Complications from residual adnexal structures following enucleation in three dogs

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Case Description—A 3-year-old neutered male Lhasa Apso (dog 1) was evaluated because of chronic swelling at an 8-month-old enucleation site, a 10-year-old spayed female Japanese Chin (dog 2) was evaluated because of chronic swelling at a 6-year-old enucleation site and chronic discharge from a 1-year-old enucleation site, and a 7-year-old spayed female Yorkshire Terrier (dog 3) was evaluated because of chronic discharge from a 3-month-old enucleation site.

Clinical Findings—In all dogs, surgical exploration revealed substantial retention of adnexal remnants within the original enucleation sites. Diagnoses of subcutaneous membranous nictitans inclusion cyst, orbital pneumatosis, and conjunctival mucocele were made in dogs 1, 2, and 3, respectively.

Treatment and Outcome—Following cyst excision, dog 1 received a short course of treatment with amoxicillin-clavulanic acid and deracoxib. There was no recurrence of clinical signs over a 2-month follow-up period. For dog 2, conjunctival tissue was excised, and the opening of the lower nasolacrimal canaliculus was cauterized. The patient received postoperative administration of deracoxib as well as orbifloxacin and clindamycin pending bacterial culture results, which were negative. There was no recurrence of clinical signs over an 8-month follow-up period. For dog 3, adnexal remnants were excised. The patient received postoperative administration of amoxicillin-clavulanic acid and meloxicam. There was no recurrence of clinical signs over a 6-month follow-up period.

Clinical Relevance—Findings in the dogs of this report highlight the need for complete removal of the ocular adnexa to minimize the risk of complications of enucleation in the long-term follow-up period. (J Am Vet Med Assoc 2011;239:1580–1583)
The results of surgical exploration supported that the fluctuant swelling was caused by orbital pneumato-
sis secondary to failed ablation of the lower nasolacrimal
canaliculus at the initial surgery. At recheck examination
2 weeks after surgery, the surgical site appeared to be heal-
ing normally. At approximately 8 months after surgery, at
the time of telephone follow-up, the owner reported that
there had been no recurrence of swelling within the right
orbit. However, the owner reported an episode of bacterial
conjunctivitis within the intact left conjunctival sac that
had been managed by the referring veterinarian.

A 7-year-old spayed female Yorkshire Terrier (dog 3)
was admitted for evaluation of persistent discharge from
an enucleation site. The right eye had been enucleated 3
months prior to admission, following proptosis incurred
during a dog fight. The owner reported that although
there was no swelling or tenderness of the surgical site
after the first week following surgery, a clear liquid dis-
charge had been noted to be leaking from the medial
aspect of the incision since that time. A course of treatment
with oral administration of antimicrobials had failed to
effect improvement.

At the time of evaluation, the patient was bright
and alert. The right orbit was palpably normal with the
exception of a clear viscous fluid elicited from the med-
dial aspect of the enucleation scar through a pinpoint
hole in the skin. Cytologic examination of the fluid re-
vealed an acellular material with no evidence of infec-
tious organisms. Examination of the contralateral eye
and orbit was within normal limits with the exception
of an immature posterior cortical cataract.

Surgical exploration of the right orbit was performed
1 month after initial evaluation. The site was shaved and
prepared in standard fashion, and the orbit was entered
through the original enucleation incision. Following inci-
sion of the skin and subcutaneous tissue, a small amount
of clear fluid exited the surgical site. Intact conjunctival
tissue was found lining most of the visible dorsal and ven-
tral aspects of the orbital cavity. In the region of the medial
canthus, intact nasolacrimal punctae were observed, and
it appeared that a small part of the lower eyelid margin had
also been left intact. No other clinically relevant findings
were noted. All conjunctival tissue was excised, and the
eyelid margin remnant was resected.

A meshwork was constructed across the orbital rim
by use of 3-0 nylon to prevent postoperative cavitation
of the surgical site. The subcutaneous tissues were ap-
posed with 4-0 polydioxanone in a simple continuous
intradermal pattern. The skin was closed with 3-0 nylon in a cruciate
pattern. A head wrap was placed to minimize swelling in
the immediate postoperative period.

