Case Report

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Dacryocystectomy for Chronic Dacryocystitis in a Beagle Dog

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Abstract A 3-year-old spayed female beagle dog was presented with epiphora, severe hemorrhagic and purulent ocular discharge in the right eye (OD). A reflux of the discharge through the other canaliculi, associated with signs of chronic inflammation, was observed on cytology. Dacryocystorhinography revealed retention of contrast media ventral to the lower punctum, indicating complete obstruction and the potential presence of radiolucent foreign body. Ocular discharge subsided after the first treatment, including flushing of the nasolacrimal duct and application of topical antibiotics and corticosteroids, but clinical symptoms of the dacryocystitis waxed and waned thereafter. Surgical treatment was delayed for 8 months due to *Dirofilaria immitis* infection, and topical treatment and monthly flushing were maintained. On the day of operation, a foreign body was released through the fistula, while flushing for disinfection under general anesthesia, just before the surgery. Dacryocystectomy was performed to remove necrotic tissue and residual foreign body around the nasolacrimal cyst. Upon histopathologic findings, the removed foreign body was considered to be a plant, and the nasolacrimal cyst was comprised of chronic active ulcerative inflammation and necrotic tissues. At the 1-week recheck, improvement of epiphora and ocular discharge and healing of the surgical site was noted. In conclusion, nasolacrimal duct foreign body can be considered in recurrent dacryocystitis, despite nasolacrimal flushing and topical medication. In this study, dacryocystectomy was curative without recurrence of dacryocystitis or epiphora.

Key words beagle, chronic dacryocystitis, dacryocystectomy, epiphora, ocular discharge.

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Introduction

The nasolacrimal system balances the amount of tear film on the surface of the eye by releasing tears and keeps the ocular surface healthy (11,22). The nasolacrimal drainage system consists of the nasal puncta, the canaliculi, the nasolacrimal sac and the nasolacrimal duct ending in the nasal vestibule (22). In dogs and cats, the nasolacrimal sac is poorly developed and slightly enlarged, surrounded by fossa sacci lacrimalis (22). The nasolacrimal duct exists in a small diameter that passes through the intraosseous canal within the maxillary bone (22).

The nasolacrimal tract is known to be occluded by inflammatory substances or foreign body. Tear stagnation induces changes in mucosal cellular structure, which renders the duct more vulnerable to infection (11). Dacryocystitis, or the inflammation of the nasolacrimal sac or the nasolacrimal duct, shows characteristic clinical signs, such as epiphora, ocular discharge, and secondary conjunctivitis, and infrequently forms a fistula ventral to the medial canthus (11,13).

Dacryocystitis can be diagnosed by checking the opening of the nasolacrimal apparatus via flushing through the nasal punctum or the Jones test (11). Imaging diagnostic methods, including dacryocystorhinography or computed tomography (CT), can specify the location of obstruction in the nasolacrimal system (8,21). Recently, it has been reported that nasolacrimal foreign bodies were identified and removed with the help of ultrasonography (4).

Surgical intervention of dacryocystitis, widely performed in veterinary medicine, is known as dacryocystotomy with an additional stent placement within the nasolacrimal duct to prevent its obstruction (6). Lacrimal rehabilitation, such as conjunctivorhinostomy, conjunctivobuccostomy, dacryocystomaxillorhinostomy or canaliculorhinostomy, can be additionally applied to facilitate tear drainage (8,22). However, in human medicine, dacryocystectomy, or the complete removal of the nasolacrimal sac, has been performed in certain conditions such as recurrent dacryocystitis, granulation tissue, or fibrotic sac, especially in elderly patients (1,4,5,16). The purpose of the present study is to report clinical outcomes after dacryocystectomy in a dog with chronic dacryocystitis with hemorrhagic and/or purulent ocular discharge.

Case Report

A 3-year-old spayed female beagle dog was referred to Veterinary Medical Teaching Hospital of Seoul National University in complaint of epiphora and severe hemorrhagic and purulent ocular discharge in the right eye (OD). The owner said that the ocular discharge OD had first appeared 4 months ago, and topical antibiotics were applied twice daily until the first presentation. Despite frequent eye-washing with saline by the owner, the symptoms worsened, without any improvements of the hemorrhagic ocular discharge 2 months prior to their presentation. In addition, the dog had been diagnosed with infection of *Dirofilaria immitis* by the referring veterinarian.

