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Clinical Report

Eviscceration as an Alternative to Enucleation in Four Pet Psittacine Birds

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Abstract: In cases in which vision cannot be restored and the eye is a source of pain, removal of the eye may be indicated. In mammals, enucleation is the most common procedure performed; however, due to the distinct anatomical features of the avian eye, evisceration may be the preferred method in these species. The large globe size and rigid sclera leave the bird with a large sunken eye socket, which may cause the bird to become unbalanced and is not cosmetically appealing. Furthermore, birds have short optic nerves that can be injured due to traction and a thin interorbital septum that can be damaged during surgery. Evisceration reduces these risks and is typically done within a shorter anesthetic time. This case series reports the successful use of a modified evisceration technique in 4 pet psittacine birds: a red-tailed black cockatoo (*Calyptorhynchus banksia*) diagnosed with severe fungal keratitis and anterior uveitis based on histopathology, a galah (*Eolophus roseicapilla*) with a traumatic injury resulting in a ruptured globe, a cockatiel (*Nymphicus hollandicus*) diagnosed with a cataract and secondary glaucoma, and a green cheek conure (*Pyrrhura molinae*) diagnosed with anterior lens luxation and suspected endophthalmitis. Each bird underwent a modified evisceration surgery because the eyes were nonvisual and painful and had a grave prognosis for recovery. All 4 birds recovered uneventfully without complications and have remained stable for between 2.5 and 4.5 years postoperatively. This report demonstrates that the modified evisceration technique is safe and achievable in psittacine patients.

Key words: fungal keratitis, intraocular trauma, modified evisceration, avian, psittacine

CLINICAL REPORTS

Case 1

A 27-year-old, female red-tailed black cockatoo (*Calyptorhynchus banksia*) weighing 618 g was referred for assessment of a corneal ulcer and anterior uveitis in the left eye of 6 days duration. Previous treatment by the referring veterinarian consisted of topical treatment with a combination antibiotic ointment (polymyxin B sulfate, bacitracin zinc, neomycin sulfate; Tricin eye ointment, Jurox Australia, Rutherford, NSW, Australia).

On physical examination, there was blepharospasm of the left eye and periocular feather loss. One drop of proxymetacaine (Alcaine; Alcon Laboratories, Australia Pty Ltd, Macquarie Park, NSW, Australia) was applied to the eye to facilitate an ophthalmic examination, including slit lamp biomicroscopy (Kowa SL-17, Kowa Company Ltd, Tokyo, Japan), indirect ophthalmoscopy (Welch Allyn Australia Pty Ltd, NSW, Australia), and rebound tonometry (IcareÒ Tonovet, Icare, Vantaa, Finland). There was marked corneal edema and corneal neovascularization with an axial 5–6 mm ulcer extending into the anterior stroma. There was ventrally settled hypopyon, but further intraocular examination was precluded by the corneal changes. Intraocular pressure (IOP) was 8 mmHg *oculus sinister* (OS) and 12 mmHg *oculus dexter* (OD). Corneal surface cytology showed inflammatory cells, occasional bacteria, and moderate squamous cells. The patient was treated for suspected bacterial keratitis and anterior uveitis with topical ofloxacin (one drop OS q6h, Ocuflox; Allergan Australia Pty Ltd, Gordon, NSW, Australia) and systemic meloxicam (0.5 mg/kg q12h PO; Dechra Veterinary Products, Australia Ptd Ltd, Somersby, NSW, Australia).

At follow-up examination 2 days later, there was persistent blepharospasm and periocular swelling. There was diffuse, marked corneal edema with corneal bullae formation and progressive neovascularization of the dorsal and lateral cornea. There had been further loss of the axial corneal stroma with an estimated loss of up to 80%

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Figure 1. A cockatiel (*Nymphicus hollandicus*) cadaver. The superior (yellow catheter) and inferior nasolacrimal puncta (purple catheter) are located on the medial aspect of the inner eyelid.

corneal thickness. The hypopyon was more organized and adherent to the corneal endothelium. The pupil was midrange in size. The IOP was 8 mmHg OS and 12 mmHg OD. The owner declined culture and susceptibility at this time. Amoxicillin-clavulanic acid (125 mg/kg q12h PO × 14 days; Dechra Veterinary Products) was added to the bird's treatment plan.

