http://dx.doi.org/10.1590/1678-4162-12855

Arq. Bras. Med. Vet. Zootec., v.75, n.5, p.921-928, 2023

Isolated *Microsporum Canis* from a canine nasal cavity bearer of intranasal foreign body and Transmissible Venereal Tumor – Radiografic imaging and rinoscopy – case report

[Microsporum canis *isolado em cavidade nasal de canino portador de corpo estranho e tumor venéreo transmissível intranasal – imagens radiográficas e rinoscópicas – relato de caso*]

D.S. *Rolemberg*[1], G.N. *Toledo*[2], S.D.S. *Reis*[3], P.P. *Moreira*[1], P.C. *Moraes*[1]

[1]Universidade Estadual Paulista (Unesp), Jaboticabal, SP, Brasil
[2]Centro de Saúde e Tecnologia Rural, Universidade Federal de Campina Grande (CSTR/UFGG), Patos, PB, Brasil
[3]Universidade Federal da Bahia (UFBA), Salvador, BA, Brasil

ABSTRACT

Rhinopathies diagnosis in small animals is challenging, especially regarding their etiology. Imaging exams are very valuable tools for diagnostic procedures. The objective here is to report a rare case of rhinitis by *Microsporum canis* in a 4-year-old male, SRD dog, sneezing and with chronic purulent nasal secretion two weeks after surgical correction of cleft palate, emphasizing the imaging tests importance for a final and assertive diagnosis. Skull radiographs revealed turbinate destruction and two soft tissue amorphous structures with radiopacity at nasal cavity. The presence of a foreign body in the left passage, soaked in mucopurulent secretion associated with fungal plaques, with firm texture were evidenced by rhinoscopy, and identified as *M. canis* colonies by microbiological examination. In association, red-brown hyperplastic areas biopsied via rhinoscopy were histologically diagnosed as transmissible venereal tumor. It is concluded that such infection can be reported as opportunistic, secondary to local immunosuppression by post-surgical foreign body and nasal TVT. This is the first case to report such a pathogen in the dog, making its insertion in the differential diagnosis of rhinopathies extremely valuable.

Keywords: rhinoscopy, ringworms, neorformation, strange body, canine

RESUMO

O diagnóstico de rinopatias em pequenos animais é desafiador, especialmente quanto a sua etiologia. Exames de imagem são ferramentas de grande valia na condução diagnóstica. Objetiva-se relatar um caso raro de rinite por Microsporum canis, *em um cão de quatro anos, macho, SRD, apresentando espirros e secreção nasal purulenta crônica, duas semanas após correção cirúrgica de fenda palatina, e enfatizar a importância dos exames de imagem no diagnóstico final e assertivo. Radiografias de crânio revelaram destruição dos turbinados e duas estruturas amorfas, de radiopacidade de tecidos moles em cavidade nasal. Presença de corpo estranho em passagem esquerda, embebido em secreção mucopurulenta, associada a placas fúngicas, de textura firme, foi evidenciada á rinoscopia, as quais foram identificadas como colônias de* M. canis *ao exame microbiológico. Em associação, áreas hiperplásicas vermelho-acastanhadas, biopsiadas via rinoscopia, foram diagnosticadas histologicamente como tumor venéreo transmissível. Conclui-se que tal infecção pode ser reportada como oportunista, secundária à imunossupressão local por corpo estranho pós-cirúrgico e TVT nasal. Este é o primeiro caso a reportar tal patógeno no cão, tornando de extrema valia a inserção deste no diagnóstico diferencial de rinopatias.*

Palavras-chave: rinoscopia, micose, neoformação, corpo estranho, canino

INTRODUCTION

Chronic rhinopathies are frequent for small animals in both medical and surgical clinics, with different etiologies (Cohn, 2014). Primary diseases such as neoplasms, foreign bodies, rhinitis, and mycotic sinusitis are commonly associated with rhinorrhea and chronic sneezing in canines (Windsor and Johnson, 2006; Peeter and Clercx, 2007), where imaging exams contribute substantially to obtaining assertive diagnosis.

Corresponding author: daniele.rolemberg@gmail.com.br
Submitted: August 30, 2022. Accepted: April 10, 2023.

