Fluorophotometric and tonometric evaluation of ocular effects following aqueocentesis performed with needles of various sizes in dogs

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Objective—To measure ocular effects (blood-aqueous barrier breakdown and intraocular pressure [IOP]) following aqueocentesis performed with needles of various sizes in dogs.

Animals—28 healthy adult dogs.

Procedures—24 dogs underwent unilateral aqueocentesis (24 treated eyes and 24 contralateral untreated eyes); 25-, 27-, or 30-gauge needles were used in 3 treatment groups (n = 8/group). Four dogs were untreated controls. Aqueocentesis was performed during sedation and topical anesthesia. Anterior chamber fluorophotometry was performed before and after aqueocentesis on day 1. On days 2 through 5, sedation and fluorophotometry were repeated. Intraocular pressure was measured with a rebound tonometer at multiple time points.

Results—Aqueocentesis resulted in blood-aqueous barrier breakdown detected via fluorophotometry in all treated eyes, with barrier reestablishment by day 5. On day 2, the contralateral untreated eyes of all 3 groups also had significantly increased fluorescence. Use of a 25-gauge needle resulted in a significant increase in treated eyes’ anterior chamber fluorescence on days 3 and 5 as well as a significant increase in IOP 20 minutes following aqueocentesis, compared with the other treatment groups.

Conclusions and Clinical Relevance—Aqueocentesis performed with a 25-gauge needle resulted in the greatest degree of blood-aqueous barrier breakdown and a brief state of intraocular hypertension. Use of a 27- or 30-gauge needle is recommended for aqueous paracentesis. A consensual ocular reaction appeared to occur in dogs following unilateral traumatic blood-aqueous barrier breakdown and may be of clinical importance. (Am J Vet Res 2011;72:556–561)

Ocular anterior chamber paracentesis (ie, aqueocentesis) is a commonly performed procedure in which aqueous humor fluid is removed from the eye. Aqueocentesis is used in clinical practice for diagnostic and therapeutic purposes. It may be performed in dogs with anterior chamber disease to collect a sample of material for diagnostic purposes. It is also used as adjunct therapy in the emergency management of glaucoma to protect the retina from the harmful effects of high IOP. Aqueocentesis is accomplished by inserting a 25- to 30-gauge hypodermic needle through the limbal cornea into the anterior chamber, with the needle passing parallel to the iris while avoiding contact with the iris, lens, or corneal endothelium. With proper patient preparation and aqueocentesis technique, the risk of complications is exceedingly low, but could include keratitis, cataract, or even endophthalmitis. It is important to note that aqueocentesis inevitably causes intraocular inflammation by inducing breakdown of the blood-aqueous barrier. For this reason, anterior chamber paracentesis has been used as a model of intraocular inflammation for research investigations in a variety of species.

The ocular blood-aqueous barrier is formed by the endothelium of the iris blood vessels, the nonpigmented layer of the ciliary epithelium, and the posterior pigmented epithelium of the iris. These structures normally prevent substances in the blood from entering the eye. When the barrier is disrupted, the blood vessels dilate and plasma proteins leak into the aqueous humor. Common causes of blood-aqueous barrier breakdown are anterior uveitis, ocular surgery, trauma, aqueous paracentesis, and ocular irritants. Blood-aqueous barrier breakdown can be assessed by subjective ophthalmic examination by use of a time-honored semiquantitative grading scheme, with aqueous flare indicating protein-
rich aqueous humor.20 Objective techniques that allow for more accurate evaluation of blood-aqueous barrier compromise include fluorophotometry, laser fluoremetry, and aqueous humor protein assays. Anterior chamber fluorophotometry noninvasively measures the fluorescein concentration in the anterior chamber following systemic administration of fluorescein. Greater amounts of fluorescein entering the anterior chamber indicate greater permeability of the blood-aqueous barrier; therefore, fluorophotometry can be used to quantify the degree of blood-aqueous barrier disruption.

Considering that aqueocentesis is a common diagnostic and therapeutic practice with known adverse effects, the question remains whether those adverse effects can be minimized with use of a small-gauge needle. This variable has not been studied, so no scientifically based recommendations for aqueocentesis needle size are presently reported in the literature. Therefore, the purposes of the study reported here were to use anterior chamber fluorophotometry to evaluate the degree of blood-aqueous barrier breakdown and use tonometry to determine the IOP response, following aqueocentesis performed by use of variable needle sizes in clinically normal dogs.

