



## INFECTIOUS DISEASE

# Nasal and Cutaneous Aspergillosis in a Goat

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## Summary

Nasal and cutaneous aspergillosis is reported in an adult goat. The clinical signs were severe respiratory distress due to partial nasal obstruction, bilateral mucopurulent nasal discharge, skin nodules on the ears and dorsal nasal region and focal depigmentation of the ventral commissure of the right nostril. At necropsy examination, sagittal sectioning of the head revealed a yellow irregular mass extending from the nasal vestibule to the frontal portion of the nasal cavity. Microscopically, there was pyogranulomatous rhinitis and dermatitis, with numerous intralesional periodic acid–Schiff-positive fungal hyphae morphologically suggestive of *Aspergillus* spp. *Aspergillus niger* was isolated by microbiological examination.

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Fungi of the genus *Aspergillus* are aerobic and distributed widely in nature, being found in soil, dust and decaying vegetation (Bennett, 2010). There are over 190 species of the genus *Aspergillus*; however, few species are involved in opportunistic infections in man (Latge, 1999) and animals (Jensen *et al.*, 1994, 1996; Tell, 2005).

In immunocompromised human patients, *Aspergillus fumigatus* is a cause of invasive fungal rhinosinusitis, disseminated aspergillosis and bronchopulmonary aspergillosis (Latge, 1999). *A. fumigatus* has also been reported as a primary agent of sinusitis in man. In such cases, affected patients are generally immunocompetent (Peric and Gacesa, 2008).

In animals, aspergillosis is a well-known disease of the air sacs and lung of birds (Tell, 2005). In horses, *Aspergillus* spp. has been reported as a cause of mycosis of the guttural pouches (Kipar and Frese, 1993), bronchopneumonia (Pace *et al.*, 1994), placentitis (Hong *et al.*, 1993) and rhinitis (Cehak *et al.*, 2008). In ruminants, *Aspergillus* spp. have been incriminated as a cause of pneumonia (Kamil and Parihar, 1991; Tell, 2005), gastroenteritis (Jensen *et al.*, 1994), mastitis (Jensen *et al.*, 1996; Pérez *et al.*, 1998) and

placentitis (Hill *et al.*, 1971). In addition, mycotic rhinitis caused by *A. fumigatus* is a common disease of immunocompetent dogs and is considered an emerging disease in cats (Benitah, 2006; Peeters and Clercx, 2007; Barrs *et al.*, 2012). However, there are no reports of rhinitis caused by *Aspergillus* spp. in ruminants in the veterinary literature. This article describes a case of nasal and cutaneous aspergillosis in a goat.

A 3-year-old crossbred goat from the municipality of Patos in the semi-arid region of the state of Paraíba, northeastern Brazil, was referred to the Veterinary Hospital of the Federal University of Campina Grande in March 2009. The farmer informed the staff that the goat had been having respiratory difficulties for 3 months. On clinical examination, the animal showed severe inspiratory dyspnoea and stertor due to partial nasal obstruction, inflation of the cheeks during expiration, bilateral mucopurulent nasal discharge and decreased air flow from the nostrils. Two prominent coalescing skin nodules with a diameter of 2–3 cm were observed in the dorsal nasal region (Fig. 1). A focal area of depigmentation was observed in the ventral commissure of the right nostril (Fig. 1). Three nodules, ranging from 0.3 to 1 cm in diameter, were observed in each ear. The largest of these nodules, which was located at the inferior

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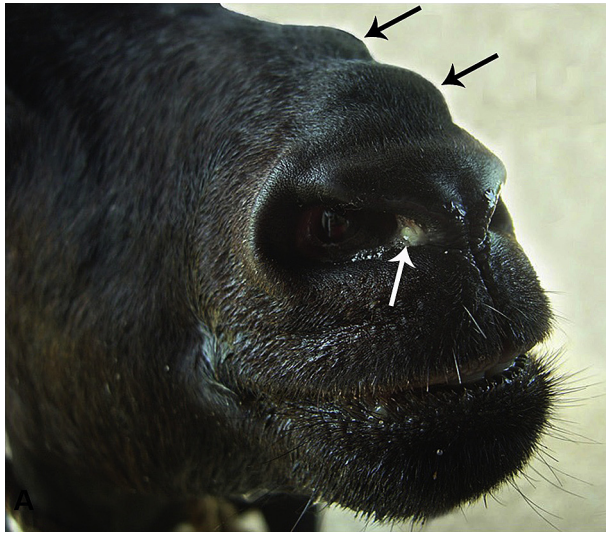


Fig. 1. Two coalescing skin nodules in the dorsal nasal region (black arrows). An area of depigmentation is present in the medial canthus of the right nostril (white arrow).

border of the right pinna, was ulcerated, with raised edges (Fig. 2).

