. Hang irrigation fluid (prefer normal saline or LRS) on IV pole inside pressure infusion bag and prepare to infuse by priming the fluid lines and connecting to the nasal cannula.
3. Position the nasal cannula on the MWD's forehead so that the prongs provide continuous irrigation into both eyes. Run continuous irrigation with lines all the way open until a neutral pH point is achieved (pH 7.0 – 7.5). If not able to measure pH with pH paper or urine dipstick strips, irrigate with a minimum of 2 liters of fluid.

PERFORMANCE IMPROVEMENT (PI) MONITORING

POPULATION OF INTEREST

All MWDs with diagnosis of ocular injuries.

INTENT (EXPECTED OUTCOMES)

- Survival from mechanism of ocular injury.
- Maintained structural integrity of the globe and associated cranial structures.
- Maintained visual integrity.
- Proper documentation of ocular injury event in MWDs medical record.

PERFORMANCE / ADHERENCE MEASURES

- Number and percentage of patients in the population of interest (deployed MWDs) that sustained an ocular injury.
    - Document how many of these MWD were wearing protective eyewear.
- Specify what component of the eye was injured, if possible.
    - Internal structures (such as lens, retina).
    - Globe (such as sclera, cornea).
    - Periocular tissues (such as conjunctiva, third eyelid).
    - Orbit (bony structures).
- Number and percentage of patients that required follow-on specialty ophthalmology care, if known.
- Number and percentage of patients in the population of interest (deployed MWDs) that recovered from ocular injury event.
    - Number and percentage of MWDs that returned to duty versus those that were medically retired following the ocular injury event.

DATA SOURCE

- Patient Record
- Department of Defense MWD Trauma Registry

SYSTEM REPORTING & FREQUENCY

- The above constitutes the minimum criteria for PI monitoring of this K9 CPG. System reporting will be performed annually; additional PI monitoring and system reporting may be performed as needed.
- The system review and data analysis will be performed by direction of the K9C4 Chair.

REFERENCES

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APPENDIX A: CLASS VIII MEDICAL MATERIEL

Based on the CPG below is an extensive list of supplies for managing ocular injuries.

Personal Protective Equipment (PPE)

- Nitrile gloves

Initial Assessment Equipment

- K9-size muzzle (soft, adjustable)

Ophthalmic Examination Supplies

- Ophthalmoscope, penlight or small LED light
- Fluorescein dye strips
- Sterile saline for eye irrigation
- Cotton-tipped applicators
- Tonopen or rebound tonometer
- pH paper

Irrigation Supplies

- 500-1000 mL sterile saline or LRS
- IV administration set or irrigation tubing
- 10-60 mL syringes
- Eye wash bottle or Morgan lens (if available/appropriate)
- Gauze sponges (2x2 or 4x4)

Foreign Body Removal Tools

- Sterile cotton swabs
- Sterile eyewash solution

Protection Supplies

- Elizabethan collar (e-collar) or similar device (bucket)
- Elastic wrap (VetWrap or equivalent)
- Tape (silk or medical adhesive)

Documentation Supplies

- K9TCCC Card (DD 3073)
- Permanent marker
- Camera (tablet/phone) for wound documentation

Medications

Topical Ophthalmic Agents

- Proparacaine 0.5%, tetracaine, lidocaine (topical anesthetic)
- Broad-spectrum ophthalmic antibiotic ointment (e.g., tobramycin)
- Triple antibiotic ophthalmic ointment
- Ofloxacin ophthalmic drops (if needed)
- Eye lubricant ointment (preservative free is preferred)
- Topical steroid (e.g. prednisolone acetate 1%)

Systemic Medications

- NSAIDs (e.g. carprofen, meloxicam)
- Opioid analgesics (e.g., fentanyl, morphine, hydromorphone)
- Sedatives for exam/treatment (e.g. trazodone, gabapentin, midazolam, dexmedetomidine, ketamine)
- Antibiotics (amoxicillin-clavulanic acid)
- Ondansetron

Surgical Supplies

- Minor surgical kit
- Suture material (5-0 to 6-0 braided absorbable suture or 3-0 to 4-0 monofilament absorbable and non-absorbable suture)
- Lidocaine for nerve blocks
- Ophthalmic surgical instruments (if available)
- Required medications for sedation and general anesthesia for K9

For additional information including National Stock Number (NSN), please contact dha.ncr.med-log.list.lpr-cps@health.mil
***DISCLAIMER**: This is not an exhaustive list. These are items identified to be important for the care of combat casualties.*