**Materials and Methods**

**Animals**—The use of dogs and all procedures in this study were approved by the Institutional Animal Care and Use Committee at Kansas State University. Adult Beagles were obtained from the Kansas State University Department of Diagnostic Medicine/Pathobiology following use in prior studies unrelated to ophthalmologic research and, following completion of the study, were returned for eventual adoption. Dogs were housed individually in a temperature-controlled environment illuminated by fluorescent lights that were automatically turned on (from 8 AM to 8 PM) and off. Prior to inclusion in the study, individual physical and ophthalmologic examinations were performed, and all dogs were deemed healthy with no confounding conditions. Ocular examination included rebound tonometry, slit-lamp biomicroscopy, and indirect ophthalmoscopy. Dogs were adapted to human contact for a minimum of 3 to 6 weeks during previous research investigations. Three dogs (2 sexually intact males and 1 sexually intact female) were used for preliminary work to determine ideas and fluorophotometer scans for optimal patient positioning and accurate measurements. Topical anesthetic (0.5% proparacaine) and povidone-iodine ophthalmic solution were applied to the eye prior to aqueocentesis. Bishop-Harmon forceps were used to grasp the bulbar conjunctiva to stabilize the eye, and a needle was inserted through the lateral perilimbal cornea parallel to the iris. Care was taken to avoid the iris, lens, and corneal endothelium. The needle hub was allowed to fill halfway and then was rapidly removed from the eye. No effort was made to prevent regurgitation of aqueous humor through the corneal puncture site. The aim of the study was to evaluate the clinical practice of therapeutic aqueocentesis; therefore, uncontrolled paracentesis was performed.

**Fluorophotometry**—A computerized scanning ocular fluorophotometer with an anterior chamber fluorophotometer was used to measure fluorescein concentrations in the central anterior chamber of each eye following administration of 10% fluorescein (20 mg/kg, IV). Each dog was placed in sternal recumbency, the head was stabilized, the eyelids were held open, and the eye was positioned in front of the scanner. For consistency, the left eye was always scanned first, followed immediately by the right eye, with no more than 2 minutes elapsing between measurements at each time point. Aqueous humor fluorescein values are reportedly maximal and stable in dogs between approximately 30 and 90 minutes after IV injection of fluorescein. Results from preliminary work with 3 dogs confirmed this finding, and for the research study, all fluorophotometric readings were scheduled during this appropriate postinjection period. Fluorophotometry was performed on sedated dogs prior to and following aqueocentesis on day 1, then daily through day 5 (and at equal time points in control dogs). To minimize motion during fluorophotometric readings, chemical restraint is commonly needed in dogs, but administration of ketamine and xylazine does not alter blood-aqueous barrier permeability.

**Tonometry**—All IOP measurements were performed by use of a rebound tonometer as described. Three consecutive IOP readings were obtained on each eye according to manufacturer specifications, and IOP was determined as the mean of these readings. Given that the cornea would be anesthetized for IOP readings immediately following aqueocentesis, initial tonometric readings were taken both prior to and after application of topical anesthetic to determine whether this caused significant variation. To maintain consistent and comparable IOP values throughout the study, topical anesthesia was used for every tonometric measurement.

