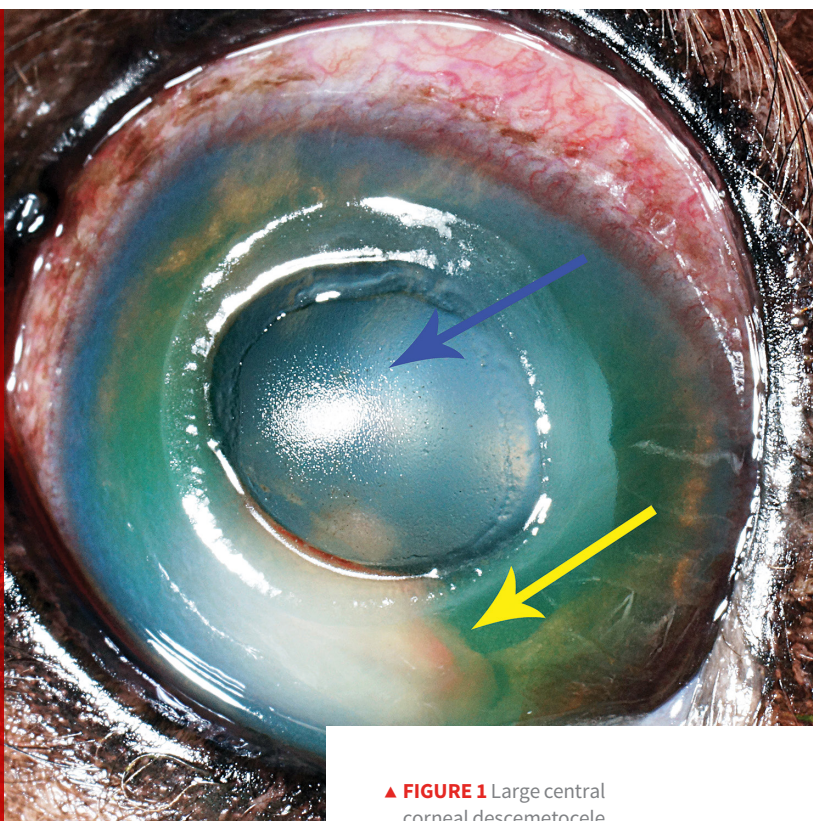


Top 5 Canine Ophthalmologic Emergencies

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▲ **FIGURE 1** Large central corneal descemetocele (blue arrow) with hypopyon (yellow arrow). Corneal vascularization, edema, and conjunctival hyperemia are also present.

Prompt, accurate recognition and treatment (or referral) of canine ophthalmologic emergencies are of paramount importance. Early and correct identification and treatment of an abnormality could mean the difference between a patient losing its vision or the clinician being able to salvage vision and, in many instances, the globe itself. This article discusses 5 of the top canine ophthalmologic emergencies seen in general practice.

1 Descemetocele & Corneal Rupture

A descemetocele is an extremely deep corneal ulcer in which the corneal epithelium and stroma have been completely eroded, leaving only Descemet's membrane and corneal endothelium (**Figure 1**).¹ A descemetocele typically occurs after a corneal ulcer has become infected with a corneal infiltrate (eg, bacterium, fungus), which results in stromal erosion extending deep into Descemet's membrane. When Descemet's membrane (usually 3-12 μm thick¹) fractures, a corneal rupture can occur. Diagnostic testing should include menace response, dazzle reflex, pupillary light reflexes (direct and consensual), fluorescein staining, and Schirmer tear testing. In addition, corneal culture and susceptibility testing should be conducted.

TOP 5 CANINE OPHTHALMOLOGIC EMERGENCIES

1. Descemetocele & Corneal Rupture
2. Proptosis
3. Corneal Laceration
4. Anterior Lens Luxation
5. Acute Glaucoma

Tonometry is typically avoided because of the potential for corneal rupture.