Blood samples were collected for haematological and serum biochemical examinations. Serum total protein, albumin, urea and creatinine concentrations and serum activities of  $\gamma$ -glutamyltransferase, alkaline phosphatase and aspartate aminotransferase were within normal values. The haematological values were also within normal ranges. The goat was humanely destroyed due to the severe respiratory distress.

At necropsy examination, a longitudinal section of the head showed a bilateral yellow irregular mass extending from the nasal vestibule to the frontal portion of the nasal cavity (Fig. 3). This mass reached the dorsal and ventral nasal conchae and ventral and dorsal nasal meatus, including the nasal septum. No gross



Fig. 2. An ulcerated skin nodule with raised edges at the inferior border of the pinna (arrow).

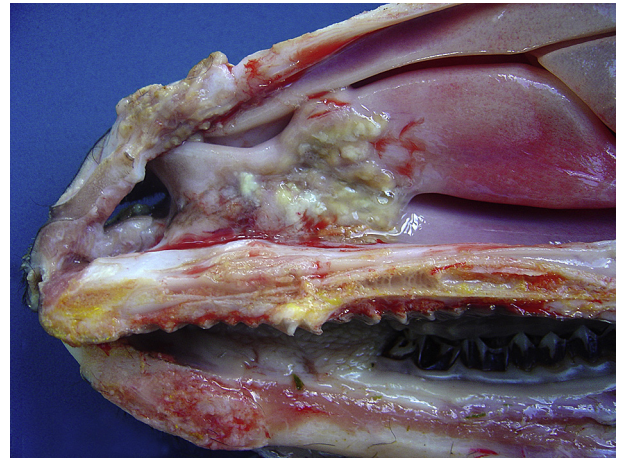


Fig. 3. Sagittal section of the head showing an irregular yellow mass extending from the nasal vestibule to the frontal portion of the nasal cavity.

changes were observed in other organs. Samples of the cutaneous and nasal lesions and other selected organs collected at necropsy were fixed in 10% neutral buffered formalin, embedded in paraffin wax, sectioned (6  $\mu$ m) and stained by haematoxylin and eosin (HE). Some sections were stained with periodic acid–Schiff (PAS) and Grocott's methenamine silver stain (GMS). Microscopically, the lesions of the nasal cavity and skin consisted of multifocal to coalescing pyogranulomas (Fig. 4) with a central necrotic area

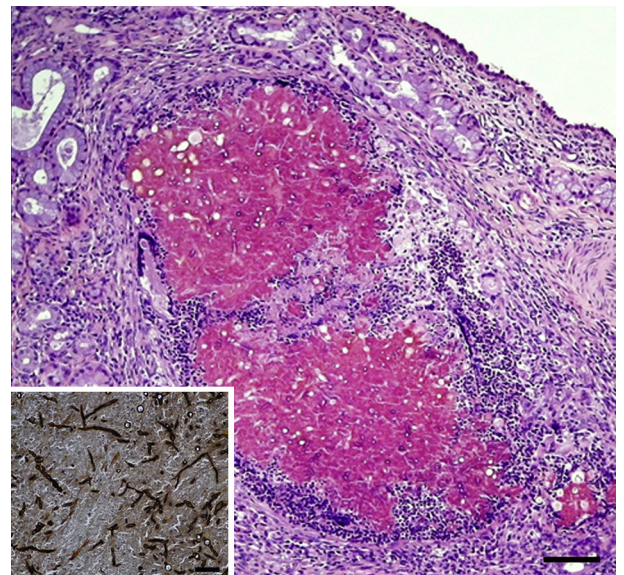


Fig. 4. Nasal mucosa. A focal pyogranuloma with a large necrotic area surrounded by neutrophils, mononuclear cells and fibrous tissue. Negative impressions of hyphae are observed in the necrotic area. HE. Bar, 100  $\mu$ m. Inset: septate hyphae with thick walls branching at an acute angle and showing occasional apical bulbous dilations. GMS. Bar, 50  $\mu$ m.