**Study time points**—The experimental schedule was based on a report from a previous study and results of preliminary testing on 3 dogs. Time points (hours:minutes) for the 24 treated dogs were used as controls, with each eye treated as an independent variable. Aqueous paracentesis, anterior chamber fluorophotometry, and tonometric measurements were all performed by a single investigator (RAA). Dogs were sedated with ketamine (8.8 mg/kg, IM) and xylazine (0.88 mg/kg, IM) prior to aqueocentesis and fluorophotometer scans for optimal patient positioning and accurate measurements. Topical anesthetic (0.5% proparacaine) and povidone-iodine ophthalmic solution were applied to the eye prior to aqueocentesis. Bishop-Harmon forceps were used to grasp the bulbar conjunctiva to stabilize the eye, and a needle was inserted through the lateral perilimbal cornea parallel to the iris. Care was taken to avoid the iris, lens, and corneal endothelium. The needle hub was allowed to fill halfway and then was rapidly removed from the eye. No effort was made to prevent regurgitation of aqueous humor through the corneal puncture site. The aim of the study was to evaluate the clinical practice of therapeutic aqueocentesis; therefore, uncontrolled paracentesis was performed.
were as follows on day 1, after initial examination and IOP determination: time 0:00, IV administration of fluorescein; 0:25, IM administration of sedative; 0:30, preaqueocentesis fluorophotometer scan (baseline); 0:33, preaqueocentesis IOP determination; 0:35, aqueocentesis; 0:36, 1 minute postaqueocentesis IOP determination; 0:53, 20 minutes postaqueocentesis IOP determination; 1:05, postaqueocentesis fluorophotometer scan; 1:15, 40 minutes postaqueocentesis IOP determination; 1:35, 60 minutes postaqueocentesis IOP determination; and IOP measurements continued every 60 minutes until 8 hours following aqueocentesis. Follow-up ocular examinations were performed 6 hours after aqueocentesis. Time points on days 2 to 5 were as follows, after examination and IOP determination: 12:06, IV administration of fluorescein 1 hour prior to fluorophotometry; 13:06, examination and IOP determination: IV administration of sedative 10 minutes prior to fluorophotometry; and fluorophotometer scans every 8 hours following aqueocentesis. Control dogs were studied similarly in regard to data collection and timing; however, aqueocentesis was not performed, and only povidone-iodine solution and ophthalmic anesthetic were applied topically to the eyes at 0:30 on day 1.

**Statistical analysis**—Intraocular pressure values obtained prior to or following application of topical anesthetic were compared by use of a paired t test. Anterior chamber fluorescein values in the aqueocentesis treated versus the contralateral untreated eyes at each time period were compared within each treatment group by use of a paired t test. Aqueocentesis treatment groups were compared by use of repeated-measures ANOVA followed by a Newman-Keuls post hoc multiple comparisons test to discern individual differences. Anterior chamber fluorescein values in treated or contralateral untreated eyes were compared over time via repeated-measures ANOVA followed by a Newman-Keuls post hoc multiple comparisons test to discern individual differences. Multiple linear regression was used to evaluate the effect of treatment group on IOP over time, and ANOVA was performed to determine whether there were significant differences in IOP measurements at specific time points among treatment groups. Results are reported as mean anterior chamber fluorescence (ng/mL), as has been used in previous investigations.13-15 A commercial software program16 was used for all statistical analyses. Values of P < 0.05 were considered significant.

### Results

**Fluorophotometry**—Aqueocentesis performed by use of needles of all sizes caused blood-aqueous barrier disruption. When all treated eyes were evaluated as a group, significantly increased anterior chamber fluorescence was present at the postaqueocentesis (P < 0.001), day 2 (P < 0.001), day 3 (P = 0.001), and day 4 (P = 0.001) time points, compared with contralateral untreated eyes. In the 25-gauge treatment group, a significant difference was present between the treated and contralateral untreated eyes at the postaqueocentesis (P = 0.004) and day 4 (P = 0.043) time points with significantly greater anterior chamber fluorescence in the treated eyes. In the 27-gauge treatment group, a significant difference was present between the treated and contralateral untreated eyes at the postaqueocentesis (P = 0.031), day 2 (P = 0.069), and day 3 (P = 0.043) time points, with significantly greater anterior chamber fluorescence in the treated eyes. In the 30-gauge treatment group, a significant difference was present between the treated and contralateral untreated eyes at the postaqueocentesis (P = 0.002), day 2 (P = 0.017), and day 3 (P = 0.008) time points, with significantly greater anterior chamber fluorescence in the treated eyes. In the 25-gauge treatment group, significantly greater fluorescence was present than in the 27- and 30-gauge treatment groups on day 3 (P = 0.017) and in the 30-gauge treatment group on day 5 (P = 0.048).

There were significant differences over time within all treatment and contralateral untreated eye groups (P < 0.001; Table 1). In the treated eyes of the 25-gauge treatment group, fluorescence on day 2 was significantly greater than prior to aqueocentesis, on day 4, and on day 5. In addition, the postaqueocentesis and day 3 fluorescence values were significantly greater than prior to aqueocentesis. In the contralateral untreated eyes of the 25-gauge treatment group, significantly greater fluorescence was present on days 2 and 3, compared with pre- and postaqueocentesis time points. In the treated eyes of the 27-gauge treatment group, the postaqueocentesis and day 2 fluorescence values were significantly greater than preaqueocentesis, day 3, day 4, and day 5 values. In addition, day 3 and 4 fluorescence values were also significantly greater than prior to aqueocentesis and on day 5. In the contralateral untreated eyes of the 27-gauge treatment group, the fluorescence value on day 2 was significantly greater than at all other time points.