Nasal foreign bodies such as pollen, twigs and grass commonly affect young, active mesaticephalic and dolichocephalic dogs (Lobetti, 2009; Cohn, 2014). These often trigger chronic idiopathic/lymphoplasmocytic rhinitis by local injury (Windsor and Johnson, 2006). Although less expressive, intranasal tumors have been reported more frequently over the years, where transmissible venereal tumor (TVT), as a round cell neoplasm with a higher rate of involvement in young, stray canines and from tropical regions (Huppes *et al*., 2014)

Fungal rhinopathy is frequent in male dogs, causing primary affections in immunosuppressed patients, or secondary to foreign bodies and nasal neoformations. *Aspergillus spp*., *Cryptococcus sp*., *Peniccillium spp*., *Alternaria spp*. and *Rhinosporidium sp*. are the main pathogens associated with nasal cavity mycotic affections (Ferreira *et al.*, 2007; Peeter and Clercx, 2007; Ostrzeszewics and Sapierzyski, 2015).

Microsporum canis is an atypical pathogen found in small animals' nasal cavity. As a dermatophyte fungus, it inhabits keratinized structures such as nails and hair, being commonly associated with skin disease in dogs and cats, with high zoonotic potential, and reported as an exceptional occurrence, affecting nasal and oral cavity of an immunosuppressed adult feline (Ziglioli *et al*., 2016).

The objective of this study is to report the case of a dog with chronic rhinitis caused by *M. canis*, resulting from the presence of a foreign body lodged in the nasal cavity, as well as to highlight and describe clinical and rhinoscopic signs, and radiographic impressions emphasizing the importance of these imaging modalities for this nasal condition diagnosis.

CASUISTRY

A 4-year-old male mixed breed (MB) canine was treated at the Veterinary Hospital of the Faculty of Agrarian and Veterinary Sciences of the Universidade Estadual Paulista "Júlio de Mesquita Filho", campus Jaboticabal, with frequent sneezing, bilateral catarrhal secretion, and a foul-smelling odor. The tutor reported clinical signs onset two weeks after cleft palate surgical correction, a procedure which used soft palate unipedicled advancement flap technique, and lateron the post-surgical therapy with sodium dipyrone (25mg/kg/TID), tramadol hydrochloride (3m/kg/TID), and with spiramycin metronidazole association (75,000 IU/kg/SID/7days). Oral hygiene was performed using chlorhexidine hydrochloride spray (0.12%/TID), and nasal passage antimicrobial control, based on nasal gentamicin solution (20mg/ml), 03 drops, BID, bilaterally and N-acetylcysteine (100mg/mL), diluted in 30mL of isotonic sodium chloride solution, until further recommendations.

Physical examination showed bilateral purulent nasal discharge, with strong odor after multiple sneezes, and obesity (body score 8/9). Blood count, serum levels of alanine aminotransferase (ALT), alkaline phosphatase (AF), urea and creatinine were unaltered and serology for *Leishmania sp*. tested negative. In skull radiographs, in the right lateral and ventrodorsal projections with open mouth, two soft tissue amorphous and similar structures were identified, with soft tissue radiopacity, irregular borders, on rostral portion of both nasal cavities. The first one was thickened in the left nasal cavity rostral portion, measuring 2.1cm x 1.7cm; and a second similar structure, with smaller diameter, in the right nasal cavity. Both nasal cavities showed hyperlucency, with massive nasal turbinate destruction were also evidenced suggesting fungal granuloma, nasal foreign body or nasal neoformation (Fig. 1).

Through rhinoscopy, with the patient under anesthesia, intense white and greenish-yellow crusted formations were shown, with a brownish and solid core, widely distributed throughout the left nasal cavity. With this, multifocal hyperplastic areas were observed, intense hyperemia, wide areas with poor mucosal vitality, cellular debris and marked mucopurulent secretion (Fig. 2), swelling, accompanied by nasal turbinate swelling, moderate destruction, and deformity. A white, filamentous structure, surrounded by a greenish surface, firm, and covered by mucoid content, partially filling the middle portion of the left nasal meatus was detected, removed, and identified as gauze. Irregularity, edema, and devitalization of the mucosa, associated with hemorrhagic areas were also visualized adjacently, due to intense local inflammation (Fig. 2).