Five days after the initial presentation, there was no clinical improvement, and evisceration was scheduled for the following day. Premedication consisted of midazolam (2 mg/kg IM; Pharmaco, Australia Ltd, Gordon, NSW, Australia) and butorphanol (2 mg/kg IM; Troy Laboratories Pty Ltd, Glendenning, NSW, Australia); this combination provided excellent sedation. The patient was intubated with a size 3.5 Cole ET tube (Sound Veterinary Equipment Pty Ltd, Rowville, VIC, Australia) and anesthesia was maintained using isoflurane (Dechra Veterinary Products). The bird was ventilated (Vetronic, Sound Veterinary Equipment Pty Ltd, Rowville, VIC, Australia) at 8 breaths per minute and 5 cmH_2O. The left eye was aseptically prepared using 5% povidone-iodine solution. A circumferential limbal incision was made using iris scissors and the cornea was excised. All intraocular structures, including the anterior and posterior uvea, lens, vitreous body, and retina, were removed, and the scleral shell was flushed out with sterile saline. The conjunctiva and nictating membranes were left intact. Swabs were taken of the conjunctival fornices and submitted for bacterial and fungal culture after the evisceration. An intraoperative splash block of bupivacaine (2 mg/kg; Aspen Pharmacare Australia Pty Ltd, St. Leonards, NSW, Australia) was used. Both nasolacrimal puncta were identified (Fig 1), and the eyelid margins were resected close to the edge to preserve the puncta. The incision was closed with poliglecaprone 25 (Mono Q 5-0, Riverpoint Medical, Portland, OR, USA) in a simple continuous pattern (Fig 2). The cornea and intraocular structures were preserved in formalin for histopathology. Anesthetic recovery was uneventful. Butorphanol (2 mg/kg IM) was repeated 2 hours after initial administration, and tramadol (15 mg/kg PO; Seqirus, Australia Pty Ltd, Melbourne, VIC, Australia) was administered once the bird had recovered from anesthesia. The patient was continued on meloxicam (0.5 mg/kg PO q12h × 5 days) and amoxicillin/clavulanic acid (125 mg/kg PO q12h × 14 days) and was discharged the following day.

Histopathological examination revealed severe fungal keratitis and anterior uveitis with large numbers of fungal hyphae and extensive inflammation affecting the cornea and anterior uvea (Fig 3). Fungal species identification was not performed. There was no evidence of neoplasia. There was no growth on bacterial and fungal culture swabs.

Figure 2. A 27-year-old, female red-tailed black cockatoo (*Calyptorhynchus banksia*) diagnosed with severe fungal keratitis and anterior uveitis immediately postsurgery, demonstrating the preservation of the shape of the skull using this method of enucleation.

Six days postsurgery, the surgical wound was clean, and the sutures remained intact. Sutures were left to dissolve on their own. The patient has remained healthy without surgical complications for 3 years and 10 months and has successfully bred and raised chicks.

Case 2

A 35-year-old male galah (*Eolophus roseicapilla*) was referred for assessment of a traumatic injury to the right eye suspected to be caused by a rat attack 3 days prior to presentation. The bird had previously been treated at the referring veterinarian with topical ofloxacin, meloxicam of an unknown dose, and systemic enrofloxacin (Troy Laboratories) of an unknown dose. The bird had difficulty perching, loss of balance, inappetence, and abnormal droppings.