A copious amount of hemorrhagic and purulent ocular discharge around the lower punctum OD, accompanied by third eyelid edema and hyperemia, were observed on ophthalmic examinations. A large number of lymphocytes and plasma cells were shown on cytology sampling from the inner surface of the third eyelid. Under topical anesthesia, the nasolacrimal duct system OD was flushed with sterile saline to identify the occlusion. Hemorrhagic and mucopurulent discharge refluxed through the other punctum, but patency from the nasolacrimal sac to the nasolacrimal duct was not established. Skull radiographs were performed to exclude the obstruction associated with maxillary or lacrimal bone fracture, and no abnormalities were identified. Dacryocystorhinography was carried out using Iohexol (Omnipaque® 300 mg/mL; GE Healthcare, Shanghai, China) as the contrast medium, which was injected into the upper and lower punctum, respectively. Dacryocystorhinography revealed no contrast media in the nasolacrimal duct distal to the cystic dilation, indicating complete obstruction. A foreign body was also identified on the contrast image as a partial filling defect in the contrast-filled nasolacrimal cyst (Fig. 1). Additionally, an intraluminal hyperechoic spot was detected on ocular sonography, supporting the contrast imaging result (Fig. 2). However, surgical intervention for removing the foreign body was

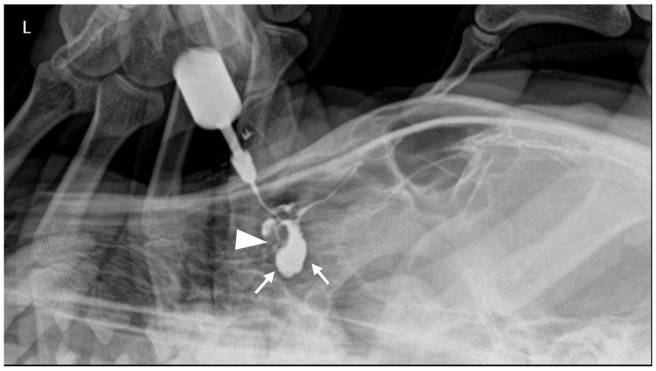

Fig. 1. A dacryocystorhinographic image. Contrast material remained in a dilated nasolacrimal cyst (arrows). Complete obstruction was confirmed as no contrast material was observed distal to the nasolacrimal cyst. The filling defect within the nasolacrimal cyst was considered as a foreign body (arrow head).

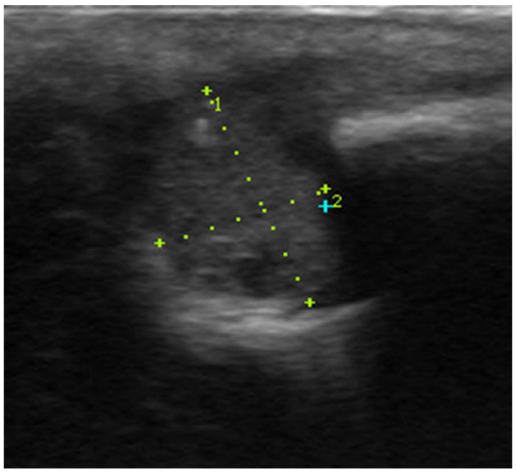

Fig. 2. An ocular sonographic image. An oval echogenic structure was observed in the nasolacrimal system. Distance of 1 & 2 was 1.03 cm and 0.76 cm, respectively.

postponed to the time after treatment of the heartworm infection to decrease the risk of general anesthesia complications. Therefore, subconjunctival injection of a mixture of triamcinolone (Dongkwang Pharmaceuticals, Seoul, Korea) and gentamicin (Shin Poong Pharmaceuticals, Seoul, Korea) was performed to relieve the inflammation beforehand. Neomycin-polymyxin B-dexamethasone compounds (Maxitrol; Alcon, Belgium) and ofloxacin (Ocuflox; Samil pharm, Iansan, Korea) eyedrops OD BID were prescribed.

