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Outcomes in dogs with sinonasal aspergillosis treated via sinuscopic debridement and clotrimazole cream application

Beatrice Hertel, DVM[1]*; Frances Bird, BVSc, CertSAS, DECVS[2]; Rosario Vallefuoco, DVM, DESV, DECVS[2]; Mark Longley, BVM&S, MSc, GPCertSAS, DECVS[2]; Hervé Brissot, DEDV, DECVS[3]

[1]Surgery Department, San Marco Veterinary Clinic and Laboratory, Veggiano, Italy
[2]Surgery Department, Pride Veterinary Referrals, Derby, UK
[3]Surgery Department, AzurVet, Saint-Laurent-du-Var, France

*Corresponding author: Dr. Hertel (beatrice.hertel@hotmail.it)

Objective
To describe surgical fungal plaque debridement and clotrimazole 1% cream application via normograde sinoscopy (NS) and report short- and long-term outcomes in dogs with sinonasal aspergillosis (SNA).

Animals
18 client-owned dogs.

Clinical Presentation
This was a retrospective single-institution case series of dogs diagnosed with SNA and treated with NS. Signalment, history, physical examination, diagnostic and sinuscopic findings, topical treatment frequency, complications, and outcome were recorded.

Results
18 dogs underwent NS for SNA treatment. The median age was 8.5 years. Unilateral disease (15 of 18) was more frequent than bilateral. Following direct access to the frontal sinus, debridement of fungal plaques was completed under direct visualization with a 2.4-mm, 30° arthroscope. Two topical cream instillations were performed in 17 of 18 cases, with a complete resolution of clinical signs recorded in 15 of 18 dogs. Re-treatment was achieved via percutaneous injection in dogs requiring more than 1 topical cream application. A small self-limiting swelling of the surgical wound was reported in 1 case. Re-treatment via percutaneous injection was a fast, well-tolerated, and low-morbidity procedure. Repeated debridement via NS was required in 4 dogs. Long-term follow-up documented an overall cure rate of 83.3% with no major complications.

Clinical Relevance
NS provided a safe approach for complete debridement of the frontal sinus with a comparable outcome to previously reported treatments. No major complications associated with the surgical procedure occurred. This technique allowed direct visualization and video-assisted debridement of fungal plaques. Normograde sinoscopy could be considered as a technique to enhance topical treatments for extensive frontal sinus aspergillosis.

Keywords: aspergillosis, soft tissue, *Aspergillus fumigatus*, sinonasal aspergillosis, sinoscopy

Sinonasal aspergillosis (SNA) is a common cause of nasal discharge in dogs, accounting for 7% to 34% of cases.[1] The most commonly isolated pathogen is *Aspergillus fumigatus*.[2] Host immunocompetence, pathogen burden, and virulence are factors associated with active infection.[3] Clinical signs include mucopurulent nasal discharge, depigmentation of the nasal planum, epistaxis, and pain.[2] Sinonasal aspergillosis mainly affects young- to middle-aged mesocephalic-dolichocephalic breeds.[2] These have typically been reported to be medium- to large-breed dogs[3–6]; however, SNA has also been reported in some small-breed dogs: West Highland White Terrier, Dachshund, Fox Terrier, and Cocker Spaniel.[7–9] *Aspergillus* spp infection incites a marked inflammatory response in the nasal cavity and sinuses.[3] Destruction of the turbinates occurs secondary to the inflammatory response and release of dermonecrolytic fungal toxins.[10] An increase in size of the sinonasal ostium is also reported in some cases of SNA.[6]

Diagnosis of SNA is made via clinical signs, diagnostic imaging, rhinoscopic examination, histopathology, culture, and serological testing.[3] Computed

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tomography has been shown to be 88% to 92% sensitive for the diagnosis of SNA,[11] compared to radiography, which is only 72% to 84% sensitive. Computed tomography allows accurate assessment of the extent of sinus involvement.[12] Diagnosis of SNA by culture of mucosal biopsies or fungal plaques is more sensitive than culture of nasal secretions.[13]