Cytologic examination of the orbital exudate revealed
suppurative inflammation with scant extracellular cocci.
Because of the history of abscessation and the presence
of suppurative inflammation, the patient was discharged,
and the owner was given instructions to administer broad-
spectrum antimicrobial treatment with orbiloxacin (3
mg/kg [1.36 mg/lb], PO, q 24 h) and clindamycin (5 mg/
kg [2.27 mg/lb], PO, q 12 h) pending bacterial culture
results. Bacterial culture results subsequently yielded no
growth. At the time of the patient’s discharge, the owner
was also given instructions to administer a 4-day course
of treatment with deracoxib (1.7 mg/kg [0.77 mg/lb], PO,
q 24 h) for postoperative pain control.

ing a traumatic injury approximately 6 years earlier. Over
the ensuing 6 years, the site was noted to have intermit-
tent, nonpainful, fluctuant swelling. The owner reported
that with warm compresses and moderate pressure, de-
flation of the site would occur, and a whistling sound
could be heard when air escaped the orbit. A pinpoint
hole in the skin overlying the orbit was also reported to
intermittently be present. Three months earlier, an epi-
sode of swelling associated with purulent discharge from
a draining tract overlying the orbit was noted. Aspira-
ation of the orbital swelling by the referring veterinarian
was consistent with an orbital abscess, and the patient
was successfully treated with amoxicillin-clavulanic acid
and warm compresses. However, swelling later recurred.
Examination of the orbit revealed nonpainful, fluctuant,
subcutaneous swelling of the right orbital region. Gentle
pressure applied to the swollen area resulted in a reduc-
tion in the size of the swelling. No discharge was noted
from the nares or orbital region.

The left globe had been removed approximately 1
year earlier on an emergency basis following trauma. Exami-
nation of the enucleation site revealed intact pal-
pebral margins overlying a shallow conjunctival sac
containing a small amount of dried, green purulent dis-
charge. The owner reported routine diligence in main-
taining cleanliness of the periocular skin and declined
surgical treatment of this site. The remainder of physi-
ocal examination was unremarkable with the exception of
bilateral grade 3 (on a 6-point scale) systolic murmurs.

Surgical exploration of the right orbit was performed
several weeks following initial examination. The patient
underwent general anesthesia, and the right orbital region
was shaved and prepared for surgery in standard aseptic
fashion. Following incision of the skin, air and yellow-
green mucus exited the incision. Samples were collected
for cytologic evaluation and aerobic bacterial culture.

Gross inspection revealed conjunctival tissue lining the
total visible surface of the orbital cavity. The lower naso-
lacrimal canaliculus opening was visible, with what grossly
appeared to be an intact epithelial lining. The conjunctiva
was excised, and electrocautery was applied to the opening
of the lower nasolacrimal canaliculus near its entrance to
the lacrimal bone. The orbit was then flushed with dilute
betadine solution, and a supportive meshwork spanning
the lacrimal bone. The orbit was then flushed with dilute

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was shaved and prepared for surgery in standard aseptic
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green mucus exited the incision. Samples were collected
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Gross inspection revealed conjunctival tissue lining the
entire visible surface of the orbital cavity. The lower naso-
lacrimal canaliculus opening was visible, with what grossly
appeared to be an intact epithelial lining. The conjunctiva
was excised, and electrocautery was applied to the opening
of the lower nasolacrimal canaliculus near its entrance to
the lacrimal bone. The orbit was then flushed with dilute
betadine solution, and a supportive meshwork spanning
the orbital rim was created with 3-0 nylon in an overlapp-
ing mattress pattern. The subcutaneous tissue was closed
with 4-0 polydioxanone in a simple continuous intradermal
pattern, and the skin was closed with 3-0 nylon in a cruciate
pattern. A head wrap was placed to minimize swelling in
the immediate postoperative period.

Cytologic examination of the orbital exudate revealed
suppurative inflammation with scant extracellular cocci.
Because of the history of abscessation and the presence
of suppurative inflammation, the patient was discharged,
and the owner was given instructions to administer broad-
spectrum antimicrobial treatment with orbiloxacin (3
mg/kg [1.36 mg/lb], PO, q 24 h) and clindamycin (5 mg/
kg [2.27 mg/lb], PO, q 12 h) pending bacterial culture
results. Bacterial culture results subsequently yielded no
growth. At the time of the patient’s discharge, the owner
was also given instructions to administer a 4-day course
of treatment with deracoxib (1.7 mg/kg [0.77 mg/lb], PO,
q 24 h) for postoperative pain control.

The following day, the head wrap was removed and
the patient was discharged, and the owner was given in-
structions to administer a 1-week course of treatment
with amoxicillin-clavulanic acid (13.75 mg/kg, PO, q 12
h) and a 5-day course of treatment with meloxicam (0.1
mg/kg [0.045 mg/lb], PO, q 24 h).