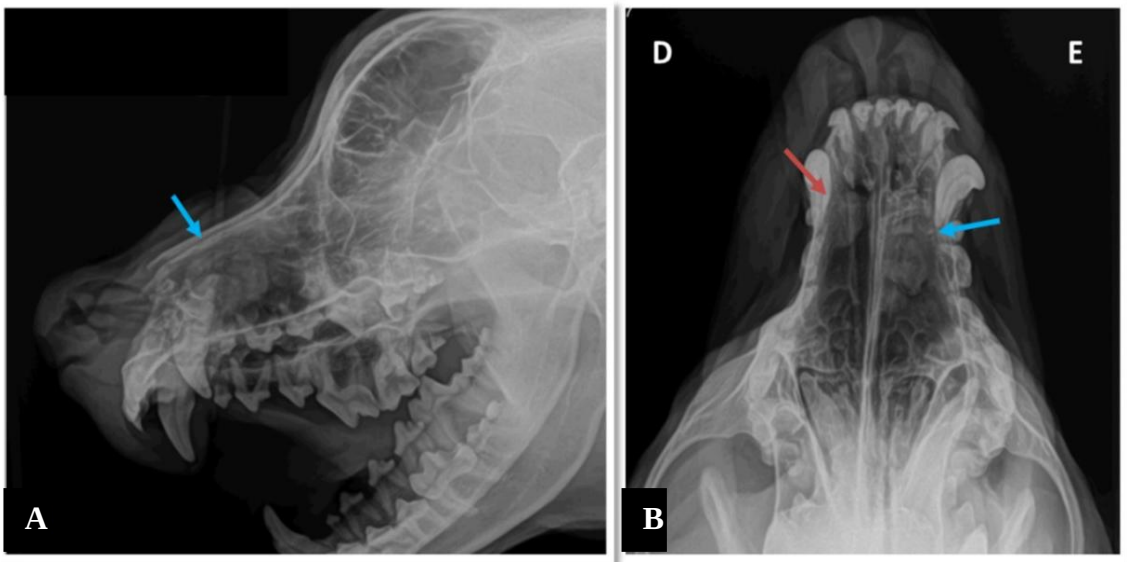

Figure 1. Right lateral (A) and ventrodorsal radiographic projections of a male mixed breed dog with sneezing and chronic purulent nasal secretion. A. Right lateral view showing an amorphous structure, soft tissue radiopacity, obliterating the left nasal cavity (blue arrow). B. Ventrodorsal view with opened mouth, showing the same structure as A with a smaller, similar one on right antimere, medial to canine maxillary (orange arrow). Diagnostic Imaging Service – FCAV/Unesp, Jaboticabal campus.

Figure 2. Nasal passage rhinoscopic image trough anterograde technique in an adult mixed breed dog. A. Foreign whitish body (gauze) on left nasal cavity (black arrow), soaked in mucopurulent and amorphous material, greenish-brown material (intranasal mycetoma - black arrow with square tip). B. Greenish-brown amorphous structure (mycetoma) uncovered by velvety white material (red arrow), subsequently isolated and identified as *M. Canis* colonies. C. Right nasal passage with severe nasal turbinate deformity and swelling (blue arrow), suggestive of severe lymphoplasmacytic rhinitis. A discrete pink proliferative area was evidenced in association, suggestive of hyperplasia tissue as consequence of chronic rhinitis (blue arrow with circular tip).

Biological samples from both hemicavities were collected with sterile "swabs" for microbiological examination, as well as for imprint cytology; for histopathological examination, tissue fragments were collected using endoscopic forceps and placed in formaldehyde 10%. The exams resulted, respectively, in colonies isolation of Microsporum sp, on Saboroud/Mycosel media, and *Escherichia coli* and *Pseudomonas sp.*; cytology exam revealed round cells with eccentric nucleus, evident nucleolus and large cytoplasm, suggestive of TVT. The histopathological findings were characterized by areas of epithelial hyperplastic tissue with edema and lymphatic dilatation, intense lymphoplasmacytic inflammatory infiltrate, and tissue fibrosis associated with dysplastic areas, suggesting severe lymphoplasmacytic proliferative rhinitis.