Multiple treatment techniques have been described,[4,6,7,14,15] with systemic treatments having reported[16] cure rates of approximately 50%. Due to high failure rates and hepatotoxicity associated with systemic therapy,[2] topical treatment is the preferred treatment. Topical treatments with clotrimazole and enilconazole have shown success rates[8,16] between 83% and 100%. However multiple treatments are often required.[15] In humans diagnosed with noninvasive fungal sinusitis, debridement is used as a sole treatment with no requirement for antifungal medication.[17] However, in cases of invasive fungal rhinosinusitis, endoscopic debridement is used in combination with systemic antifungal medication.[18] Surgical and endoscopic debridement have also been described in dogs,[3,4,6,14] and, in 17% of cases of SNA, fungal plaques are only observed within the frontal sinus.[12] Access to the frontal sinus via rhinoscopy is not possible in all patients.[12] A minimally invasive technique has been described including irrigation and topical antifungal medication via retrograde placement of a catheter into the frontal sinus with the Seldinger technique, thereby avoiding the need for trephination.[19] The median number of treatments reported with this technique was 2, but this was limited to dogs without bilateral frontal sinus involvement. For dogs with more extensive disease, 3 or 4 topical treatments were required. Direct (normograde) sinuscopic access for sampling and debridement is a low-morbidity procedure and, in cases where there is extensive fungal material within the sinus, is indicated to improve outcomes.[3,20] Sinoscopy is the main technique used for diagnosis and treatment of sinus disease in horses.[21] In 1 study,[21] 69% of horses with paranasal sinus disease had resolution of clinical signs after trephination, sinoscopy, sinuscopic debridement, and lavage. This technique has been demonstrated to be the most effective in horses with primary sinusitis, hemorrhage, or small sinus cysts.[21] Complete debridement of the fungal plaques before infusion of antifungal medication has been recommended to improve success rates in dogs.[22] Normograde sinoscopy (NS) and video-assisted debridement has never been reported in dogs.

The aim of this study was to describe surgical fungal plaque debridement and clotrimazole 1% weight/weight cream application via NS and report short- and long-term outcomes in a cohort of dogs. We hypothesized that NS would allow for direct visualization and debridement of fungal plaques and the cure rate and frequency of treatment would compare favorably with the previously described techniques.

Methods

The Committee for Animal Research and Ethics of the University of Nottingham School of Veterinary Medicine granted study ethical approval (No. 3326 210205) for this retrospective single-institution case series.

Inclusion criteria

Dogs presented to a single institution between January 2015 and December 2023 with a definitive diagnosis of SNA and treated with NS were included in this case series. Medical records were searched by a single author, and terms searched included *Canesten*, *aspergil*, *clotrimazole*, *neuro burr*, *Jacobs chuck*, *debrid*, *fumigatus*, *sinus*, and *sinos*. Diagnosis of SNA was based on clinical signs, evidence of a destructive rhinopathy, extension of the disease within the frontal sinus on CT, rhinoscopic demonstration of fungal plaques, fungal culture, cytology, and/or histopathology.

The medical records were reviewed by 2 authors. Descriptive information including signalment, history (date of examination, presenting complaint, duration of clinical signs), physical examination, laboratory data, culture results, treatment method, perioperative complications, and histopathology was recorded. Follow-up data, consisting of short-term complications within 14 days from NS, treatment frequency and response, any long-term complications between 14 days and 3 months after the last treatment, morbidity, and mortality rate, were obtained from the medical records and telephone calls with the clients between 6 months and 8 years after the final treatment.

Diagnostic imaging performed

All patients underwent preoperative CT study with contrast of the head and normograde rhinoscopy with either a rigid telescope or flexible endoscope. Computed tomography studies were performed with a 16-slice, multi–detector-row, helical CT scanner (BrightSpeed; GE HealthCare) with the animal in sternal recumbency. The images were acquired in soft tissue and bone reconstruction algorithms. Window width and level were appropriately adjusted, and multiplanar reformatting was used whenever necessary for optimal evaluation. For all dogs, CT images were acquired prior to and after administration of iohexol at 600 mgI/kg.