At follow-up 2 weeks later, the surgical site was
cosmetically and palpably normal with a healed skin
incision and no evidence of discharge. At the time of
telephone follow-up at 2 months and 6 months after
surgery, the owner reported that the site appeared nor-
mal with no swelling or discharge.
**Discussion**

Ocular enucleation is commonly performed for the end-stage treatment of blind animals with signs of eye pain that are not amenable to other treatments. The most common short-term complications of enucleation are hemorrhage and edema. Although rare, postoperative infection must be considered as a potential short-term complication of enucleation, particularly in instances of preexisting ocular infection. Contralateral blindness resulting from damage to the optic chiasm has also been reported and is of particular concern in cats.

Complications of enucleation arising in the long-term follow-up period are less commonly reported. In the 3 dogs of the present report, enucleation resulted in long-term complications necessitating a second surgery. In each affected dog, the initial surgery had been performed on an emergency basis.

To our knowledge, dog 1 (the Lhasa Apso) represents the first reported case of a membrana nictitans epithelial inclusion cyst following enucleation. Incomplete excision of the membrana nictitans and subsequent subcutaneous inclusion of epithelial remnants resulted in the formation of a cyst and patient discomfort, which necessitated surgical excision. Although incomplete excision of conjunctival or glandular epithelium is recognized as a risk factor for cyst formation, some published accounts of enucleation technique suggest that retention of some conjunctival tissue is acceptable. Findings in dog 1 clearly demonstrate the need for complete removal of adnexal tissues as well as careful identification and apposition of tissue planes during incisional closure.

For dog 2 (the Japanese Chin with orbital pneumatosis), most of the conjunctival tissue was left within the orbit. Retention of the conjunctiva within the orbital cavity resulted in an attendant accumulation of secretory material within this space and likely contributed to failed obliteration of the lower nasolacrimal canaliculus by preventing the normal scarification that is expected to occur when the nasolacrimal canaliculi are transected during removal of the conjunctival tissue. The chronic infection of this site may have been the result of ascending infection through the patent nasolacrimal duct or via bacterial contamination through the small opening in the skin overlying the orbit.

To our knowledge, there are 4 other reports of orbital pneumatosis, all in brachycephalic breeds. Failure to adequately excise conjunctiva or eyelid margin in the medial canthal area, combined with increased intranasal expiratory pressure in brachycephalic breeds, contributes to this phenomenon. It is proposed that increased intranasal expiratory pressure in these breeds creates the pressure differential necessary to force air through the nasolacrimal duct in a retrograde fashion, causing air to accumulate within the orbit. Increased intranasal expiratory pressure may contribute to failed obliteration of the duct by continually forcing the duct open during the healing process.

Although not performed in the dogs of this report, when orbital emphysema is encountered, skull radiography should be performed to rule out fractures of the paranasal sinuses as a cause of air accumulation in the orbit. To test for the presence of a patent nasolacrimal duct, a Jones test may be performed by injecting fluorescein dye into the orbital cavity and assessing its drainage from the nose. However, a negative Jones test result may not definitively rule out a patent nasolacrimal duct, as a reversing valve effect created by pressure occlusion of nasolacrimal punctum or canaliculus likely is present in instances of orbital pneumatosis. Regardless of the results of a Jones test, surgical exploration of the orbit is indicated in dogs with persistent pneumatosis. If an orifice communicating with the nasolacrimal duct is identified, ligation is recommended.

In the dog of the present report, electrocautery of this orifice was performed, with no recurrence of orbital emphysema over an 8-month follow-up period. In 1 report of a dog in which no such orifice could be found, wide resection of the eyelid tissue resulted in resolution of orbital emphysema.

In the contralateral orbit of dog 2 of the present report with orbital pneumatosis, the globe had been removed, leaving eyelids and conjunctiva intact. Although there were no severe long-term consequences, the owner reported 1 episode of bacterial conjunctivitis requiring medical treatment, and the orbit was unsightly in appearance and required regular cleaning by the owner to remove secretory debris. Therefore, it is the opinion of the authors that this technique should be avoided.

In dog 3 of the present report, conjunctival remnants were left within the orbit following removal of the globe. The secretory products of this tissue resulted in the persistent discharge noted by the owner. We surmise that this fluid did not accumulate substantially within the orbit because of the intact nasolacrimal drainage system. In addition, failure to completely resect the eyelid margin led to the small area of nonunion through which this fluid was noted to drain by the owner.