Hence, prednisone therapy with immunosuppressive dose (1.0mg/kg/BID/VO) was applied and weaned after five days of treatment. Antibiotic therapy with spiramycin and metronidazole (75,000 IU/kg/SID/VO) for 15 days was also instituted for microbial control. After 60 days the patient returned with similar clinical signs. New laboratory tests revealed intense liver function biochemical levels increase (ALT: 480 UL; FA: 837 UL), cholesterol (159 mg/dL) and triglycerides (43mg/dL), and low TH4 serum values, suggesting hypothyroidism. New radiographic and rhinoscopic exams showed lesion progression and the appearance of two new amorphous and radiopaque structures in the rostral portion of the right nasal cavity, measuring 1.51cm x 0.94cm and 0.96cm x 0.53cm, respectively. Furthermore, massive nasal turbinate destruction and extensive nasal septum lysis were observed, with communication between both nasal passages and common nasal meatus visualization by rhinoscopy. Ethmo and endoturbinates were partially eroded, with diffuse edema and mucosal irregularity throughout the cavity (Fig. 3). Greenish mucopurulent secretion and small, rigid, greenish-brown crusted formations were identified, corroborating radiographic findings.

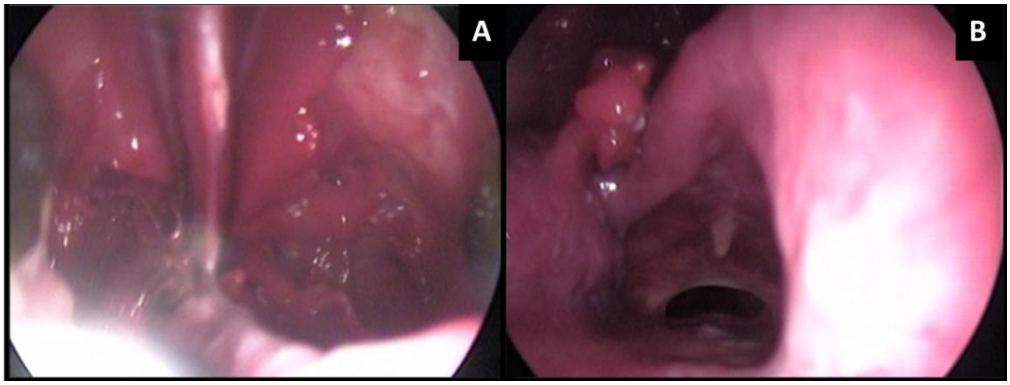

Figure 3. Rhinoscopic images of a male mixed breed canine patient, 60 days after nasal foreign body removal A. Marked and diffuse destruction of septum (orange arrow) and nasal turbinates (white arrow), with communication between both hemicavities, and a brownish structure in the nasal cavity rostral portion (mycetoma) (red arrow). B. Nasopharyngeal meatus identification (green arrow).

New cytological, microbiological, and histopathological exams were performed. The first and second revealed, respectively, intense neutrophilic inflammatory infiltrate and *Proteus sp.* and *Micorsporum sp.* colonies (Saboroud/Mycosel media). Histopathological analysis confirmed neoplastic round cell presence, compatible with TVT (Fig. 4).

Considering the tests, chemotherapy was instituted in 4 sessions with vincristine (0.5mg/m^2/IV/15-day interval), and itraconazole administration (5mg/kg/VO/BID/30 days, plus S-adenosyl-L-methionine (225mg/dog/VO/SID) and Silymarin (70mg/dog/VO/TID/40 days). Due to antifungal hepatological effects, the patient's general condition was worsening, corroborated by ALT (690 UL) and FA (1310 UL) serum levels, resulting in its interruption after using it for 15 days.

At the end of chemotherapy, the new cytology, the new tissue collection by gynecological brush for cytology was negative for cells suggesting TVT. Due to the tutor impossibility, imaging or microbiological exams were not repeated to certify nasal disorders eradication, although the marked improvement of patient's clinical condition was observed after completion of therapy.