The hemorrhagic and purulent ocular discharge resolved two weeks after the first nasolacrimal flushing, but relapsed at the 1-month recheck. Bacterial culture and susceptibility testing of the discharge revealed *Staphylococcus pseudointermedius* as the infectious agent and resistance to ofloxacin, respectively. Susceptible antibiotics included gentamicin, amikacin, tobramycin, and chloramphenicol. The nasolacrimal system was flushed with gentamicin (Shin Poong Pharmaceuticals, Seoul, Korea), and topical application of tobramycin (Ocuracin, Samil, Korea) OD BID was the choice of option according to the susceptibility test results. At the 2-month recheck, conjunctival fistula between the upper and lower punctum was revealed by the release of mucopurulent discharge during nasolacrimal flushing. All along the treatment of the heartworm infection, monthly nasolacrimal flushing and topical medications were maintained. Clinical symptoms of dacryocystitis waxed and waned during the treatment period. Schirmer tear test 1 (STT; Merck Animal Health, NJ, USA) was performed during all follow-up visits, and results ranged from 14 to 17 mm/min.

Heartworm infection was completely treated 8 months after the first presentation, and surgical intervention was planned for the ultimate treatment of the recurrent dacryocystitis. Following the induction of general anesthesia, nasolacrimal flushing with 0.5% povidone-iodine was performed for disinfection just before the surgery. A suspected foreign body, measuring 1 × 0.8 cm, refluxed through the fistula, and was fixed with 10% neutral phosphate-buffered formalin for histopathologic examination. The surgical procedure was continued to remove damaged tissues, including the possible residual foreign body, and to prevent the recurrence of dacryocystitis. A 3-cm-curvilinear skin incision was made parallel to the lower eyelid margin at the level of the medial lower conjunctival sac (Fig. 3A). Blunt dissection between the orbicularis oculi muscle and the levator nasolabialis muscle was performed to approach the orbital septum, and was continued until the dilated nasolacrimal sac was exposed (Fig. 3B, C). The severely necrotized nasolacrimal sac was removed by debriding the adjacent tissues, and was also submitted for histopathology exams. Monopolar electrocautery (Ellman Surgitron; Ellman international Inc, Hewlett, New York, USA) and direct pressure with gauze or cotton swabs were utilized for hemostasis during blunt dissection. The fistula and both the upper and lower punctal sites identified by the implantation of catheters near the cyst resection site were sutured with 6-0 polyglactin 910 (Vicryl® Ethicon) in a cruciate pattern (Fig. 3D). The orbital septum and subcutaneous tissues were closed using 6-0 polyglactin 910 in a simple continuous pattern (Fig. 3E). The skin was apposed with 4-0 polyglactin 910 in a simple interrupted pattern (Fig. 3F).

Postoperative care included topical application of ofloxacin ophthalmic ointment (Ocuflox; Samil Pharmaceutical, Seoul, Korea) OD TID, oral administration of carprofen (Rimadyl; Pfizer, New York, USA) at 2.2 mg/kg PO BID, streptokinase (Retonase; Withus Pharmaceutical, Seoul, Korea) at 0.5 mg/kg PO BID, and amoxicillin and clavulanic acid (Augmentin, Il Sung Pharmaceutical, Seoul, Korea) at 12.5 mg/kg PO BID for 12 days.

At the time of suture removal, 9 days after surgery, neither ocular discharge nor epiphora OD was noted and the STT-1 value was 15 mm/min. One month postoperatively, no evidence of epiphora, conjunctivitis, nor elevation of third eyelid was noted on complete ophthalmic examinations, and the STT-1 measures were in normal ranges at 20 mm/min. Complications associated with dacryocystectomy were not found until ten months postoperatively.

For histopathological examination of the suspected foreign body and the resected nasolacrimal sac, representative samples were processed routinely, embedded in paraffin wax, sectioned (3 μm thickness), and stained with hematoxylin and eosin (H&E).