On presentation, the bird weighed 295 g and was fluffed up and lethargic. The patient was generally weak when handled. The left eye was mildly sunken, likely due to dehydration. The right eye was completely blepharospastic, dry purple/black material was noted around the lower eyelid, and there was periocular bruising and swelling. When the eyelids were opened, mucoid material evacuated from the eye, and it was not possible to determine if the globe was intact. Cytology of the mucoid material revealed marked heterophils with toxic changes.

The patient was admitted for supportive care and stabilization. The bird was placed in an incubator set to 30°C (86°C), and 1 drop of ofloxacin was administered OS. Warmed fluids (20 mL SC q12h; Hartmann's, Baxter Healthcare Pty Ltd, Old Toongabble, NSW, Australia) and butorphanol (2 mg/kg IM q12h) were provided. Once warmed, the bird was crop-fed a 20 mL/kg mixture of Avian Crittacare (Vetafarm, Wagga Wagga, NSW, Australia) and Polyaid q12h (Vetafarm).

The following day, the patient was quiet, alert, and responsive and fluffed up but appeared stronger than when handled the day prior. Biliverdinuria was noted, and the subcutaneous fluids administered the day before were not absorbed. An ophthalmic examination, including slit lamp biomicroscopy, indirect ophthalmoscopy,

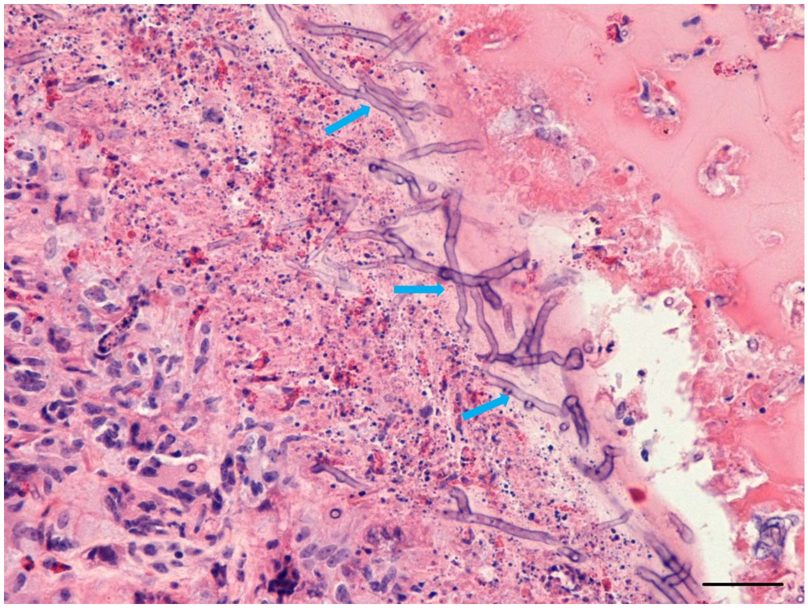

Figure 3. Histopathology from the 27-year-old, female red-tailed black cockatoo (*Calyptorhynchus banksia*) described in Figure 2 revealed severe fungal keratitis and anterior uveitis with large numbers of fungal hyphae (blue arrows) and extensive inflammation affecting the cornea and anterior uvea (hematoxylin and eosin, bar = 20 μm, ×80).

and rebound tonometry, revealed a ruptured right globe with intraocular content dried along the lower lid. The treatment plan was updated to the following medications: butorphanol (2 mg/kg IM q12h), meloxicam (0.5 mg/kg IM q12h), ceftiofur crystalline-free acid (20 mg/kg IM; Zoetis Australia Pty Ltd, Rhodes, NSW, Australia), ofloxacin (q8h OD), proxymetacaine (q12h OD), and crop feeding 20 mL/kg q8h.