Frontal sinus disease was defined based on a previous study[23] describing CT features of canine nasal aspergillosis. Computed tomography criteria evaluated included extension of the lesions (nasal cavity, frontal sinus, and uni- or bilateral), presence or absence of abnormal soft tissue and/or mucosal thickening (absent, mild [one-third nasal cavity], moderate [two-thirds nasal cavity], severe [all nasal cavity], maxillary recesses, caudal recess, frontal sinuses, presence of a focal rounded soft tissue accumulation), presence of the turbinate and/or cribriform plate lysis, and presence of hyperostosis or reactive new bone. Frontal sinus lysis was also recorded.

All rhinoscopic evaluations were performed by a board-certified internist or supervised internal medicine resident. Rhinoscopy was performed either with a 2.7-mm, 30° multipurpose telescope with a triport

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operating sheath (Hopkins Straight Forward Telescopes; Karl Storz) or with a Vesco 5.8-mm flexible endoscope. Turbinate destruction, severity of intranasal fungal plaques, unilateral or bilateral presence of mucopurulent material, and damage to the nasal mucosa were recorded.

Surgical procedure

All animals were anesthetized and monitored according to individual protocols defined by a board-certified anesthesiologist (diplomate of the American College of Veterinary Anesthesia and Analgesia or European College of Veterinary Anaesthesia and Analgesia). Dogs were premedicated with dexmedetomidine (Dexdomitor) or acepromazine or both in combination with methadone (Comfortan). Anesthesia was induced with alfaxalone (Alfaxan) or propofol (Propoflo). Cefuroxime (20 mg/kg; Zinacef) and meloxicam (0.2 mg/kg; Metacam) or carprofen (4 mg/kg; Rimadyl) were given perioperatively. A cuffed endotracheal tube was placed, and anesthesia maintained with isoflurane (IsoFlo) in 100% oxygen. The pharynx was packed with dampened swabs to prevent aspiration of fluid. Patients were positioned in sternal recumbency and maintained in position with sandbags. The skin over the frontal sinuses was clipped and aseptically prepared.

All surgeries were performed by a European board–certified surgeon or a surgical resident under the direct supervision of a board-certified surgeon. A 1-cm incision was made over the affected sinus at the most dorsal aspect of the frontal sinus **(Figure 1)**. This was continued through the fascia and periosteum, and 2 small Gelpi selfretaining retractors were placed to retract the soft tissues. The entry point to the sinus was calculated as *x* mm from the midline and *x* mm caudal to the line joining the zygomatic processes of the frontal bones on the multiplanar reconstruction of the preoperative CT scan, ensuring safe entry at the deepest point of the frontal sinus as defined by Burrow et al.[9] A 4.5-mm air powered burr or drill bit (gradually increasing in size from 2 mm to 4.5 mm) in a Jacobs chuck followed by rongeur enlargement was used to make a 5- to 8-mm-diameter hole in the frontal bone sufficiently large to allow simultaneous insertion of a 2.4-mm, 30° arthroscope without sheath in conjunction with either a Yankauer suction tip or curette. A sample of fungal material and mucosa was taken for histopathology and extended culture in the majority of the cases. Any visible fungal material and discharge was gently debrided under direct visualization (video assisted) with suction, flushing, and lifting with instrumentation until the frontal sinus was grossly free of all fungal material **(Supplementary Videos S1 and S2)**. The sinus was then injected with clotrimazole cream 1% (Canesten) under direct visualization with the scope to fill the sinus. The fascia and skin were then closed in 2 layers (3-metric poliglecaprone [Monocryl; Ethicon] and 3-metric nylon [Ethilon; Ethicon]). Postoperative medications included NSAIDs (meloxicam [0.1 mg/ kg; Metacam] or carprofen [2 mg/kg; Rimadyl]) for 5 days and opioid medication (methadone [0.1 mg/kg; Comfortan]) for 12 hours.



Figure 1—Surgical incision to access the frontal sinus.