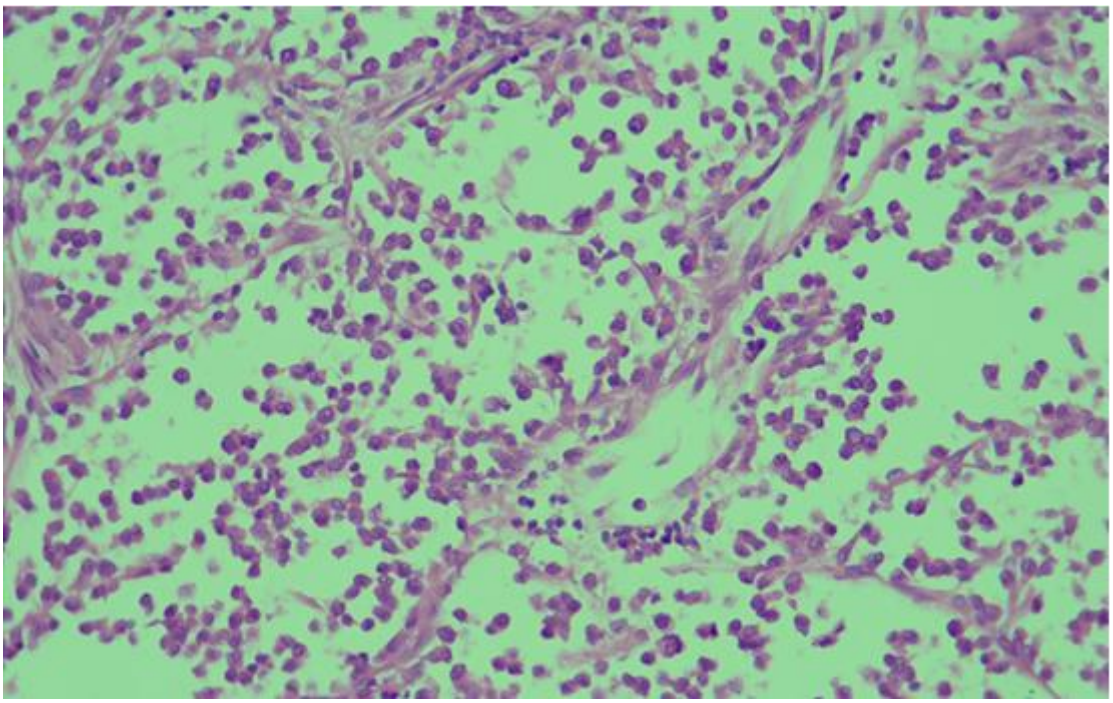

Figure 4. Canine nasal TVT histological photomicrograph, showing multiple round cells with eccentric nuclei, evident nucleolus, and large cytoplasm, infiltrated in nasal tissue. Image kindly provided by VETPAT- Campinas/SP.

DISCUSSION

Nasal discharge, mucopurulent rhinorrhea, and sneezing are clinical signs often associated with various rhinopathy etiologies, such as fungal infection, tumor, or foreign body rhinitis (Windsor and Johnson, 2006; Peeter and Clercx, 2007; Cohn, 2014; Ostrzeszewicz and Sapierzyński, 2015). Similar symptoms can be exhibited in patients with cleft palate (Bezerra *et al*., 2019), classified as primary (congenital malformation), and secondary or acquired, due to ingestion or seizure due perforating foreign bodies, high-voltage electrical accidents or large portions nasal neoformations and osteolytic origin, as intranasal TVT (Ignatenko *et al*., 2020; Thatcher *et al*., 2020).

Intranasal transmissible venereal tumors represent only 3% of extragenital neoplasy forms (Papazoglou *et al*., 2001; Huppes *et al*., 2014). Characterized as benign with low metastatic potential, this kind of neoplasy shows highly invasive and aggressive behavior obliterating the nasal cavity and, nevertheless, with local bone lysis. Furthermore, it can trigger acquired cleft palate, with rapid palate bone transposition (Ignatenko *et al*., 2020; Thatcher *et al*., 2020).

Errant or recently rescued dogs, as shown in this study, are more predisposed to acquired cleft palate-related nasal conditions, due to their high exposure to traumatic factors, unrestricted and inadequate diet, as well as acquire nasal forms of TVT (Papazoglou *et al*., 2001; Huppes *et al*.; 2014; Bezerra *et al*., 2019). Extragenital presentations of TVT, such as intranasal, without the involvement of the sexual organ, may occur due to the sociable habit of vigorously sniffing and licking sick dogs' genitalia, and because the high tumor cells transplantation potential to healthy tissues (Abedin, 2020). This makes it difficult to distinguish cleft palate etiology, especially in cases with associated comorbidities.

