

***Morganella* sp. infection in scent gland of corn snake (*Pantherophis guttatus*) - case report**

Infecção por Morganella sp. em glândula de cheiro de corn snake (Pantherophis guttatus) - relato de caso

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ABSTRACT

The corn snake (*Pantherophis guttatus*) is a non-venomous snake from the Colubridae family. The pair of scent glands is indispensable in the physiology of reproduction and defense of the species. This structure is located caudal to the cloaca. It is responsible for releasing a thick material based on lipids containing pheromones that perform functions associated with animal behavior and survival. This work aims to report infection by *Morganella* sp. in a scent gland in a female corn snake, evidencing the diagnosis and treatment. An increase in volume was seen in the final third, proximal to the cloaca, firm consistency, immobile, and approximately 4 cm long and painful to touch. Samples of the material were collected for bacterial culture and antibiogram examination, being positive for bacteria of the genus *Morganella*. Based on the result of the antibiogram, it was possible to determine the most appropriate therapeutic protocol, with the referral to perform the surgical procedure to remove the tissue compromised by the infection, remaining stable until the removal of the stitches 40 days after the procedure, with total surgical wound healing.

Keywords: Reptiles. Adenitis. Surgery.

RESUMO

A *corn snake* (*Pantherophis guttatus*) é uma serpente não peçonhenta, da família Colubridae. Na fisiologia da reprodução e defesa da espécie, o par de glândulas de cheiro é indispensável. Essa estrutura está localizada caudal à cloaca e é responsável pela liberação de um material espesso à base de lipídeos, contendo feromônios que exercem funções associadas ao comportamento animal e à sua sobrevivência. O objetivo desse trabalho é relatar uma infecção por *Morganella* sp. em glândula de cheiro em uma fêmea de *corn snake*, evidenciando o diagnóstico e tratamento. Observou-se um aumento de volume no terço final, proximal a cloaca, de consistência firme, imóvel e com aproximadamente 4 cm de comprimento e sensibilidade dolorosa ao toque. Foram coletadas amostras do material para cultura bacteriana e exame de antibiograma, sendo positivo para bactérias do gênero *Morganella*. Com base no resultado do antibiograma, foi possível determinar o protocolo terapêutico mais adequado, como o encaminhamento para realização do procedimento cirúrgico para remoção do tecido comprometido pela infecção, se mantendo estável até a remoção dos pontos, 40 dias após o procedimento, com total cicatrização da ferida cirúrgica.

Palavras-chave: Répteis. Adenite. Cirurgia.

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The *Colubridae* family includes the non-venomous corn snake (*Pantherophis guttatus*). They originate in North America, have terrestrial habits, and grow to an adult size between 80 and 150 cm. They take about two years to attain sexual maturity (Doneley et al., 2018). The physiology of the species' reproduction and defense and those of other snakes depends on the pair of scent glands.

This pair of structures, which are caudal to the cloaca, is in charge of releasing a thick lipid-based substance that contains pheromones that help animals survive by attracting mates, defending themselves, scaring off intruder animals, and marking their territory (Weldon et al., 2015).

According to Divers & Stahl (2019), neoplasms, mineralization, blockages, inflammation, and infections can all clinically impact the scent gland. According to Stahl, colubrid species, particularly adult females that frequently breed, are more likely to experience inflammations. Such inflammations often create conducive environments for the development of infections.

The colonization and invasion of cells by bacteria, protozoa, or viruses—endogenous or exogenous—represents an infection (McVey et al., 2016). Consequently, there are three primary ways that an infection might develop: local, regional, and systemic (Zachary, 2018).

According to Oliveira (2003), gram-negative bacteria typically cause opportunistic infections in reptiles' respiratory, digestive, and skin/epidermal systems. One gram-negative species isolated from healthy and diseased captive snakes is *Morganella morganii* (Jacobson, 2007).

This paper aims to describe a *Morganella* sp. infection in a female corn snake's scent gland while highlighting the diagnosis and course of treatment.