Outcome and follow-up

All patients underwent repeated clinical examination and rhinoscopy between 3 and 5 weeks after initial treatment. In cases of persistence of clinical signs such as sneezing, persistence of nasal discharge and discomfort, or visible fungal plaques in the nasal cavity on rhinoscopy, an additional topical cream application was repeated. It consisted of percutaneous catheterization of the hole in the frontal sinus with a 19-gauge needle, flushing with 20 to 50 mL of warmed saline and 1% clotrimazole cream (Canesten) instillation. If fungal plaques were still visible on rhinoscopy at the sinonasal ostium, another NS debridement was repeated. All patients that required additional treatment underwent repeated rhinoscopy to evaluate the response 3 to 5 weeks after the repeated treatment. Short-term follow-up was recorded 14 days after initial NS. Long-term follow-up interviews were performed via telephone between 6 months and 8 years after the last topical treatment.

Statistical analysis

Only descriptive statistics were performed in this study. Continuous variables were reported as medians and ranges, while categorical variables were summarized as frequencies and percentages.

Results

Animals

The medical records of 33 dogs diagnosed with SNA and treated by NS between January 2015 and

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May 2022 at a single institution were reviewed. Only 18 dogs met the inclusion criteria; 15 dogs were excluded for either lost follow-up or incomplete medical records.

Signalment and clinical signs

Represented breeds included 4 Border Collies, 4 Labrador Retrievers, 2 Golden Retrievers, 1 Collie, 1 Standard Poodle, 1 German Shepherd Dog, 1 Rottweiler, 1 Newfoundland, 1 English Springer Spaniel, 1 American Bulldog, and 1 crossbreed dog. The median age was 8.5 years (range, 2 to 14 years). Of the 18 dogs, 10 were female (2 entire and 8 spayed) and 8 were male (2 entire and 6 neutered). The most common clinical signs included nasal discharge (16 of 18), sneezing (5 of 18), and epistaxis (3 of 18; **Table 1**). The median duration of clinical signs prior to presentation was 8 weeks (range, 4 to 48 weeks). The disease was unilateral in 15 of 18 cases and bilateral in 3 of 18 cases. The left side was affected in 9 of 18 cases, followed by the right side (6 of 18) and both sides (3 of 18). None of the patients had had previous antifungal treatment.

Diagnostic imaging findings

All patients showed nasal and concurrent frontal sinus involvement based on preoperative CT and the primary clinician considering flushing alone to be inadequate for the fungal burden and that debridement was indicated. Abnormal soft tissue material and/or mucosal thickening was recorded in all cases (18 of 18): mild in 2 of 18, moderate in 4 of 18, and severe in 12 of 18. Turbinate destruction was recorded in all cases except 1 (17 of 18), while the presence of concurrent cribriform-plate thinning was reported in 3 of 18 cases. Frontal sinus lysis was recorded in 11 of 18. Presence of hyperostosis was noted in 8 of 18. No intracranial lesions were reported.

Rhinoscopic findings

Turbinate destruction and erosion of nasal conchae were recorded in 7 of 18 cases (38.8%). Direct visualization of fungal plaques in the frontal sinuses was observed in 5 of 18 cases (27.7%). When there were no signs of destructive rhinitis, inflammation of the nasal mucosa and mucopurulent material was recorded in all cases except for 1, where the disease was confined to the frontal sinus.

Surgical procedure and topical treatment

Surgical time varied from 20 to 120 minutes (median unilateral, 52.5 minutes; median bilateral, 90 minutes). Normograde sinoscopy confirmed the presence of visible fungal plaques within the frontal sinuses in all cases. No intraoperative complications were recorded, and all dogs were discharged within 24 hours postoperatively.

Of the 18 cases, 14 dogs underwent a single NS, while 3 dogs required a second NS due to persistence of fungal plaques identified during repeated rhinoscopy. One dog was debrided sinuscopically 3 times.

The number of topical treatments varied, with a median of 2 (range, 2 to 5). Re-treatment was performed via percutaneous injection in those cases that did not require additional NS. Results are summarized in **Table 2**.

Laboratory findings

Fungal culture was performed in 16 of 18 cases and positive for *A fumigatus* in 8 of 16 cases (50%). Other microorganisms isolated were coagulase-positive *Staphylococcus* spp (3 of 16 [18.75%]) and *Pseudomonas aeruginosa* in 1 case.

Fungal hyphae were identified histopathologically in 8 of 16 (50%), while the remainder showed chronic rhinitis. A definitive diagnosis of SNA based on either positive fungal culture or confirmation of mycotic rhinitis on histology was recorded in 12 of 16 (75%).