surrounded by neutrophils and an outermost layer of epithelioid macrophages, lymphocytes and rare multinucleated giant cells. These pyogranulomas were bordered by connective fibrous tissue. Negative impressions of fungal hyphae were observed within the necrotic areas. On PAS and GMS stains, these hyphae were septate, 5–7 µm in diameter, had thick walls, were branched at an acute angle and showed occasional bulbous apical dilation (Fig. 4, inset). No microscopical changes were observed in other tissues.

Tissue samples were collected from the nasal cavity for microbiological examination. The samples were seeded on 5% sheep blood agar, MacConkey agar (both incubated at 37°C) and Sabouraud's dextrose agar with chloramphenicol (incubated at 25°C) under aerobic conditions. After 48 h, cottony black colonies with beige underside were observed on Sabouraud's agar. In microculture, the fungus showed long conidiophores and a globular and radial conidial head with biseriate phialides, characteristic of *Aspergillus niger* (Bennett, 2010).

The diagnosis of aspergillosis was based on clinical and pathological characteristics of the disease and the isolation of *A. niger* from the nasal lesion. The clinical findings and the inflammatory response of the affected goat were similar to those observed in nasal aspergillosis in dogs (Benitah, 2006; Peeters and Clercx, 2007). It is suggested that the depigmentation of the nostril and the destruction of the mucosa and turbinates, usually found in dogs with nasal aspergillosis (Benitah, 2006), is caused by the action of fungal toxins (Tilden *et al.*, 1961). However, the pathogenesis of nasal aspergillosis remains unclear because the mechanism responsible for the invasion of the respiratory mucosa by the fungus is not known (Peeters and Clercx, 2007). In goats, mammary aspergillosis has been reported as an ascending infection due to intramammary treatment with antibiotics before parturition (Jensen *et al.*, 1996). Mammary and pulmonary aspergillosis were reproduced by intramammary and intratracheal inoculation, respectively, but in only one of 15 goats inoculated intratracheally was the infection disseminated to other organs (Mandal and Gupta, 1993, 1994).

Cutaneous aspergillosis, which is rarely reported in man (Ozer *et al.*, 2009) and domestic animals (Davis and Schaefer, 1962), can occur primarily through the penetration of the skin by the fungus through traumatic injury or secondarily due to the systemic dissemination of the pathogen in immunocompromised individuals. However, the involvement of the nasal cavity has not been reported in people and animals with systemic aspergillosis (Pérez *et al.*, 1996, 1998; Latge, 1999). In the present case, there was no evidence of pre-existing disease and the lesions

were confined to the nasal cavity and the skin of the ears and nasal dorsal region.

Clinically, this case of aspergillosis in a goat is similar to protothecosis caused by *Prototheca wickerhamii*, which was also reported in goats in northeastern Brazil and should be considered in the differential diagnosis. Histologically, protothecosis caused by *P. wickerhamii* is characterized by daisy-like sporangia within the inflammatory exudate (Camboim *et al.*, 2010). In Brazil, sheep can be affected by nasal conidiobolomycosis or nasal pythiosis. The lesions caused by *Conidiobolus lamprauges* are mainly rhinopharyngeal, localized in the ethmoidal region and associated with exophthalmos and the infections by *Pythium insidiosum* are rhinofacial involving mainly the frontal region of the nose and hard palate (Ubiali *et al.*, 2013).

In conclusion, goats can be affected by nasal aspergillosis. In the present case, the disease was characterized by a chronic and debilitating clinical condition associated with destruction and necrosis of the mucosa and turbinates, resulting in severe respiratory distress. Morphologically, it was characterized by erosive pyogranulomatous multifocal to coalescing rhinitis and dermatitis with intralesional fungal hyphae.

### Conflict of Interest Statement

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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