Two days postpresentation, evisceration was performed. The same anesthetic protocol as described in case 1 was used. A corneal laceration along the dorsal aspect at the level of the limbus was noted, the lens was cataractous and displaced, intraocular purulent material was visualized, and fibrin leaked out. The same surgical technique described in case 1 was used. Anesthetic recovery was uneventful. The patient was stable and quiet, alert, and responsive overnight. It was eating on its own and was discharged 1 day postsurgery. Meloxicam (1 mg/mg PO BID) was continued for 5 days.

Two days postsurgery, the surgical site was clean with intact sutures, and the periorbital area was less swollen. A final injection of ceftiofur crystalline-free acid (20 mg/kg IM) was administered. Four days postsurgery, the owner reported that the bird was eating well on its own and grooming. It was bright, alert, and responsive, and the surgical site was healing well with no swelling or discharge. The patient has remained stable with no surgical complications for 4 years and 7 months.

Case 3

An 11-year-old male cockatiel (*Nymphicus hollandicus*) presented for sudden onset blepharospasm and suspected loss of vision to the right eye. On physical examination, the bird weighed 85 g, the right eye was blepharospastic, and the eyelids were erythematous. One drop of proxymetacaine was applied to the eye to facilitate ophthalmic examination. The cornea was clear with no ulceration. There were strands of white material in the anterior chamber that were associated with the anterior lens capsule. The pupillary light reflex was absent. The IOP was 35 mmHg OD and 14 mmHg OS; IOP values of 8–24 mmHg in healthy cockatiels have been published.[1] The rest of the physical examination was unremarkable. The patient was diagnosed as blind in the affected eye with a suspected lens rupture of a cataractous lens with secondary uveitis and glaucoma. The bird was discharged with meloxicam (1 mg/kg PO q12h × 5 days), and a full ophthalmic examination was scheduled.

After 1 week, blepharospasm was still evident in the right eye. An ophthalmic examination that included slit lamp biomicroscopy, indirect ophthalmoscopy, and rebound tonometry was performed. Mild periocular erythema and diffuse moderate corneal edema were present. There was a dense fibrinous web within the anterior chamber, precluding a detailed intraocular exam. There was a dense cataract visible, and the iris was not able to be examined in the right eye. A pulverulent cataract was noted in the left eye. The IOP was 35 mmHg OD and 6 mmHg OS. Fluorescein staining was not repeated. The prognosis for a comfortable and visual eye was considered grave.

Evisceration was recommended due to severe intraocular pathology, lack of vision, and pain. The anesthetic and surgical procedures were the same as described in case 1. The patient recovered uneventfully. The bird was administered tramadol (15 mg/kg PO) a few hours postsurgery for additional pain relief. The patient was hospitalized for monitoring and prescribed meloxicam (1 mg/kg PO q24h × 5 days) and amoxicillin/clavulanic acid (125 mg/kg PO q12h × 10 days). The patient was discharged 2 days postsurgery with the aforementioned medications. Eight days postsurgery, the surgical wound was intact and clean. The patient has had no surgical complications in 3 years and 11 months.

Case 4

A 13-week-old green cheek conure (*Pyrrhura molinae*) was presented with a swollen and closed right eye. The owner reported that the eye sustained an injury at the breeder prior to adoption, about 1 month prior to presentation. The owner reported that the eye suddenly closed and became swollen and had remained that way for a few weeks. The bird would occasionally open the eye, and fluid had begun leaking out of the eye.

On physical examination, the bird weighed 61 g. The right eye was blepharospastic, and the globe appeared to be sunken. Tetracaine (Bausch & Lomb, Australia Pty Ltd, Chatswood, NSW, Australia) was applied OD to allow for examination. The cornea was transparent with no discharge. The eye was too small to assess intraocular structures and slit lamp biomicroscopy was not available at this visit. The IOP was 5 mmHg OD and 13 mmHg OS. The rest of the physical examination was unremarkable.