Table 1—Summary of signalment, affected side, and clinical signs.

	Signalment				
Case	**Breed**	**Age (y)**	**Sex**	**Affected side**	**Clinical signs**
1	Border Collie	5	NM	Left	Nasal discharge
2	Collie	7	NM	Bilateral	Nasal discharge
3	Labrador Retriever	10	SF	Right	Nasal discharge
4	Border Collie	9	NM	Left	Nasal discharge
5	Labrador Retriever	11	SF	Right	Nasal discharge
6	English Springer Spaniel	8	F	Left	Nasal discharge
7	Golden Retriever	6	SF	Right	Nasal discharge, sneezing, and epistaxis
8	Border Collie	12	NM	Bilateral	Nasal discharge
9	Golden Retriever	11	SF	Bilateral	Nasal discharge
10	German Shepherd Dog	7	M	Left	Nasal discharge and sneezing
11	Newfoundland	4	SF	Left	Nasal discharge
12	Crossbreed	13	SF	Left	Sneezing and epistaxis
13	American Bulldog	2	M	Left	Sneezing and epistaxis
14	Labrador Retriever	4	F	Right	Nasal discharge and depigmentation
15	Labrador Retriever	12	SF	Right	Nasal discharge
16	Standard Poodle	11	NM	Right	Nasal discharge
17	Rottweiler	3	NM	Left	Nasal discharge and sneezing
18	Border Collie	14	SF	Left	Nasal discharge

F = Female. M = Male. NM = Neutered M. SF = Spayed F.

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Table 2—Summary of the number of sinuscopic debridements, number of topical cream applications, and outcome.

Case	Sinuscopic debridement (n)	Topical treatment (n)	Outcome
1	1	2	Resolved
2	2	3	Deterioration and euthanasia
3	1	3	Resolved
4	1	2	Resolved
5	1	2	Resolved
6	1	2	Resolved
7	1	2	Resolved and oral medication
8	1	2	Resolved
9	1	1	Resolved
10	1	2	Resolved
11	1	3	Resolved
12	1	2	Resolved
13	3	3	Resolved
14	2	5	Resolved
15	1; 1	3; 2	Reinfection after 2 years that resolved with re-treatment
16	1	2	Resolved
17	2	4	Deterioration and euthanasia
18	1	4	Resolved

Short-term follow-up (14 days after NS)

No major postoperative complications associated with NS were recorded; a small self-limiting swelling of the surgical wound, which did not require further intervention, was reported in 1 case and related to the depth of penetration of the needle at the time of injection. The swelling resolved 72 hours after the procedure.

Outcome and long-term follow-up

Long-term follow-up ranged from 6 months to 8 years after the last topical treatment. Nine dogs were confirmed endoscopically to be free from visible fungal plaques after 2 topical cream applications. One of the dogs that received 2 topical cream applications had full resolution of the clinical signs with concurrent administration of systemic antimycotic medications. Five dogs had full resolution after 3 treatments, 1 dog after 4, and 1 dog after 5. Lack of response to treatment was recorded in 2 dogs, which were euthanized due to deterioration of the clinical signs and poor quality of life. Reinfection of the disease was observed in 1 dog 2 years after the initial treatment. Following relapse, the animal was re-treated twice (one NS debridement with topical cream application and a second topical cream application) and resolved afterwards on long-term follow-up.

One dog had concurrent osteomyelitis secondary to *P aeruginosa*, but long-term follow-up was not available. Resolution of clinical signs was achieved in 15 of 18 on long-term follow-up, with 8 of 18 requiring more than 2 treatments. Results are summarized in Table 2.

Discussion

This case series aimed to describe the technique for NS debridement for the treatment of canine sinonasal aspergillosis and report outcomes and complications associated with this procedure. For invasive fungal rhinosinusitis, debridement is used in combination with clotrimazole. Clotrimazole at high concentrations causes direct damage to fungal membranes, inhibits ergosterol synthesis,[24] and has been shown to persist in the frontal sinus for at least 96 hours after treatment,[25] prolonging contact time. Intuitively, the presence of necrotic tissue, fluid, and debris in direct contact with fungal plaques will reduce exposure to antifungal agents and therefore compromise efficacy.[18] Debridement in these cases ensures good contact of the cream with the mucosa and remaining microscopic fungal hyphae.