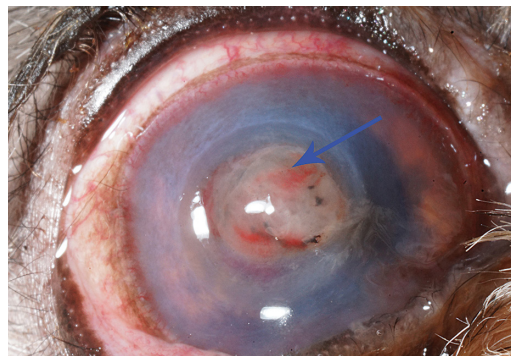
A full-thickness corneal rupture can result in aqueous humor loss and, occasionally, iris prolapse, hyphema, corneal fibrin clot, and/or decreased depth of the anterior chamber (**Figure 2**).¹ If the rupture is not addressed quickly, bacterial contamination of the anterior chamber can occur, resulting in endophthalmitis, which carries a poor prognosis for vision and saving the globe.^{1,2} In affected patients, diagnostic testing should consist of menace response, dazzle reflex, pupillary light reflexes (direct and consensual), and fluorescein staining. Schirmer tear testing is typically avoided, as the test strip can dislodge a fibrin clot. Tonometry is avoided because of the potential risk for re-injuring a sealed corneal rupture; however, cytology and corneal culture and susceptibility testing should be conducted.

In general, an Elizabethan collar is recommended as a preventive measure in patients with corneal rupture or rerupture. Topical fluoroquinolone treatment can also be initiated. In addition, a topical mydriatic such as atropine should be administered q24h to facilitate mydriasis and improve patient comfort. In the case of corneal rupture, amoxicillin-clavulanic acid (13.75 mg/kg PO q12h³) is advantageous because it can reach therapeutic levels in the anterior chamber.³ Carprofen (2.2 mg/kg PO q12h⁴) is also indicated as an anti-inflammatory. In addition, immediate referral to a board-certified ophthalmologist should be recommended, along with consideration of options such as conjunctival pedicle grafting, corneoconjunctival transposition, corneal transplantation, or corneal collagen extracellular matrix grafting.¹

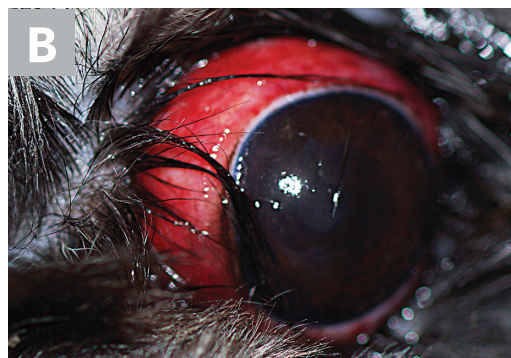
2 Proptosis

Proptosis is forward displacement of the globe with simultaneous entrapment of the eyelids behind the equator

of the globe (**Figure 3**).^{5,6} The condition occurs more often in brachycephalic breeds^{6,7}; of note, considerably greater trauma is necessary to cause proptosis in dolichocephalic breeds.



▲ **FIGURE 2** Central corneal rupture with fibrin clot (blue arrow), corneal edema, iris prolapse, hyphema, corneal vascularization, edema, and conjunctival hyperemia



▲ **FIGURE 3** Proptosis showing the eyelids trapped behind the equator of the globe. (A) A miotic pupil, common following proptosis, subconjunctival hemorrhages (blue arrow), and (B) hyperemia are also evident.

A traumatic incident that can cause blindness, desiccation of the cornea, and corneal ulceration, proptosis requires immediate attention,⁶ including initiation of pain medications (eg, carprofen [2.2 mg/kg PO q12h⁴], tramadol [2-4 mg/kg PO q8h]).

Globes should be salvaged when possible. If more than 2 extraocular muscles are avulsed, the globe should usually be removed, as proper innervation and vascular supply have been compromised. Often, patients with

scleral ruptures are candidates for enucleation when the globe develops hyphema, prognosis for return to vision is grave, or the eye remains painful.^{6,8} Furthermore, in the author's experience, small scleral tears may result in hyphema, requiring globe replacement; these patients will require acute pain medication for an extended period (eg, 4-6 weeks), and although the globe may become phthisical, owners often are pleased with the cosmetic result.⁹

Diagnostic testing (eg, menace response, dazzle reflex, pupillary light reflexes [direct and consensual], Schirmer tear testing, tonometry, fluorescein staining) is important in deciding whether the globe can be salvaged or should be removed. Patients have a grave prognosis for return of vision if they lack dazzle and consensual pupillary light reflexes and have intraocular pressures (IOPs) >25 mm Hg (ie, glaucoma).