A corn snake was treated in a private clinic. The female animal was 2 years old, weighed 0.410 kg, and was kept in good condition. She displayed an increase in volume in the left lateral region of the tail, close to the cloaca, which had developed over about a month. The guardian reported that 12 sterile eggs had been laying there for almost six months. Physical examination revealed a pronounced inflammatory process, painful sensitivity to touch, and increased volume in the final third, close to the cloaca (Figure 1), of hard consistency, immovable, and about 4 cm long.

The contents were aspirated to obtain samples for culture and antibiogram testing, yielding a serosanguineous liquid and dense caseous debris. The therapy plan, which included ketoprofen (2 mg/kg intramuscularly, every 48 h for 10 days) and gentamicin (2.5 mg/kg intramuscularly, every 72 h for 15 days), could be determined based on the antibiogram results (Table 1). The animal was then admitted to the hospital, subjected to preoperative exams, and referred for surgery to remove the caseous material.

Ketamine (10 mg/kg) and midazolam (2 mg/kg) were used as pre-anesthetic drugs for the surgical procedure, allowing for the intubation, maintenance of anesthesia with isoflurane, and local blockade with lidocaine. In the surgical procedure, a 3 cm incision was made in the afflicted area, and the remains of the local muscles that were damaged by the infection and caseous material and clots were seen. By recognizing the structures of the scent glands, which were damaged due to the bacterial action, the site of infection was identified during the operation. The gland and all surrounding tissues injured by the inflammatory/infectious process were removed, and the area was then cleansed with a gentamicin solution. The skin incision was stitched with a 3-0 nylon suture featuring an isolated wolf motif.

Gentamicin and ketoprofen were continued as therapeutic support in the postoperative period, topical use of an ointment containing gentamicin and urea, and daily baths for hydration. The surgical site totally healed, the animal ate well, and its skin changed normally 40 days after the operation. The animal stayed stable until the stitches were removed. There are currently no indications that the infection will return.

All species of snakes have a pair of scent glands in their reproductive system that directly impact animal behavior and interactions between and within species. These structures, which are close to the cloaca and contain ducts that open in the area ventral to the vertebral column, feature sphincters that allow lipid-based pheromones to be released through the ducts (Divers & Stahl, 2019).



Figure 1 – Left lateral portion of the tail, near the cloaca, showing a lesion in a female corn snake (*Pantherophis guttatus*) with increased volume.

Table 1 – Antibioqram result

AMINOGLYCOSIDES	
Gentamicin	Sensitive
BETALACTAMICS	
Amoxicillin + Ac. clavulanic	Resistant
Ampicillin	Resistant
Cephalexin	Resistant
Ceftriaxone	Resistant
Cefovecine	Resistant
Ceftiofur	Resistant
Ceftazidime	Sensitive
FLUOROQUINOLONES	
Ciprofloxacin	Sensitive
Enrofloxacin	Intermediary
Marbofloxacin	Sensitive
Norfloxacin	Sensitive
POLYPEPTIDES	
Polymyxin	Resistant
SULPHONAMIDES	
Sulfatrim	Sensitive
TETRACYCLINES	
Doxycycline	Resistant

There are anatomical changes between species, sexes, and ages due to variances in the mechanism and frequency of expectoration. Studies have shown that females have a larger expectorating gland than males, which can be attributed to their much higher production levels (Young et al., 1999). Additionally, each animal's metabolic rate varies, as do the contents of the glands that produce them. These contents can differ based on sex, age, sexual maturity, and species. Still, they are generally made up of lipids (fatty acids free), mucoproteins, and mucopolysaccharides, among other things (Weldon et al., 2015).

Some disorders connected to this structure can have unilateral or bilateral effects, directly alter lipid content generation and excretion, and perhaps even impact reproduction. Three males and three females of six distinct kinds of snakes with some impaction in the cloacal glands participated in Couture et al.'s (2018) study. According to the diagnoses, four of these animals had infections, one had fibrosarcoma, and the final one had gland mineralization.