**Table 1**—Mean ± SD anterior chamber fluorescence concentrations (ng/mL) for treated, contralateral untreated, and control eyes at various time points in dogs that underwent aqueocentesis with needles of different gauges.

<table>
<thead>
<tr>
<th>Group</th>
<th>Preaqueocentesis</th>
<th>Postaqueocentesis</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-gauge treated</td>
<td>286.51 ± 140.94</td>
<td>2,174.96 ± 942.66</td>
<td>916.35 ± 1,360.54</td>
<td>1,419.71 ± 778.85</td>
<td>801.50 ± 391.61</td>
<td>723.71 ± 276.82</td>
</tr>
<tr>
<td>25-gauge contralateral</td>
<td>282.64 ± 116.72</td>
<td>310.53 ± 128.66</td>
<td>760.01 ± 518.49</td>
<td>631.79 ± 313.80</td>
<td>504.16 ± 250.46</td>
<td>509.15 ± 221.69</td>
</tr>
<tr>
<td>27-gauge treated</td>
<td>355.11 ± 112.24</td>
<td>1,067.4 ± 421.49</td>
<td>1,219.06 ± 348.89</td>
<td>756.02 ± 190.34</td>
<td>862.31 ± 192.47</td>
<td>465.18 ± 120.72</td>
</tr>
<tr>
<td>27-gauge contralateral</td>
<td>338.15 ± 127.35</td>
<td>958.34 ± 111.69</td>
<td>567.73 ± 190.72</td>
<td>433.90 ± 101.22</td>
<td>453.29 ± 137.72</td>
<td>446.64 ± 110.06</td>
</tr>
<tr>
<td>30-gauge treated</td>
<td>320.29 ± 95.18</td>
<td>761.20 ± 418.01</td>
<td>1,395.36 ± 1,064.39</td>
<td>705.45 ± 338.96</td>
<td>594.86 ± 238.48</td>
<td>483.13 ± 117.62</td>
</tr>
<tr>
<td>30-gauge contralateral</td>
<td>264.84 ± 80.74</td>
<td>315.71 ± 96.10</td>
<td>651.28 ± 414.23</td>
<td>540.34 ± 243.32</td>
<td>524.31 ± 252.25</td>
<td>445.19 ± 157.54</td>
</tr>
<tr>
<td>All treated eyes</td>
<td>314.57 ± 118.51</td>
<td>1,041.19 ± 557.10</td>
<td>1,556.63 ± 1,014.25</td>
<td>964.40 ± 583.51</td>
<td>685.83 ± 255.72</td>
<td>584.00 ± 207.75</td>
</tr>
<tr>
<td>All contralateral eyes</td>
<td>295.41 ± 112.22</td>
<td>327.53 ± 110.20</td>
<td>659.67 ± 389.33</td>
<td>535.34 ± 240.68</td>
<td>494.96 ± 212.00</td>
<td>469.91 ± 164.85</td>
</tr>
<tr>
<td>Control eyes</td>
<td>286.57 ± 122.74</td>
<td>323.72 ± 119.42</td>
<td>372.63 ± 113.06</td>
<td>400.77 ± 125.82</td>
<td>349.65 ± 135.59</td>
<td>442.90 ± 129.31</td>
</tr>
</tbody>
</table>

For each treated and contralateral untreated group, n = 8; for control eyes, n = 6. *Significant (P < 0.05) difference at that time point between treated and contralateral untreated eyes.
and 30-gauge treatment groups. For the purposes of statistical analysis, this dog’s data were not included in the control group; however, data values were still collected over the 3 days. On day 2 of the study, the anterior chamber fluorescence value in the ulcerated eye was 1,385 ng/mL, whereas the value in the contralateral healthy eye was 661 ng/mL. The 95% confidence interval for the day 2 control eyes was 282.4 ± 463.3 ng/mL (n = 6; mean ± SD fluorescein concentration, 372.83 ± 113.06 ng/mL), which indicated that values from both the ulcerated and contralateral eyes of the dog in question were outliers.