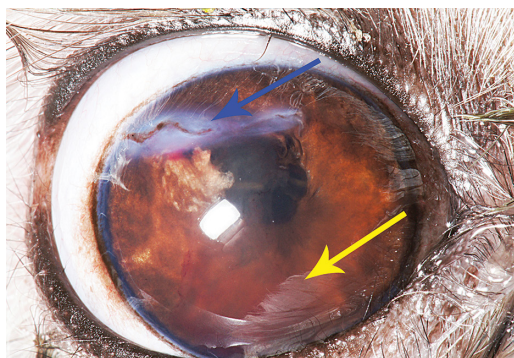
If the owner is reluctant to make a decision after all options have been discussed, the globe can be replaced and secured with a temporary tarsorrhaphy, then removed later if necessary. This temporary procedure should be performed with the patient under general anesthesia, using stents (eg, IV tubing) and 4-0 to 2-0 monofilament nonabsorbable suture.⁶

Approximately 20% of dogs with proptosis will regain or retain vision in the proptosed eye.⁵⁻⁷

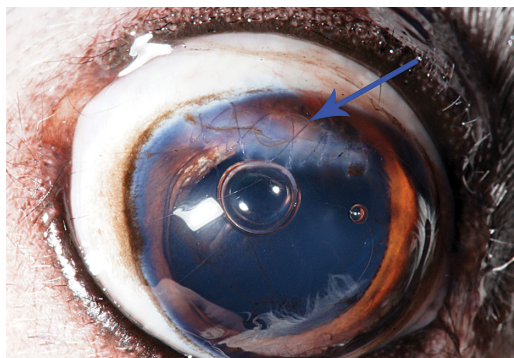
3 Corneal Laceration

A full-thickness corneal laceration can be devastating. Reported causes have included laceration by cat claw,⁹ along with contact with a stick or other vegetative foreign body. Potential sequelae can include anterior chamber collapse, hyphema, hypopyon, iris prolapse, cataract, uveitis, and endophthalmitis (Figure 4).¹⁰

IOP = intraocular pressure



▲ **FIGURE 4** This cornea was lacerated horizontally (via cat claw) in the dorsal aspect (blue arrow). Iris prolapse, dyscoria resulting from the laceration, fibrin, and hyphema (yellow arrow) are present.



▲ **FIGURE 5** Postoperative appearance of the same eye shown in Figure 4 after repair of the corneal laceration; a bootlace pattern of 8-0 polyglactin 910 suture was used to close the wound (blue arrow). The bubbles visible in the anterior chamber are of minimal significance, as they will resolve in <12 hours and cause no consequence to the eye.

A menace response, dazzle reflex, pupillary light reflexes (direct and consensual), fluorescein staining, and Seidel test should be performed. Referral to an ophthalmologist is critical for reinflation of the anterior chamber, closure of the laceration, and examination of the lens for lens capsule rupture and cataract formation.¹¹ Surgery should be performed with proper microsurgical instrumentation, magnification, and expertise (*Figure 5*, previous page). If a cataract is present from the laceration, referral for phacoemulsification should be considered at the time of corneal laceration repair.

4 Anterior Lens Luxation

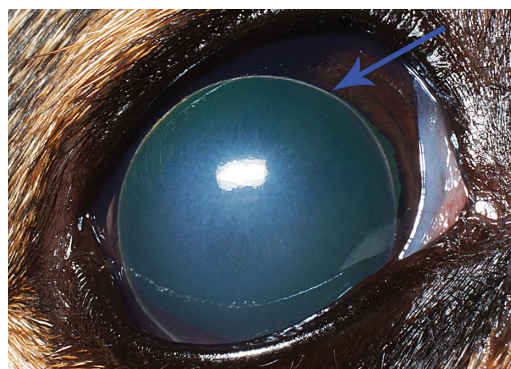
Anterior lens luxation is a result of the crystalline lens moving from the patellar fossa in front of the iris and into the anterior chamber (*Figure 6*).¹² Causes can vary and be primary, secondary, congenital, or traumatic.¹² Primary lens luxation generally occurs in terrier breeds, although the shar-pei is also overrepresented.¹² Secondary lens luxation may be associated with buphthalmos of the globe, which is attributable to glaucoma or chronic lens-induced uveitis secondary to cataract formation.¹² Traumatic lens luxation has typically been implicated in cases of blunt trauma and, in the author's experience, most frequently occurs in animals hit by an automobile.⁹ Unresolved anterior lens luxation can lead to rapid increase in IOP, which can result in irreversible blindness and pain.¹² In addition, corneal edema can develop when the lens contacts the endothelium.¹² Finally, the constant intraocular movement of the lens can cause secondary glaucoma and microtrauma to other intraocular structures.¹²