The increase in the volume of hard consistency, with painful sensitivity, which corroborates the symptoms displayed by the corn snake in the described case and may be related to the *Morganella* bacteria *morganii*, is a clinical marker of bacterial infection of this structure (Ferreira et al., 2012). Samples were obtained for bacterial culture and antibiogram, which identified the infection as being caused by *Morganella* bacteria sp. and indicated sensitivity to ceftazidime, ciprofloxacin, marbofloxacin, norfloxacin, sulfatrim, and gentamicin, as well as intermediate sensitivity to enrofloxacin, for the diagnosis of the animal in question.

In general, surgical excision of the gland(s) and infectious material combined with antibacterial and anti-inflammatory treatments is the optimal course of treatment. However, in milder or less severe situations, the material can be expelled by gently rubbing the gland following immersion in warm water. In addition, with bigger snakes, it may be possible to use probes to route the substance through the blocked duct (Couture et al., 2018; Divers & Stahl, 2019).

In the study mentioned earlier by Couture et al. (2018), one of the cases was treated with medication but was unsuccessful. As a result, the approach employed to treat all animals was complete surgical excision of the glands. In the current instance, the animal was sent for surgical excision of the gland damaged by bacterial action after the start of anti-inflammatory and antibiotic therapy established to reduce the symptoms of impaction.

Gentamicin and ketoprofen were administered postoperatively for 7 days, and an ointment made of gentamicin and urea was used to treat the surgical site. Since the afflicted glandular tissue was entirely removed, the infection was treated, and there was no recurrence, as determined by the antibiogram's results and the effectiveness of the antibiotic medication.

The gram-negative bacterium *M. morganii* is a member of the *Enterobacteriaceae* family (Falagas et al., 2006; McDermott & Mylotte, 1984). It belongs to the facultative anaerobic bacteria that do not digest lactose. They are bacteria found in the oral and cloacal microbiota of snakes and the gastrointestinal microbiota of humans, animals, and reptiles (Ferreira et al., 2012), and they are frequently connected to opportunistic infections in nearby structures. Fimbrial adhesins, which aid in developing biofilms and colonization, hemolysins, proteases, ureases, and apoptotic toxins, are only a few virulence factors they possess (Liu et al., 2016). Necrotizing enteritis, soft tissue granulomas, and sepsis are among the infections frequently brought on by this species.

Bacterial infections can develop through various pathways, mainly due to inflammation, damage, immunosuppression,

insufficient humidity, or substrate, according to Divers & Stahl (2019). The excessive production of lipid content, followed by the inability to clear it from the scent glands due to muscular overload or obstruction, might result in infection. This can induce rupture and allow opportunistic bacteria to colonize these structures.

It is believed that the patient in this report's case had worsened glandular content production, which is biologically already heightened in adult females capable of reproducing. The structures may have been overburdened by hyperproduction, which prevented the removal of the generated material. This led to an accumulation of lipid material, which caused the glands to enlarge and rupture, creating an environment favorable to opportunistic bacterial infections (Divers & Stahl, 2019). The cloaca's proximity to the glands makes it easier for bacteria from the cloacal microbiota, including *Morganella* sp., to spread to the afflicted structures.

A snake's ability to reproduce and coexist with other creatures depends on the presence of a scent gland. Depending on the nature and intensity of the injury, changes to these structures can result in reproductive harm and secondary severe issues such as neoplasms, mineralization, and infections that are relevant in the care of non-conventional pets and can cause the animal's death.

Since they have more developed glands, create more lipid content, and are more prone to accumulating this material, which causes obstruction and predisposes to infections, females are among the demographics most impacted by this ailment.

An assertive diagnosis based on complementary tests and selecting an appropriate clinical or surgical therapy are crucial, considering the significance of these structures and the possibility of additional consequences.

Conflict of Interest

The authors declare no conflict of interest associated with the publication of this manuscript. They affirm that there are no financial, personal, or professional relationships that could potentially influence the objective presentation, analysis, or interpretation of the research findings presented in the aforementioned article. This declaration includes, but is not limited to, any financial affiliations, employment relationships, consultancies, stock ownership, honoraria, or paid expert testimony. They are committed to upholding the integrity of the research presented in this article and ensuring that the information provided is accurate, unbiased, and free from any external influences that might compromise its validity.

Ethics Statement

The study did not require ethical approval.

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