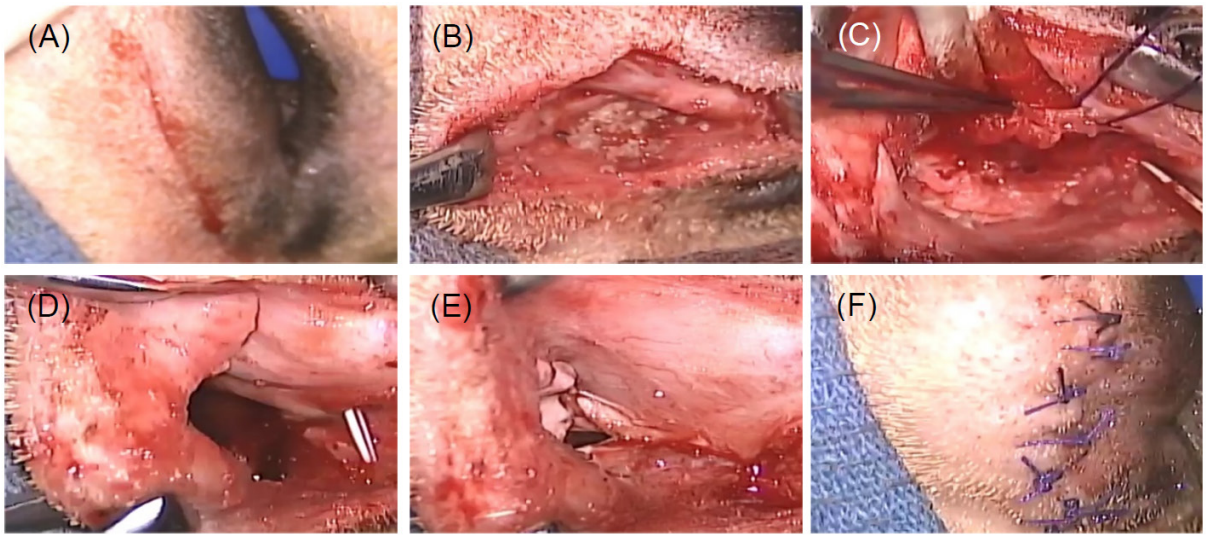

Fig. 3. Surgical procedures of dacryocystectomy in the right eye. (A) A 3-cm incision was made at the lower eyelid near the conjunctival sac. (B) Gentle blunt dissection with the Stevens tenotomy scissors was continued to reach the nasolacrimal sac. (C) Following separation of the dilated nasolacrimal sac from the adjacent tissue, amputation of the sac was performed with debridement of the adjacent necrotic tissue. (D) After checking the location of the fistula with a catheter, it was closed in a cruciate pattern. (E) The orbital septum and the subcutaneous tissue were separately sutured by a simple continuous pattern. (F) Dacryocystectomy was completed by skin apposition.

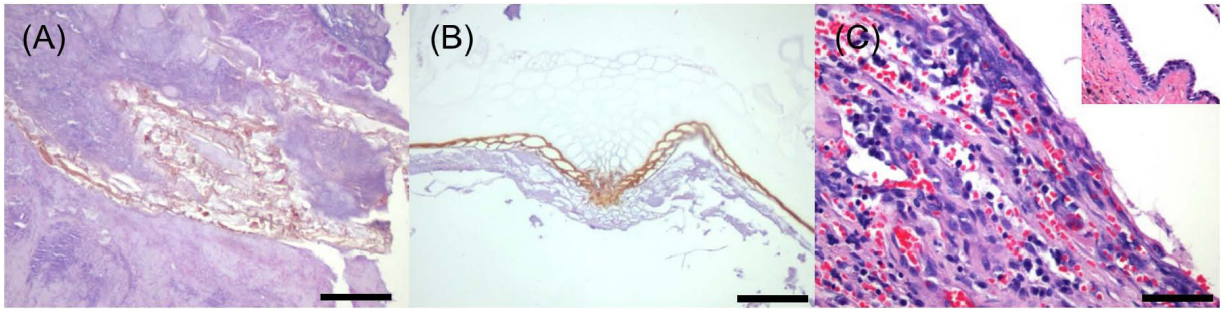

Fig. 4. Histopathology of the foreign body and the nasolacrimal sac. (A) The plant was embedded in necrotic debris. H&E. Bar = 50 μm. (B) The plant showed honeycomb-like configuration with pale brown coloration. H&E. Bar = 50 μm. (C) The removed nasolacrimal sac had severe chronic-active ulcerative inflammation with hemorrhage. Normal epithelium of the nasolacrimal sac remained in some area (inset). H&E. Bar = 50 μm.