**Tonometry**—Initial tonometric readings taken in each dog were obtained prior to and after application of topical anesthetic, and a significant (P = 0.001) difference in IOP was observed following topical anesthesia (no topical anesthesia, mean ± SD IOP, 21.20 ± 4.36 mm Hg; after topical anesthesia, 19.17 ± 3.60 mm Hg). This result was relevant for design of the study but did not have clinical importance. To maintain consistent and comparable IOP values throughout the study, topical anesthesia was used for every tonometric measurement.

When IOP was compared among treatment groups, a significant difference was present at 20 minutes after aqueocentesis; IOP in the 25-gauge treatment group (32.96 ± 13.03 mm Hg) was significantly (P = 0.03) higher than that in the 27-gauge (20.15 ± 8.07 mm Hg) or 30-gauge (19.54 ± 9.77) treatment groups (Figure 1). Aside from transient ocular hypertension in the 25-gauge treatment group, IOP rapidly returned to baseline values in treated eyes, and the IOP of contralateral untreated eyes had no clinically important changes.

**Discussion**

Consistent with previous reports, aqueocentesis caused blood-aqueous barrier disruption in all treated eyes of this study. Anterior chamber fluorophotometry allowed noninvasive, repeated daily assessment of the breakdown and reestablishment of the blood-aqueous barrier. Maximal fluorescence was detected in the treated eyes of all groups on day 2 (24 hours after aqueocentesis), with declining values thereafter. By day 5 in all treatment groups, the mean anterior chamber fluorescein value of the treated eyes was not significantly different than the contralateral untreated eyes.

It was of interest that the contralateral untreated eyes of all groups had maximal anterior chamber fluorescence on day 2 (Table 1). Values declined subsequently, but no significant difference was found between the contralateral untreated eyes and control eyes at any point in time. There are 2 possible explanations for this finding. The first supports the statistical analysis and suggests that aqueocentesis did not affect the contralateral eye and that the value disparities over time were attributable to random variation. The second explanation is that aqueocentesis did affect the contralateral untreated eye by causing a subtle degree of blood-aqueous barrier disruption as measured via fluorophotometry, but because of limited sample size and high variability, a significant difference was not detected. This latter theory is supported by an inadvertent finding in the control dog that developed a unilateral corneal ulcer. In that dog, a corneal ulcer was present in the left eye on day 2, and at that time, increased anterior chamber fluorescein concentration was measured. In addition, increased fluorescence was present on day 2 in the same dog’s healthy right eye. Over days 3 through 5, anterior chamber fluorescence declined in both eyes as the ulcer healed. The increased fluorescence in the ulcerated eye of this dog was not surprising and can be attributed to axonal reflex causing blood-aqueous barrier breakdown.29–30 It was the increased fluorescence in this dog’s contralateral healthy eye that paralleled the mean response seen in the contralateral eyes of treated dogs in this study; further supporting the possibility of a consensual ocular reaction in dog eyes.

Consensual ocular reactions have been reported in humans and rabbits,31–36 but have not been documented in dogs. Scanning electron microscopic examination of rabbit eyes treated with paracentesis and contralateral control eyes reveals changes in ciliary body processes consistent with both a direct and consensual reaction.37 The mechanism for this reaction is hypothesized to be a neural reflex arc,32,34,37 but others suggest it is attributable to a transfer of prostaglandins via systemic circulation.31,35 The consensual ocular reaction is an important biological finding and is clinically noteworthy because it was documented immediately following and then up to 1 month after cataract surgery in humans.32 Although it is commonly recognized that drugs applied topically to 1 eye can result in effects in the opposite eye, likely

Figure 1—Mean IOP (mm Hg) of canine eyes (8/group) that underwent aqueocentesis by use of a 25- (circles), 27- (squares), or 30-gauge (triangles) needle. Pre-Aqueo = Preaqueocentesis. * Significant (P < 0.05) difference, compared with the 27-gauge and 30-gauge treatment groups.

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because of systemic absorption of the medication. The present study is the first to suggest a consensual blood-aqueous barrier breakdown reaction in dogs.