When evaluating patients with anterior lens luxation, it is important to perform a menace response, dazzle reflex test, pupillary light reflexes (direct and consensual) test, Schirmer tear test, and tonometry. In

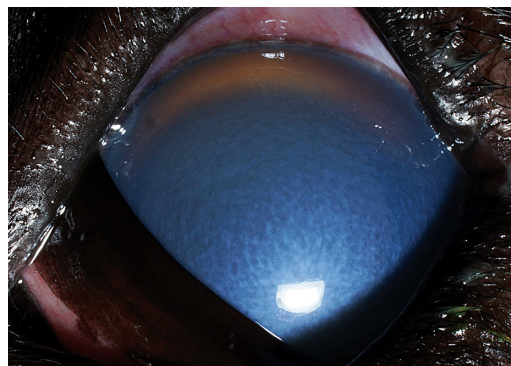
patients with glaucoma, topical carbonic anhydrase inhibitors and β -blockers (eg, dorzolamide–timolol drops q8h) should be administered, whereas miotics (eg, pilocarpine, latanoprost) are contraindicated because they can severely increase IOP. Referral is recommended for evaluation of anterior lens luxation and to discuss such options as lensectomy.

5 Acute Glaucoma

Primary acute glaucoma involves acute increase in intraocular pressure that can result in vision loss.¹³



▲ **FIGURE 6** Visualization of the equator of the lens (blue arrow), a hallmark feature of an anterior lens luxation, as well as posterior displacement of the dyscopic pupil are key in detecting anterior lens luxation.



▲ **FIGURE 7** Acute glaucoma in a Great Dane. Note the severe corneal edema, conjunctival hyperemia, and mydriasis. In addition to being a defining clinical sign of glaucoma, the presence of mydriasis suggests clinical evidence of the condition, which can be especially helpful when tonometry is not available.

IOP = intraocular pressure

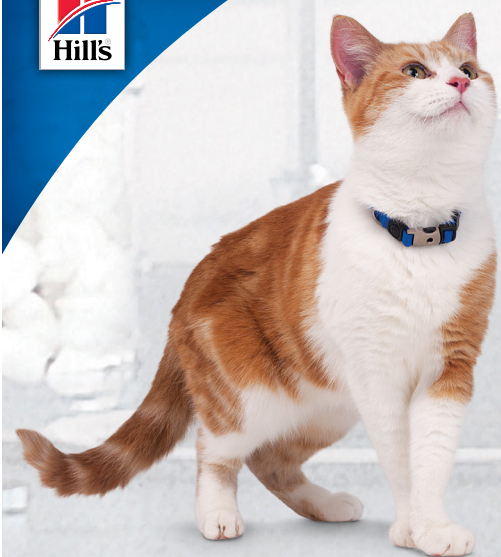
Primary acute glaucoma typically occurs in dogs affected by primary glaucoma. Clinical signs include IOP >25 mm Hg, episcleral injection, corneal edema, loss of menace response, potential loss of dazzle reflex, and mydriatic pupil (**Figure 7**).¹³ Initial diagnostics should examine menace response, dazzle reflex, pupillary light reflexes (direct and consensual), and tonometry.