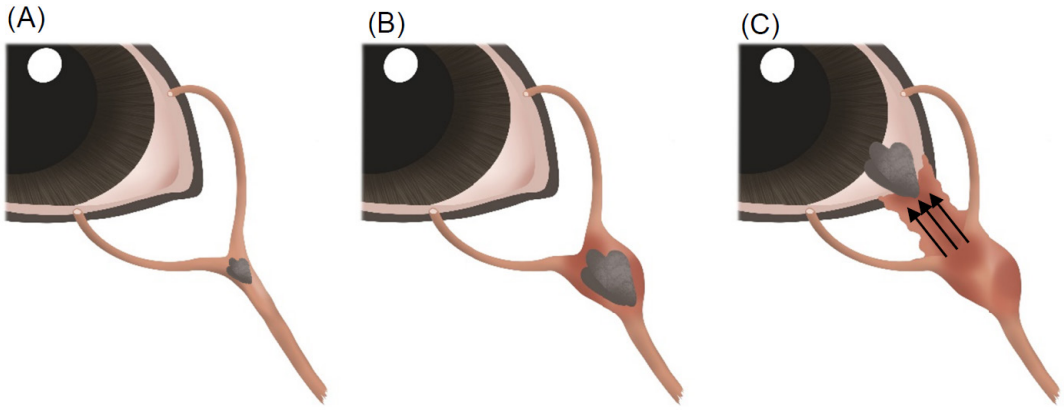

Fig. 5. Illustration of the hypothetical steps of chronic dacryocystitis before releasing the foreign body. (A) Initially, a small foreign body invaded into the nasolacrimal sac. (B) Deposition of necrotic substances or tear components progressed further with the persistence of chronic dacryocystitis. (C) Large fistula formation was induced by chronic irritation and inflammation. Foreign body could reflux through the enlarged fistula.

Histopathologically, the suspected foreign body was considered as a plant. Necrotic tissue with infiltration of numerous neutrophils was observed around the plant (Fig. 4A). The plant had a honeycomb-like configuration and was pale brown in H&E stain (Fig. 4B). In addition, the plant showed birefringence on a polarized light microscopy. The nasolacrimal sac was accompanied by severe chronic-active inflammation with hemorrhage and ulceration of the nasolacrimal sac epithelium (Fig. 4C).

Discussion

Previous reports on nasolacrimal system obstruction identified various causes such as foreign body, congenital malformation, fractures of the maxillary and lacrimal bone, neoplasia, and intranasal teeth (11,13,18,21). The most common cause of blockage is known as the foreign body (11,13). In the present case, foreign body was not identified during routine flushing just under topical anesthesia, but was released through nasolacrimal flushing under general anesthesia, which was identified as a brown honeycomb-shaped plant upon histopathological examination.

Removing the causative factor of the occlusion and preserving the patency of the nasolacrimal duct is the basis of successful treatment for dacryocystitis induced by a foreign body (8). Dacryocystotomy for removing the causative factor and catheterization for the prevention of stenosis of the nasolacrimal duct is known as the typical surgical procedure (8,17). Non-surgical methods to remove foreign bodies for treating dacryocystitis include nasolacrimal flushing and ultrasonography-, lacrimoscopy- or fluoroscopically guided removal (3,18,19). In the current case, nasolacrimal flushing, which can be performed only after topical anesthesia, was implemented periodically because the surgical plan was delayed due to the heartworm treatment. Therefore, nasolacrimal flushing with diluted antibiotic and anti-inflammatory agents was performed monthly, showing a temporary improvement in clinical symptoms. However, the causative foreign body was not released, and only mucopurulent discharge from the other punctum and/or the fistula refluxed. According to previous studies, plants that enter the nasolacrimal duct can sometimes be lysed and cleared because herbaceous materials break down (8,13). However, in the present case, the size of the foreign body released from the fistula was 1 × 0.8 cm, and the diameter of the canaliculi in dogs is known to be 0.5 to 1 mm (6), so there seemed to be a limit in complete flushing out or lysis of the foreign body. The foreign body may have induced chronic irritation within the nasolacrimal sac and may be considered to have increased in size due to the deposition of necrotic materials. Elevation of tear evaporation and tear saturation with secondary complete obstruction of the nasolacrimal system is considered to promote the accumulation of necrotic debris or minerals in tears, resulting in enlargement of the foreign body in this study (Fig. 5A, B) (10,12). Histopathologic examination also showed a massive amount of necrotic material surrounding the brown-colored plant. However, the enlarged foreign body was finally released through the fistula during nasolacrimal flushing under general anesthesia just before the surgery (Fig. 5C). Release of the foreign body could have been caused not only by the gradually increasing size of the fistula as the dacryocystitis becomes protracted, but also by loosening of the fistula opening due to muscle relaxation of the orbicularis oculi muscle following general anesthesia.