Results of the present study indicated that aqueocentesis performed with a 25-gauge needle caused greater blood-aqueous barrier breakdown than aqueocentesis performed with a 27- or 30-gauge needle. Significant differences were documented by use of anterior chamber fluorophotometry on days 3 and 5. The large individual variances observed at other time points were likely caused by the uncontrolled aqueous paracentesis. This method causes larger variance than does controlled, timed paracentesis, but is the technique commonly used during therapeutic aqueocentesis. The aim of the study was to evaluate the clinical practice of aqueocentesis and its effect on blood-aqueous barrier breakdown, so uncontrolled paracentesis with various needle sizes was performed.

In this study, the cause of increased blood-aqueous barrier breakdown was not clear, but appeared to be needle size. It is logical that a larger needle stimulates more corneal sensory nerves or results in greater corneal tissue trauma, ultimately releasing additional intraocular fluid. It is logical that a larger needle stimulates more corneal sensory nerves or results in greater corneal tissue trauma, ultimately releasing additional intraocular fluid. It is logical that a larger needle stimulates more corneal sensory nerves or results in greater corneal tissue trauma, ultimately releasing additional intraocular fluid. It is logical that a larger needle stimulates more corneal sensory nerves or results in greater corneal tissue trauma, ultimately releasing additional intraocular fluid. It is logical that a larger needle stimulates more corneal sensory nerves or results in greater corneal tissue trauma, ultimately releasing additional intraocular fluid.

A 1940 study revealed that speed of aspiration during aqueous paracentesis in humans had no effect on protein content of the reforming aqueous humor; however, aqueous protein content was measured subjectively via turbidity following addition of sulfoacetic acid. Quantitative evaluation of aqueous humor protein concentration may reveal that outflow speed does affect blood-aqueous barrier breakdown and therefore may be the cause of differences in our study. In addition, there is considerable species variation in the responsiveness of the eye to damage. So prior studies on humans or other species may not be appropriate for extrapolation to dogs.

Not only did 25-gauge needle aqueocentesis induce greater blood-aqueous barrier breakdown, it also resulted in transient ocular hypertension 20 minutes following treatment. This point of increased IOP was an unexpected finding given that in all treatment group eyes, the IOP immediately after aqueocentesis was a mean value of 2 mm Hg. Increased IOP in the 25-gauge treatment group was consistent with a greater degree of blood-aqueous barrier breakdown because initial ocular hypertension is found in uveitis caused by prostaglandin release. Paracentesis-induced ocular hypertension is likely attributable to a sudden increase in anterior uveal blood volume with a subsequent increase in ultrafiltration and plasma extravasation. Paracentesis-induced blood-aqueous barrier breakdown in dogs is primarily mediated by prostaglandins. Although topically administered flurbiprofen significantly reduces blood-aqueous barrier breakdown as measured via anterior chamber fluorophotometry, the inability of flurbiprofen and proparacaine to completely abolish the response suggests that additional nonprostaglandin, non–sensorineurally derived mediators may be involved or that the rapid reduction in IOP causes physical damage to the blood-aqueous barrier.

Although dogs with glaucoma were not evaluated in the present study, the rapid resolution of ocular hypotony in all groups confirmed the assumption that aqueocentesis alone is not sufficient treatment for increased IOP in dogs. This is consistent with a human study in which cataract surgery patients with postoperative ocular hypertension treated with paracentesis had an immediate reduction in IOP followed by rebounding pressures to near initial values 1 hour after treatment. Conversely, aqueous paracentesis combined with medical treatment provides rapid relief of acutely increased IOP and could be considered as adjunctive therapy.

Aqueocentesis performed with a 25-gauge needle resulted in the greatest degree of blood-aqueous barrier breakdown and a brief state of ocular hypertension. Use of a 27- or 30-gauge needle is therefore recommended for aqueous paracentesis because there was no significant difference in fluorescein concentration or IOP between those treatment groups. Peak anterior chamber fluorescence was detected in the contralateral untreated eyes of all treatment groups on day 2, suggesting a consensual ocular reaction in dogs; however, values were not significantly greater than those in control eyes. Substantial variability common in biological systems complicates research studies, and as in this investigation, high variability and large SDs are a problem with statistical analysis. Given the known risks and possible complications, aqueocentesis should be performed only in select cases in which the diagnostic or therapeutic benefit outweighs the potential consequences.

References