Therapeutics should not only lower but also maintain lowered IOP, along with vision and comfort. Mannitol (20%) can be administered at 1-2 g/kg IV over 30 minutes.¹³⁻¹⁵ Topical dorzolamide-timolol inhibitors (eg, dorzolamide q8h) as well as prostaglandin analogues (eg, latanoprost q12h) may also be indicated to lower IOP. These patients can be managed in-house until IOP is within normal limits. Both IOP and vision response should be re-examined within a week. In addition, adjunctive analgesics (eg, carprofen 2.2 mg/kg PO q12h,⁴ tramadol 2-4 mg/kg PO q8h¹⁶) may be necessary. Consultation with an ophthalmologist is helpful to determine a preferred course of therapy and medical and surgical options. ■

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NexGard® (afoxolaner) Chewables

CAUTION: Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

Description:

NexGard® (afoxolaner) is available in four sizes of beef-flavored, soft chewables for oral administration to dogs and puppies according to their weight. Each chewable is formulated to provide a minimum afoxolaner dosage of 1.14 mg/lb (2.5 mg/kg). Afoxolaner has the chemical composition 1-Naphthalenecarboxamide, 4-[5-[3-chloro-5-(trifluoromethyl)-phenyl]-4,5-dihydro-5-(trifluoromethyl)-3-isoxazolyl]-N-[2-oxo-2-(2,2,2-trifluoroethyl)amino]ethyl.

Indications:

NexGard kills adult fleas and is indicated for the treatment and prevention of flea infestations (*Ctenocephalides felis*), and the treatment and control of Black-legged tick (*Ixodes scapularis*), American Dog tick (*Dermacentor variabilis*), Lone Star tick (*Amblyomma americanum*), and Brown dog tick (*Rhipicephalus sanguineus*) infestations in dogs and puppies 8 weeks of age and older, weighing 4 pounds of body weight or greater, for one month.

Dosage and Administration:

NexGard is given orally once a month, at the minimum dosage of 1.14 mg/lb (2.5 mg/kg).

Dosing Schedule:

Body Weight	Afoxolaner Per Chewable (mg)	Chewables Administered
4.0 to 10.0 lbs.	11.3	One
10.1 to 24.0 lbs.	28.3	One
24.1 to 60.0 lbs.	68	One
60.1 to 121.0 lbs.	136	One
Over 121.0 lbs.	Administer the appropriate combination of chewables	

NexGard can be administered with or without food. Care should be taken that the dog consumes the complete dose, and treated animals should be observed for a few minutes to ensure that part of the dose is not lost or refused. If it is suspected that any of the dose has been lost or if vomiting occurs within two hours of administration, redose with another full dose. If a dose is missed, administer NexGard and resume a monthly dosing schedule.

Flea Treatment and Prevention:

Treatment with NexGard may begin at any time of the year. In areas where fleas are common year-round, monthly treatment with NexGard should continue the entire year without interruption.

To minimize the likelihood of flea reinfestation, it is important to treat all animals within a household with an approved flea control product.

Tick Treatment and Control:

Treatment with NexGard may begin at any time of the year (see **Effectiveness**).

Contraindications:

There are no known contraindications for the use of NexGard.

Warnings:

Not for use in humans. Keep this and all drugs out of the reach of children. In case of accidental ingestion, contact a physician immediately.

Precautions:

The safe use of NexGard in breeding, pregnant or lactating dogs has not been evaluated. Use with caution in dogs with a history of seizures (see **Adverse Reactions**).

Adverse Reactions:

In a well-controlled US field study, which included a total of 333 households and 615 treated dogs (415 administered afoxolaner, 200 administered active control), no serious adverse reactions were observed with NexGard.

Over the 90-day study period, all observations of potential adverse reactions were recorded. The most frequent reactions reported at an incidence of > 1% within any of the three months of observations are presented in the following table. The most frequently reported adverse reaction was vomiting. The occurrence of vomiting was generally self-limiting and of short duration and tended to decrease with subsequent doses in both groups. Five treated dogs experienced anorexia during the study, and two of those dogs experienced anorexia with the first dose but not subsequent doses.

Table 1: Dogs With Adverse Reactions.

	Treatment Group			
	Afoxolaner		Oral active control	
	N ¹	% (n=415)	N ²	% (n=200)
Vomiting (with and without blood)	17	4.1	25	12.5
Dry/Flaky Skin	13	3.1	2	1.0
Diarrhea (with and without blood)	13	3.1	7	3.5
Lethargy	7	1.7	4	2.0
Anorexia	5	1.2	9	4.5

¹Number of dogs in the afoxolaner treatment group with the identified abnormality.

²Number of dogs in the control group with the identified abnormality.