Debridement of the frontal sinus has been reported via the sinonasal ostium[6]; however, access is not always possible[12] and, if the osseus septum is intact, access to the lateral component will be limited by this method. Other techniques including temporary trephination or rhinotomy with open debridement have been described.[9,14] Open debridement[14] gives good visualization and access but is associated with longer surgical times and increased morbidity. Additionally, penetration of the cranial vault during trephination in a cadaveric study has been reported.[9]

For these reasons, we performed NS. It provided good visualization of all compartments of the frontal sinus and allowed sufficient access to perform complete debridement and topical cream application.

The use of a burr to enter the frontal sinus and planning via the preoperative CT to assess the entry point prevented iatrogenic damage in these cases. The lack of intraoperative complications supported the safety of this technique.

With this technique, the debridement was gentle, avoiding the need for an aggressive curettage. All the plaques were removed by suction and grasping, and this did not generate any significant bleeding. This is a clear advantage compared with flexible or rigid rhinoscopy, where hemorrhage can occur, affecting visualization, in our experience.

The median surgical time was comparable to the previous reports of trephination[7] and endoscopic debridement via the sinonasal ostium.[6] Clotrimazole irrigation and depot therapy has a reported 86% cure rate following a single treatment for nasal

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aspergillosis.[7] However, no repeated rhinoscopy or postoperative imaging was performed in that study. Additionally, no preoperative CT was performed and the full extent of the disease was not established. This may have had overestimated the cure rate. Pomrantz et al[26] confirmed that presence/absence of nasal discharge was not predictive of the disease state, and follow-up rhinoscopy had been recommended to assess response to treatment. In that paper, the reported success rate was 67%, with only 48% after a single treatment. Additionally, Sharman et al[15] reviewed the treatment response of dogs with mycotic rhinosinusitis to commonly utilized treatment techniques including temporary trephination, reporting treatment success of 69.4% for multiple treatments, which is less than that previously reported. This suggests that SNA treatment remains challenging, and it is difficult to establish which dogs are likely to have a superior prognosis regardless of the treatment type used.[15]

In our case series, 16 of 18 dogs had moderate to severe disease and 17 of 18 required a second treatment based on repeated rhinoscopy 3 and 5 weeks after the initial procedure. An advantage of this technique was that re-treatment via percutaneous injection was a fast, low-morbidity procedure and well tolerated in all patients. Minor swelling and leakage were the only complications noted in 1 case and may have related to the depth of penetration of the needle at the time of injection. This gave an overall complication rate of 5%, supporting the safety of the procedure.

Long-term follow-up documented resolution of the clinical signs in 15 of 18 dogs. This gave an overall treatment success rate of 83.3%, which is comparable to previous treatments.[8,16] Schuller et al[8] described long-term resolution of the SNA in a population of 27 dogs, with 14 dogs cured after 1 treatment, 8 after 2 treatments, and 5 after 3 treatments, suggesting that multiple topical treatments may be required in the case of SNA. In our case series, more than 1 topical treatment was required in 17 of 18 cases, supporting the need for multiple treatments.

We reported persistence of SNA in 2 dogs after initial NS debridement and multiple topical treatments. In these animals, the frontal sinuses were considered severely affected. Due to the lack of response and persistence of fungal disease on repeated rhinoscopy, a second NS was repeated. Following further NS, both dogs were euthanized because of deterioration of the clinical signs and poor quality of life. This gave an overall treatment failure rate of 11.1%, which is lower compared to the previous reports for frontal trephination[27] and minimally invasive treatment of SNA in dogs.[19]

Reinfection was documented in 1 case 2 years after the initial treatment had resolution of the clinical signs following repeated NS and 1 topical cream application. This is in line with the previous report[19] where delayed or reinfection was documented in dogs with frontal sinus involvement.

Our study had some limitations, including its retrospective nature, its small sample size, different surgeons performing the procedure, the lack of an objective scoring system to quantify frontal sinus involvement, and the lack of posttreatment CT to objectively assess frontal sinus filling following debridement. In our case series, satisfactory dosing was confirmed by direct visualization at the surgical site. Despite these limitations, our findings supported NS as a viable, minimally invasive approach for managing SNA, particularly in cases with frontal sinus involvement.