In human medicine, dacryocystectomy, a complete excision of the nasolacrimal sac with abnormal tissues, is proposed as a substitution for dacryocystotomy in treating chronic dacryocystitis to avoid possible recurrence after dacryocystotomy (1,14,16). Additional indications for dacryocystectomy may include dry eye, lacrimal sac tumor, and fibrotic sac after severe trauma (1,14,16). In the current study, a wide range of necrosis and granulation tissues of the nasolacrimal sac were discovered during the surgery, hence dacryocystotomy with stenting was abandoned for the concern of high probability of recurrence. Postoperative histopathologic findings showed severe chronic-active inflammation with ulceration of the nasolacrimal sac epithelium. In a previous study, there was a case of recurrence of epiphora after 49 days of stent placement in dogs with chronic dacryocystitis concurring with serosanguineous or seromucoid ocular discharge for 4 months (19). The study suggested that loss of nasolacrimal duct function due to chronic fibrotic change was presumed to be the cause (19). In humans, it is known that valves of canaliculi might be able to regulate nasolacrimal drainage (2). Therefore, nasolacrimal drainage after dacryocystotomy may also be decreased as a result of the functional loss of the intracanalicular valve due to fibrosis caused by chronic dacryocystitis. Thus, dacryocystectomy would be concerned in case of fibrotic damage from chronic dacryocystitis.

Rare occurrences of comorbidities following dacryocystectomy were reported in humans (1,14,20). Typical complications of dacryocystectomy in humans include elevation of the tear meniscus, epiphora, or relapse of dacryocystitis caused by residual sac (1,14). In this case, 1 month after the surgery, no signs of epiphora or recurrent dacryocystitis was found on a full ophthalmic examination. Additionally, one of the representative intraoperative complications of dacryocystectomy is known as copious bleeding due to damage of the

angularis oculi vein (1,14). The surgical method to access the nasolacrimal sac in the current study was similar to the ventral transpalpebral approach to the ventral orbit, described in a previous study, which demonstrated that ventral orbital rim exposure, including the lacrimal bone, is possible without excessive bleeding (15). Thus, the surgical approach used in the current study could be an adequate method for avoiding injury to the angularis oculi vein while exposing the nasolacrimal sac for complete excision (15).

On the period of medical treatment before the surgery, the STT-1 values measured from 14 to 17 mm/min in this case, which are the lower limits of the normal range based on reports of STT-1 tests in dogs (9). A previous study in healthy humans showed that STT-1 values and ocular surface sensation both decreased after the upper and lower punctal occlusion (23). Reduction in ocular surface sensation caused a decrease in the sensory stimuli for the tear production as well (23). Nevertheless, the tear production/clearance and ocular sensation were recovered to pre-occlusion levels 14-17 days after the occlusion, and so it is suggested that an autoregulatory mechanism regulating tear homeostasis exists in the absence of ocular irritation (23). However, in the current case, the STT values were also measured within the lower limits of the normal range during the presence of dacryocystitis, which might indicate persistent ocular irritation by foreign bodies. One month after the dacryocystectomy with removal of the foreign body, STT-1 value was 20 mm/min and had slightly increased than before. Hence, the mild elevation of STT could be thought that the ocular irritation was eliminated by surgery, and that the autoregulatory mechanism has been normalized in this case (7,23).

In this case, no complications such as epiphora were observed until ten months, even though lacrimal rehabilitation had not been made. However, the limitations of this case report is that it discusses only one case with a short follow-up time, so further large-population studies of post-dacryocystectomy and investigation for complications in a long-time follow-up are required.

In conclusion, a foreign body in the nasolacrimal duct should be considered if dacryocystitis recurs despite repetitive nasolacrimal flushing and medical management. Dacryocystectomy could be a surgical option in chronic or recurrent dacryocystitis associated with foreign body in dogs. To the best of our knowledge, this is the first case report of applying dacryocystectomy, by extirpation of the nasolacrimal sac, in chronic dacryocystitis caused by foreign body in dogs.

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Conflicts of Interest

The authors declare no conflicts of interest and there was no financial support of manufacturer associated with the products used in this case report.

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