Clinical signs of TVT and nasal foreign body and cleft palate are characterized by dyspnea, unilateral or bilateral mucopurulent discharge and halitosis, often associated with oronasal fistula (Ignatenko *et al*., 2020; Thatcher *et al*., 2020). In these cases, surgical intervention is necessary (Ignatenko *et al*., 2020). Although the surgical technique of unipedunculated soft palate

flap presents satisfactory results in patients with cleft palate, local infection and stitches dehiscence can occur due to poor hygiene, and densification of food that remains at the suture region (Bezerra *et al*., 2019). Due to the clinical signs, recent history of palate surgical restoration and the knowledge of potential complications after surgery; stitches dehiscence was considered as the main suspect, being ruled out after imaging tests, especially by rhinoscopy with neoplasm detection and foreign body, associated with fungal infection.

Nasal foreign bodies are common, between 5 to 20% in young and active canids, due to their exploratory behavior (Moreno-Aguado *et al*., 2019). There are also reports of iatrogenic foreign bodies secondary to surgery in intrathoracic (Reed and Gosling, 2020), intrabdominal (Brun, *et al*., 2021) and musculoskeletal (Corbin *et al*., 2013) portions, forming gossypibomas. However, an intranasal foreign body related to this condition has not yet been reported in the literature, being considered very rare, especially when identified by imaging exams. Thus, this becomes the first report of an iatrogenic foreign body by sterile gauze in the nasal cavity of a canine, characterized by rhinoscopy and radiography.

Anomalous structures, such as foreign bodies and intranasal neoplasms, when chronically inhabiting the nasal cavity can cause lymphospasmocytic inflammatory rhinopathy, and secondary microbiological proliferation consequent to local fluid accumulation and stasis (Windsor and Johnson, 2006; Lobetti, 2009).

Bacteria of the genera *Staphylococcus, Streptococcus, Proteus, Escherichia, Pseudomonas, Pasteurella, Corinebacterium* and *Bordetella* are commonly associated as secondary infection of the nasal cavity, especially in inflammatory unknown primary basis rhinitis, as evidenced in this report, with consequent local inflammatory response leading to local immunosuppression and secondary infection (Windsor and Johnson, 2006; Lobetti, 2009). Fungal rhinopathies in dogs are widely described in the literature, in which the main responsible agents are *Cryptococcus neoformans*, *Aspergilus sp*. and *Penicillium sp*., *Alternatia* and *Rhinosporidium* (Ostrzeszewicz and Sapierzyński, 2015, Ferreira *et al*., 2007), which may be secondary to foreign bodies, immunosuppression or nasal cavity neoplasia (Windsor and Johnson, 2006; Ostrzeszewicz and Sapierzyński; 2015).

In addition, immunologically compromised and early age patients are more likely to implant transmissible tumor cells in the nasal cavity, presenting more severe forms of this kind of lesion, with possible metastases (Abedin, 2020). It is suggested that, although any comorbidity such as hypothyroidism is evidenced in this study, the presence of a non-exuberant intranasal TVT without metastatic lesions may infer a immunocompetent patient condition, in response to this condition. Thus, it is believed that neoplasm and nasal foreign body promote local immunosuppressive role, in which the latter also played a role as a contaminant with subsequent development of intranasal *M. canis*.

A similar case of *M. Canis* on nasal and oral cavities of an immunosuppressed feline was reported (Ziglioli *et al*, 2016), but there are no similar reports in other domestic species, making this the first case of intranasal *M. canis* in a canine. In the present report, can be recognized that the pathogen growth was associated with the presence of a foreign body contaminated by *M. Canis*, with local immunosuppression due to lymphoplasmacytic rhinitis secondary to cleft palate and intranasal neoplasm.

Imaging tests can help in the diagnosis of rhinopathies in dogs (Ostrzeszewics and Sapierzyski, 2015) with radiography and rhinoscopy, exams considered less expensive and widely available. Of these, rhinoscopy is classified as the best choice for foreign body identification, detection, and detailing canine lymphoplasmacytic rhinitis (Windsor and Johnson, 2006).

Radiographic impressions associated with *M. Canis* were described in the literature as fungal rhinitis, which is characterized by massive destruction of nasal turbinates and hyperlucency of the nasal cavity (Meler *et al*., 2008). In contrast, classic radiographic lesions associated with intranasal TVT such as increased volume of soft tissue radiopacity, with loss of nasal turbinate trabecular bone, with mass effect and deviation or destruction of the nasal septum, as well as total or partial obliteration were

evidenced (Ignatenko *et al*., 2020). Hypotheses related to this observation raise the possibility of overlapping the destructive character of chronic fungal rhinitis with TVT (Ostrzeszewics and Sapierzyski, 2015) or, uncommonly, a picture of spontaneous remission of TVT, six months after intranasal involvement (Papazoglou *et al*., 2001).