In the dogs described herein, long-term complications arose following enucleation of globes on an emergency basis, which necessitated a second surgery for each patient. Although it is unknown whether this was a substantial factor influencing the surgical outcome of these dogs, it is the opinion of the authors that only rarely is it necessary for enucleation to be performed on an after-hours emergency basis, as most conditions for which enucleation is indicated may be palliatively managed on a temporary basis with analgesic medications, antimicrobials, and other supportive care as indicated until surgery is performed.

In the author’s practice, the transpalpebral technique for enucleation is performed because it obviates the need to resect conjunctiva or membrana nictitans in additional surgical steps as the globe, conjunctiva, and nictitating membrane are removed en bloc with this procedure. This makes the transpalpebral technique an expedient procedural choice to minimize the risk of long-term complications from inadvertent retention of adnexal or secretory tissues within the enucleation site. Although suturing of the eyelid margins is classically described as the initial surgical step for this technique, a time-saving alternative involves clamping the lid margins together with 3 or 4 Allis tissue forceps. When a surgeon is faced with enucleation of a protrpted globe, vitreal aspiration may be used to deflate the globe and facilitate its easy replacement into the orbital cavity, thus allowing the surgeon to proceed with a transpalpebral technique.

An orbital meshwork was used in the dogs of the present report to minimize postoperative cavitation of
the enucleation site. Implantation of an orbital prosthesis in the form of a silicone or methyl methacrylate sphere is also considered to be a safe means of achieving postoperative cosmesis; however, in some circumstances, complication rates may be higher when prosthetics are used. In a study comparing the outcome of silicone prosthesis implantation with orbital meshwork implantation, the reported extrusion rate was 20% in cats and approximately 1% in dogs receiving silicone prostheses. There were no complications in cats and dogs receiving an orbital meshwork; however, an insufficient number of cases were evaluated to draw firm conclusions about the success of the orbital meshwork procedure. Complication rates for methyl methacrylate prostheses have been reported to be as high as 40% in cats and 4.1% in dogs. In the authors’ practice, the orbital meshwork technique is chosen to minimize the risk of complications such as extrusion and rotation that may occur with prostheses. Given the lack of definitive data on the success rate of the meshwork procedure and the low incidence of prosthesis-related complications in dogs, this is a subjective decision based on surgeon preference. Findings in the dogs of the present report highlight the need for complete removal of the eyelid margins, conjunctiva, nictitating membrane, and adnexal tissues at the time of enucleation to minimize the risk of adverse consequences such as failed incisional closure, pneumatosis, and cyst formation in the long-term follow-up period.

References

From this month’s AJVR

Anesthetic induction with guaifenesin and propofol in adult horses

Robert J. Brosnan et al

Objective—To evaluate whether guaifenesin can prevent adverse anesthetic induction events caused by propofol and whether a guaifenesin-propofol induction combination has brief cardiovascular effects commensurate with rapid drug washout.

Animals—8 healthy adult horses.

Procedures—Guaifenesin was administered IV for 3 minutes followed by IV injection of a bolus of propofol (2 mg/kg). Additional propofol was administered if purposeful movement was detected. Anesthesia was maintained for 2 hours with isoflurane or sevoflurane at 1.2 times the minimum alveolar concentration with controlled normocapnic ventilation. Normotension was maintained via a dobutamine infusion. Plasma concentrations of propofol and guaifenesin were measured every 30 minutes.

Results—Mean ± SD guaifenesin and propofol doses inducing anesthesia in half of the horses were 73 ± 18 mg/kg and 22 ± 0.3 mg/kg, respectively. No adverse anesthetic induction events were observed. By 70 minutes, there was no significant temporal change in the dobutamine infusion rate required to maintain normotension for horses anesthetized with isoflurane or sevoflurane. Mean plasma guaifenesin concentrations were 122 ± 30µM, 101 ± 33µM, 93 ± 28µM, and 80 ± 24µM at 30, 60, 90, and 120 minutes after anesthetic induction, respectively. All plasma propofol concentrations were below the limit of quantitation.

Conclusions and Clinical Relevance—Guaifenesin prevented adverse anesthetic induction events caused by propofol. Guaifenesin (90 mg/kg) followed by propofol (3 mg/kg) should be sufficient to immobilize > 99% of calm healthy adult horses. Anesthetic drug washout was rapid, and there was no change in inotrope requirements after anesthesia for 70 minutes. (Am J Vet Res 2011;72:1569–1575)