In the US field study, one dog with a history of seizures experienced a seizure on the same day after receiving the first dose and on the same day after receiving the second dose of NexGard. This dog experienced a third seizure one week after receiving the third dose. The dog remained enrolled and completed the study. Another dog with a history of seizures had a seizure 19 days after the third dose of NexGard. The dog remained enrolled and completed the study. A third dog with a history of seizures received NexGard and experienced no seizures throughout the study.

To report suspected adverse events, for technical assistance or to obtain a copy of the MSDS, contact Merial at 1-888-637-4251 or www.merial.com/NexGard. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at <http://www.fda.gov/AnimalVeterinary/SafetyHealth>.

Mode of Action:

Afoxolaner is a member of the isoxazoline family, shown to bind at a binding site to inhibit insect and acarine ligand-gated chloride channels, in particular those gated by the neurotransmitter gamma-aminobutyric acid (GABA), thereby blocking pre- and post-synaptic transfer of chloride ions across cell membranes. Prolonged afoxolaner-induced hyperexcitation results in uncontrolled activity of the central nervous system and death of insects and acarines. The selective toxicity of afoxolaner between insects and acarines and mammals may be inferred by the differential sensitivity of the insects and acarines' GABA receptors versus mammalian GABA receptors.

Effectiveness:

In a well-controlled laboratory study, NexGard began to kill fleas four hours after initial administration and demonstrated >99% effectiveness at eight hours. In a separate well-controlled laboratory study, NexGard demonstrated 100% effectiveness against adult fleas 24 hours post-infestation for 35 days, and was > 83% effective at 12 hours post-infestation through Day 21, and on Day 35. On Day 28, NexGard was 81.1% effective 12 hours post-infestation. Dogs in both the treated and control groups that were infested with fleas on Day -1 generated flea eggs at 12- and 24-hours post-treatment (0-11 eggs and 1-17 eggs in the NexGard treated dogs, and 4-90 eggs and 0-118 eggs in the control dogs, at 12- and 24-hours, respectively). At subsequent evaluations post-infestation, fleas from dogs in the treated group were essentially unable to produce any eggs (0-1 eggs) while fleas from dogs in the control group continued to produce eggs (1-141 eggs).

In a 90-day US field study conducted in households with existing flea infestations of varying severity, the effectiveness of NexGard against fleas on the Day 30, 60 and 90 visits compared with baseline was 98.0%, 99.7%, and 99.9%, respectively. Collectively, the data from the three studies (two laboratory and one field) demonstrate that NexGard kills fleas before they can lay eggs, thus preventing subsequent flea infestations after the start of treatment of existing flea infestations.

In well-controlled laboratory studies, NexGard demonstrated >97% effectiveness against *Dermacentor variabilis*, >94% effectiveness against *Ixodes scapularis*, and >93% effectiveness against *Rhipicephalus sanguineus*, 48 hours post-infestation for 30 days. At 72 hours post-infestation, NexGard demonstrated >97% effectiveness against *Amblyomma americanum* for 30 days.

Animal Safety:

In a margin of safety study, NexGard was administered orally to 8 to 9-week-old Beagle puppies at 1, 3, and 5 times the maximum exposure dose (6.3 mg/kg) for three treatments every 28 days, followed by three treatments every 14 days, for a total of six treatments. Dogs in the control group were sham-dosed. There were no clinically-relevant effects related to treatment on physical examination, body weight, food consumption, clinical pathology (hematology, clinical chemistry, or coagulation tests), gross pathology, histopathology or organ weights. Vomiting occurred throughout the study, with a similar incidence in the treated and control groups, including one dog in the 5x group that vomited four hours after treatment.

In a well-controlled field study, NexGard was used concomitantly with other medications, such as vaccines, anthelmintics, antibiotics (including topicals), steroids, NSAIDs, anesthetics, and antihistamines. No adverse reactions were observed from the concomitant use of NexGard with other medications.

Storage Information:

Store at or below 30°C (86°F) with excursions permitted up to 40°C (104°F).

How Supplied:

NexGard is available in four sizes of beef-flavored soft chewables: 11.3, 28.3, 68 or 136 mg afoxolaner. Each chewable size is available in color-coded packages of 1, 3 or 6 beef-flavored chewables.

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