In conclusion, NS represented a safe approach for effective debridement of the frontal sinus, with lower failure rates compared to temporary trephination. However, the overall cure rate reported here aligns with success rates reported for topical clotrimazole therapy, suggesting that SNA remains a challenging disease to treat. For this reason, it is important to inform the owner about the need for multiple treatments and difficulty in controlling the disease, especially in cases where SNA is advanced with confirmed frontal sinus involvement.

This technique allowed direct visualization and manual debridement of fungal plaques. Normograde sinoscopy should be considered in patients where frontal sinus disease is severe as a method to enhance topical treatments. Preoperative measurements of the entry point based on individual CT prevented iatrogenic penetration in the cranial vault. Future studies with larger sample sizes, standardized lesion scoring systems, and standardized postoperative imaging are required to further validate these findings.

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References

1. Sharp NJH, Harvey CE, O'Brien JA. Treatment of canine nasal aspergillosis/penicilliosis with fluconazole. *J Small Anim Pract*. 1991;32(10):513–516. doi:10.1111/j.1748-5827.1991.tb00868.x
2. Peeters D, Clercx C. Update on canine sinonasal aspergillosis. *Vet Clin North Am Small Anim Pract*. 2007;37(5):901–916, vi. doi:10.1016/j.cvsm.2007.05.005
3. Sharman MJ, Mansfield CS. Sinonasal aspergillosis in dogs: a review. *J Small Anim Pract*. 2012;53(8):434–444. doi:10.1111/j.1748-5827.2012.01245.x
4. Stewart J, Bianco D. Treatment of refractory sino-nasal aspergillosis with posaconazole and terbinafine in 10 dogs. *J Small Anim Pract*. 2017;58(9):504–509. doi:10.1111/jsap.12686
5. Stanton JA, Miller ML, Johnson P, Davignon DL, Barr SC. Treatment of canine sinonasal aspergillosis with clotrimazole infusion in patients with cribriform plate lysis. *J Small Anim Pract*. 2018;59(7):411–414. doi:10.1111/jsap.12835
6. Vedrine B, Fribourg-Blanc LA. Treatment of sinonasal aspergillosis by debridement and sinonasal deposition therapy with clotrimazole under rhinoscopic guidance. *J Am Anim Hosp Assoc*. 2018;54(2):103–110. doi:10.5326/JAAHA-MS-6648
7. Sissener TR, Bacon NJ, Friend E, Anderson DM, White RA. Combined clotrimazole irrigation and depot therapy for canine nasal aspergillosis. *J Small*