Thirteen days later, the right globe was sunken and ongoing marked blepharospasm was noted despite the use of a topical anesthetic. Erythema, swelling, and dermatitis were noted around the lower eyelid. An ophthalmic examination that included slit lamp biomicroscopy, indirect ophthalmoscopy, and rebound tonometry was performed. The right globe appeared small, and the cornea was misshapen with lateral corneal neovascularization and diffuse moderate-marked corneal edema. The anterior chamber was irregular and asymmetrical with a cataractous lens ventromedially displaced within the anterior chamber. There was 3+ aqueous flare and 3+ free cells evident within the anterior chamber.[2] The entire iris could not be visualized due to anterior changes, but there was yellow discoloration to both the lens and the part of the iris that could be examined. Examination of the vitreous, retina, and choroid was precluded by changes in the anterior chamber. Ophthalmic examination of the left eye was unremarkable. The IOP was 11 mmHg OS and 4 mmHg OD. A diagnosis of anterior lens luxation, immature cataract, and severe anterior uveitis was made. Due to the severity and chronicity of ocular abnormalities in this eye, evisceration was recommended.

Evisceration surgery was performed 27 days postpresentation. The anesthetic and surgical procedures were the same as described in case 1. Intraocular structures were submitted for histopathology, and a swab of the eye was submitted for culture and antimicrobial sensitivity. The recovery was uneventful, and the patient was discharged the following day with meloxicam (1 mg/kg PO q24h × 5 days) and amoxicillin/clavulanic acid (125 mg/kg PO q12h × 10 days).

Histopathology showed no recognizable ocular structures. There was fibroplasia and chronic inflammation. Clusters of cells containing melanin were observed that may have been remnant uveal tracts. The pathologist was not able to determine if this was end-stage inflammation and atrophy or a congenital lesion. There was no growth on fungal and bacterial cultures.

Ten days postsurgery the wound was clean, and the sutures were intact. The patient has not experienced any surgical complications for 2 years and 5 months.

DISCUSSION

The goal of treating ophthalmic disease is to maintain vision and alleviate pain.[3–5] When vision is lost and the eye is a source of pain for the animal, removal of the eye may be indicated.[4,6–9] Typical veterinary indications for eye removal include uncontrolled glaucoma, trauma, severe infection, severe corneal disease, and intraocular neoplasia.[4,6,7,9–11] Enucleation is the most common orbital procedure performed in mammals; however, this can be challenging in avian species because of distinctly different anatomical features.[4,6,8] These features include a rigid sclera made up of 10 to 18 small overlapping ossicles, a large globe size relative to the surrounding bony orbit, lack of surrounding soft tissue structures (retrobulbar fat and the retractor bulbi muscle), a thin interorbital septum, and short optic nerves compared with other species.[4,6–8,12–14]

Several enucleation techniques have been described to remove the globe and surrounding periocular tissues in birds, including the transpalpebral approach, the transconjunctival approach, the transaural approach, and the globe-collapsing procedure.[4–6,9,12,13] The transconjunctival approach is commonly used in dogs and cats.[9] In this

Figure 4. The evisceration technique described in this report performed on a cockatiel (*Nymphicus hollandicus*) cadaver. (A) This image demonstrates the small socket that remains postevisceration due to the rigid sclera being left intact. (B) Enucleation performed on a cockatiel cadaver. This image demonstrates the large socket that remains postenucleation.

technique, a 360° bulbar conjunctival incision is made around the limbus to expose and dissect the extraocular muscles and the optic nerve in order to remove the globe as well as the lacrimal gland and conjunctiva.[9] The transpalpebral approach involves suturing the eyelids together and making a circumferential incision through the skin.[9,15] In certain species, collapsing of the globe may be necessary prior to enucleation.[9,15] The globe-collapsing procedure may be required for birds with narrow orbits when complete histological examination is not needed because the globe is incised and collapsed.[4–7] The transaural approach is only appropriate for owl species that have extensive ear openings because it allows for visualization of the globe through the auricular skin.[5,6] This technique is preferred in animals that require complete histological examination of the intact eye.[5,7] Each technique has a risk of contralateral optic nerve damage from excessive traction at the optic chiasm, which is especially important because birds have short optic nerves compared with other species, increasing the risk of optic nerve damage and blindness in the contralateral eye.[4,6–8,13]