Rhinoscopic findings of moderate to severe destruction of nasal turbinates, hyperemia, and turbinate tortuosity, in addition to hemorrhagic areas, associated with a velvety white-green surface diffusely distributed throughout the nasal mucosa, are described by Ostrzeszewics and Sapierzyski (2015). Although the velvety appearance was restricted to the foreign body surroundings, findings related to this case corroborate the literature. Brownish and firm structures, observed at rhinoscopy covering the limits of the foreign body and distributed multifocally, correspond the human literature to fungal balls, called mycetomas. These result from densely tangled masses of fungal hyphae, associated with non-invasive rhinitis (Uri *et al*., 2003).

In contrast, rhinoscopic findings of nasal TVT were inconsistent with other authors (Papazoglou *et al*., 2001), which described them as multiple, friable, and easily bleeding formations. A recent study, reported by Parker *et al*. (2020), describes it as multiple and discrete areas of pale and vascular proliferation along the mucosa, progressing to greater thickening and obliteration at caudal portion of the nasal passage into the nasal passage. Similar findings were seen in the present study, consisting of small and multiple hyperplastic areas; however, reddish-brown in the midst of nasal conchae massive erosion. It is believed that color divergence, mentioned above regarding the radiographic impressions, is due to a possible superimposition of fungal lesions evidencing patient's immunocompetence in response to TVT, occurring with more evident areas of hyperemia.

Because *M. canis* inhabits surfaces and has saprophytic behavior, it is believed that the sample may be contaminated for microbiological analysis because the cytopathological and histopathological results were different, corticosteroid therapy was instituted according to severe lymphoplasmocytic inflammatory rhinitis diagnosis and, although controversial, is commonly used for this condition, may have developed the rhinopathy, with accelerated nasal turbinate destruction and greater pathogenic microorganisms susceptibility.

Studies claim that brush cytology and other cytological samples are not suitable for detecting fungal pathogens due to low sensitivity and specificity, which justifies the pathogen absence in cytological analysis for the current research. Also, when recommending bacterial and fungal isolation from the nasal cavity, the collection should be performed in deeper portions, as the microbiota of rostral and caudal portions differ (Windsor and Johnson, 2006).

Although histopathology is considered the most sensitive and specific exam for fungal rhinopathies final diagnosis, through hyphae identification interspersed with nasal tissues, fungal isolation and identification were responsible for the definitive diagnosis of *M. Canis*. Cytological and histological findings diagnosed TVT as a comorbid fungal rhinitis, while the final diagnosis of nasal foreign body was defined by rhinoscopy.

Fungal rhinitis treatment in dogs is difficult (Ostrzeszewics, Sapierzyski, 2015), in this case, and as reported by (Ziglioli *et al*., 2016), therapy with Itraconazole was effective with remarkable clinical improvement at three weeks after its administration. Removing the nasal foreign body, associated with the suspension of corticosteroid-based therapy, as well as the completion of the antineoplastic chemotherapy treatment, may have positively influenced the remission of the condition.

CONCLUSIONS

Even though rhinitis due to *M. canis* is extremely rare, it should be inserted as a differential diagnosis for canine rhinopathies, especially when associated with any comorbidity such as an intranasal foreign body, as reported for the first time in the present case. The presence of a foreign body and nasal TVT were predisposing factors for fungal development. The association of histopathological, microbiological and imaging exams (radiography and rhinoscopy) contributed to final diagnosis and an adequate chemotherapy therapy establishment, which resulted in evident clinical improvement of the

patient. It should be noted that rhinoscopy is indicated for characterization of lesions caused by *M. canis*.

ACKNOWLEDGEMENTS

Special thanks to CNPq (National Council for Scientific and Technological Development, Brazil) for the economic resources on this study. Also, to Prof. Dr. Júlio Carlos Canola for his contribution and enriching knowledge in the diagnostic procedure. To Maria Eduarda Bastos Moutinho da Conceição, Gabriel Luiz Montanhim, Paloma S. Silva, Roberta Martins Crivelaro and Fabiana Del Lama Rocha for their assistance in medical management.

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