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Anim Pract. 2006;47(6):312–315. doi:10.1111/j.1748-5827.2006.00017.x
8. Schuller S, Clercx C. Long-term outcomes in dogs with sinonasal aspergillosis treated with intranasal infusions of enilconazole. *J Am Anim Hosp Assoc*. 2007;43(1):33–38. doi:10.5326/0430033
9. Burrow R, Baker M, White L, McConnell JF. Trephination of the frontal sinuses and instillation of clotrimazole cream: a computed tomographic study in canine cadavers. *Vet Surg*. 2013;42(3):322–328. doi:10.1111/j.1532-950X.2013.01105.x
10. Peeters D, Day MJ, Clercx C. An immunohistochemical study of canine nasal aspergillosis. *J Comp Pathol*. 2005;132(4):283–288. doi:10.1016/j.jcpa.2004.11.002
11. Saunders JH, van Bree H. Comparison of radiography and computed tomography for the diagnosis of canine nasal aspergillosis. *Vet Radiol Ultrasound*. 2003;44(4):414–419. doi:10.1111/j.1740-8261.2003.tb00478.x
12. Johnson LR, Drazenovich TL, Herrera MA, Wisner ER. Results of rhinoscopy alone or in conjunction with sinuscopy in dogs with aspergillosis: 46 cases (2001–2004). *J Am Vet Med Assoc*. 2006;228(5):738–742. doi:10.2460/javma.228.5.738
13. Billen F, Clercx C, Le Garérrès A, Massart L, Mignon B, Peeters D. Effect of sampling method and incubation temperature on fungal culture in canine sinonasal aspergillosis. *J Small Anim Pract*. 2009;50(2):67–72. doi:10.1111/j.1748-5827.2008.00672.x
14. Claeys S, Lefebvre JB, Schuller S, Hamaide A, Clercx C. Surgical treatment of canine nasal aspergillosis by rhinotomy combined with enilconazole infusion and oral itraconazole. *J Small Anim Pract*. 2006;47(6):320–324. doi:10.1111/j.1748-5827.2006.00154.x
15. Sharman M, Paul A, Davies D, et al. Multi-centre assessment of mycotic rhinosinusitis in dogs: a retrospective study of initial treatment success (1998 to 2008). *J Small Anim Pract*. 2010;51(8):423–427. doi:10.1111/j.1748-5827.2010.00957.x
16. Sharp NJ, Sullivan M, Harvey CE, Webb T. Treatment of canine nasal aspergillosis with enilconazole. *J Vet Intern Med*. 1993;7(1):40–43. doi:10.1111/j.1939-1676.1993.tb03167.x
17. Uri N, Cohen-Kerem R, Elmalah I, Doweck I, Greenberg E. Classification of fungal sinusitis in immunocompetent patients. *Otolaryngol Head Neck Surg*. 2003;129(4):372–378. doi:10.1016/S0194-59980301304-4
18. Stringer SP, Ryan MW. Chronic invasive fungal rhinosinusitis. *Otolaryngol Clin North Am*. 2000;33(2):375–387. doi:10.1016/S0030-6665(00)80012-2
19. Ballber C, Hill TL, Bommer NX. Minimally invasive treatment of sino-nasal aspergillosis in dogs. *J Vet Intern Med*. 2018;32(6):2069–2073. doi:10.1111/jvim.15311
20. Sharman M, Lenard Z, Hosgood G, Mansfield C. Clotrimazole and enilconazole distribution within the frontal sinuses and nasal cavity of nine dogs with sinonasal aspergillosis. *J Small Anim Pract*. 2012;53(3):161–167. doi:10.1111/j.1748-5827.2011.01181.x
21. Ruggles AJ, Ross MW, Freeman DE. Endoscopic examination and treatment of paranasal sinus disease in 16 horses. *Vet Surg*. 1993;22(6):508–514. doi:10.1111/j.1532-950X.1993.tb00429.x
22. Vangrinsven E, Girod M, Goossens D, Desquilbet L, Clercx C, Billen F. Comparison of two minimally invasive enilconazole perendoscopic infusion protocols for the treatment of canine sinonasal aspergillosis. *J Small Anim Pract*. 2018;59(12):777–782. doi:10.1111/jsap.12933
23. Saunders JH, Zonderland JL, Clercx C, et al. Computed tomographic findings in 35 dogs with nasal aspergillosis. *Vet Radiol Ultrasound*. 2002;43(1):5–9. doi:10.1111/j.1740-8261.2002.tb00434.x
24. Iwata K, Yamaguchi H, Hiratani T. Mode of action of clotrimazole. *Sabouraudia*. 1973;11(2):158–166. doi:10.1080/00362177385190321
25. Hayes GM, Demetriou JL. Distribution and persistence of topical clotrimazole after sinus infusion in normal canine cadavers. *J Small Anim Pract*. 2012;53(2):95–100. doi:10.1111/j.1748-5827.2011.01164.x
26. Pomrantz JS, Johnson LR. Repeated rhinoscopic and serologic assessment of the effectiveness of intranasally administered clotrimazole for the treatment of nasal aspergillosis in dogs. *J Am Vet Med Assoc*. 2010;236(7):757–762. doi:10.2460/javma.236.7.757
27. Mathews KG, Davidson AP, Koblik PD, et al. Comparison of topical administration of clotrimazole through surgically placed versus nonsurgically placed catheters for treatment of nasal aspergillosis in dogs: 60 cases (1990–1996). *J Am Vet Med Assoc*. 1998;213(4):501–506. doi:10.2460/javma.1998.213.04.501

Supplementary Materials

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