Because there are multiple risks involved with enucleation in birds, alternative methods, such as evisceration, have been described to treat pathological conditions of the avian eye. Murray et al[16] and Dees et al[6] describe a modified evisceration technique in birds of prey in which the cornea is excised 360° and the iris, lens, vitreous body, retina, and uvea are removed via blunt dissection. The scleral shell and bony ossicles remain intact (Fig 4), reducing intraoperative risks and resulting in a better cosmetic outcome.[4,6,7,16] There are only limited published descriptions of globe evisceration in psittacine birds; Christen et al[4] describe evisceration in a sulfur-crested cockatoo (*Cacatua galerita*) with a 2-month follow-up period, and Gralla et al[5] describe globe evisceration in a blue-fronted Amazon parrot (*Amazona aestiva*) with a 2-year follow-up period. Minimal postoperative complications have been described with this technique with one South African ostrich (*Struthio camelus australis*) experiencing subcutaneous emphysema and one free-living barred owl developing a seroma postoperatively.[16,17]

This case series describes a modified evisceration technique in 4 pet psittacine birds: a red-tailed black cockatoo with severe fungal keratitis and uveitis; a galah with globe rupture; a cockatiel with a cataract and secondary glaucoma; and a green cheek conure with anterior lens luxation and suspected endophthalmitis. In all 4 cases, the birds recovered without complications and have remained stable for 2.5 to 4.5 years postoperatively.

In this report, the surgeon followed the same technique described in Murray et al;[16] however, in the original report, the procedure was performed in birds of prey, which have larger eyes compared with psittacine birds. This case series demonstrates that, despite having significantly smaller eyes, this technique can be performed with basic surgical instruments and magnification and offers a favorable outcome in these species. Benefits of this technique include reduced anesthetic time, decreased pain postoperatively, decreased risk of excessive traction of the optic nerve, decreased risk of hemorrhage, and a more desirable cosmetic appearance and symmetry of the head allowing for improved balance.[5–7,10,11,16–18] Reduced anesthesia time and minimal blood loss are especially important when working with small species because they can become hypothermic more rapidly and have a smaller total blood volume.[4,6,7,16] In this study, anesthetic time, including surgical preparation and surgery, was about 30 minutes. Gralla et al[5] reported an anesthetic time of 25 minutes, and Dees et al[6] reported a total anesthetic time of 45 minutes with 15 minutes for the surgery itself.

When choosing this technique, patient selection should be carefully considered and limited to pathologies confined to the globe.[4,6] This procedure is not appropriate for patients with pathology extending outside the globe.[4,6,17] Culture and antimicrobial sensitivity testing should be performed in cases in which infection is of concern. Additionally, this evisceration technique does not allow for full histopathological examination because the entire eye is not removed[17] although histopathological examination of the globe contents can still be performed.

With this technique, the third eyelid, the Harderian gland, the lacrimal gland, and the conjunctival tissue are left in place, which helps to reduce the risk of intraoperative hemorrhage.[16,17] For this reason, it is important that the nasolacrimal puncta are visualized and preserved intraoperatively to allow any lacrimal secretions produced by the remaining conjunctiva to drain via the choana.[14–16] Because the sclera remains intact, the quadratus and pyramidalis muscles responsible for moving the third eyelid are preserved[13,14,19,20] Therefore, the third eyelid may remain mobile postevisceration and may assist in tear drainage via the nasolacrimal puncta. In comparison with dogs and cats, birds typically produce less lacrimal secretions with Schirmer tear test readings ranging from 4.5 ± 1 mm in smaller parrots to 8 ± 1.55 mm in larger parrots.[12,13,15,20] This may reduce the risks associated with seroma and cyst formation in comparison with mammalian species undergoing similar procedures.

Gralla et al[5] made note that the surgeon did not visualize the nasolacrimal puncta intraoperatively and questioned if this surgical step is necessary. Additionally, they specified that the surgeon removed the conjunctiva and third eyelid, which was not done in the cases in this report. Nevertheless, in techniques in which the third eyelid is removed, this does not account for the remaining gland of the nictating membrane, which runs along the caudal aspect of the sclera in the bird.[5,13,18] Tear-producing glands are shown to have a compensatory increase in tear production when left partially nonfunctional.[18] Therefore, even if the third eyelid is removed, there is still a risk of seroma or cyst formation because the residual glands can compensate for the tear-producing glands after removal.[18]

Although seroma and cyst formation are possible postoperative complications of this technique, they are also possible complications of enucleation and the traditional evisceration techniques described.[9] Murray et al[16] included a follow-up period of 1 to 2.5 years for 5 of the birds who did not show any postoperative complications despite leaving the third eyelid and conjunctiva intact. However, 1 of the free-living owls did experience seroma formation due to a piece of gelatin sponge occluding the nasolacrimal puncta and preventing lacrimal secretions from draining 2 days postoperatively. The gelatin sponge was subsequently removed, and both puncta were flushed prior to closure. No further complications were seen in this owl, and the animals was released.[16] In this case series reported here, intraoperative bleeding was managed with gentle direct pressure and gelatin sponge was not used, which may have helped prevent postoperative complications. Furthermore, the birds were all monitored closely at home by owners, and each bird received follow-up appointments and ongoing annual veterinary visits. Although it is possible that, with larger numbers of avian cases, cyst or seroma formation could be seen, it was not noted in this study.

Other postoperative complications may include wound dehiscence, swelling of the surgical site, draining fistulas, infection, and orbital emphysema.[15–17] Rogers et al[17] described an evisceration technique in a South African ostrich with chronic keratoconjunctivitis secondary to anterior chamber collapse. Evisceration was performed following the technique described in Murray et al[16] except that the third eyelid and palpebral and bulbar conjunctiva were completely excised.[14] The nasolacrimal puncta was not identified during the surgery.[17] Four weeks postsurgery, the patient developed orbital emphysema. The orbital swelling was aspirated and air was evacuated from the region.[17] The orbital emphysema recurred about 48 hours postdecompression and then began to spontaneously regress about 5 months postoperatively.[17] The authors postulated that the surgical trauma to the nasolacrimal duct caused it to become partially blocked, serving as a 1-way valve that allowed air to build up within the bony orbit.[17] This further highlights the need to visualize and preserve the nasolacrimal puncta and ensure that surgical excision is performed close to the eyelid margins, which is especially important when working with small psittacine species.

One benefit of evisceration is that the preservation of the rigid sclera prevents the orbit from becoming sunken, which often occurs with enucleation.[4] This allows the bird to maintain better balance, which can be especially important for flying.[4,5,7,16] However, long-term evaluation of the sclera has been limited with only 1 paper evaluating the orbit postoperatively with ultrasound.[5] Grala et al[5] examined the orbit at 6, 12, and 52 weeks postsurgery and found that it had filled with soft tissue material, but showed no evidence of free fluid at the surgical site. It is possible the sclera may begin to degenerate over time although, in this study, there has been no indication of this occurring.[5] Future studies including long-term postoperative evaluation of the orbit via ultrasound or other modalities are needed.

Although careful consideration should be made in patient selection because this technique is only appropriate for birds with pathologies confined to the globe, evisceration is a feasible procedure for pet psittacine birds.[4,6,15] This technique is relatively straightforward to perform with minimal risks and does not require specialized surgical equipment. This case series demonstrates successful use of an evisceration technique in 4 psittacine birds with 4 distinct pathologies and no postoperative complications.

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