DOI: 10.53660/CLM-3656-24M38

# Impact of pine processionary caterpillar toxins in canine: Clinical implications and treatment of a severe case

## Impacto de toxinas de lagarta-do-pinheiro em canino: Implicações clínicas e tratamento de um caso grave

Received: 18-05-2024 | Accepted: 21-06-2024 | Published: 24-06-2024

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## ABSTRACT

This case report details the clinical consequences of a dog's contact with the pine processionary caterpillar (*Thaumetopoea pityocampa*), emphasizing the relevance of this issue in endemic areas. The study describes a seven-month-old German Shepherd that presented with lingual edema, necrosis, and systemic signs of sepsis following contact with the caterpillar. Therapeutic interventions included the removal of urticating hairs, the use of corticosteroids, antibiotics, nutritional support, and induced coma to control pain and inflammation. The animal's recovery was successful after intensive treatment. This case highlights the need for rigorous preventive measures, such as the destruction of nests and the use of insecticides, in addition to raising awareness among pet owners about the risks. The conclusion underscores the lack of specific treatments for the toxins of the pine processionary caterpillar and the need for further research to improve the clinical management of these intoxications.


**Keywords:** *Thaumetopoea pityocampa*; Veterinary Toxicology; Sepsis; Urticating Hairs.


## RESUMO

Este relato de caso detalha as consequências clínicas do contato de um cão com a lagarta-do-pinheiro (*Thaumetopoea pityocampa*), enfatizando a relevância deste problema em áreas endêmicas. O estudo descreve um Pastor Alemão de sete meses que apresentou edema lingual, necrose e sinais sistêmicos de sepse após o contato com a lagarta. As intervenções terapêuticas incluíram a remoção das cerdas urticantes, uso de corticoides, antibióticos, suporte nutricional e coma induzido para controlar a dor e a inflamação. A recuperação do animal foi bem-sucedida após tratamento intensivo. Este caso evidencia a necessidade de medidas preventivas rigorosas, como a destruição de ninhos e uso de inseticidas, além da conscientização dos tutores sobre os riscos. A conclusão ressalta a falta de tratamentos específicos para as toxinas da lagarta-do-pinheiro e a necessidade de mais pesquisas para aprimorar o manejo clínico dessas intoxicações.


**Palavras-chave:** *Thaumetopoea pityocampa*; Toxicologia veterinária; Sepse; Cerdas urticantes.

## INTRODUCTION

The pine processionary caterpillar (*Thaumetopoea pityocampa*) is a defoliating insect of pines and cedars, highly relevant in Mediterranean countries such as Italy, Spain, and Portugal. This insect, also known as the pine processionary, has been expanding its habitat due to environmental changes despite being more prevalent in European countries. The caterpillars do not tolerate extreme temperatures, which leads them to seek suitable environments for their development and reproduction (Mirchev et al., 2021).

The pine processionary caterpillar stands out for the toxins it produces as a defense mechanism, which cause severe allergic and inflammatory reactions in animals and humans when they come into contact with the skin (Pouzot-Nevoret et al., 2018). Animals, being naturally curious, often come into contact with this insect, resulting in adverse effects that range from mild to severe, as documented in cats (Pouzot-Nevoret et al., 2017) and dogs (Kaszak, Planellas, Dworecka-Kaszak 2015).

This work aims to describe a severe case of poisoning in a dog due to contact with the pine processionary caterpillar (*Thaumetopoea pityocampa*), addressing the clinical manifestations, diagnostic challenges, therapeutic interventions performed, and the subsequent recovery of the animal. The report aims to raise awareness about the risks associated with this type of poisoning in pets, discuss the effectiveness of the treatment strategies employed, and propose recommendations for preventing similar future cases. Additionally, it intends to contribute to the existing literature by offering insights that may help veterinarians recognize and more effectively manage similar intoxications in clinical contexts.

## CASE REPORT

### Geographical location characterization of the accident

Charneca de Caparica is a Portuguese village located in the Municipality of Almada, near Lisbon, Portugal. The region experiences a cool winter from December to the end of March and a warm summer from the end of June to September, with annual temperatures ranging from 9°C to 27°C, rarely dropping below 5°C. The village is one of the largest and most populous localities in the Municipality of Almada, characterized by gentle terrain and significant biodiversity.

### Case description

A seven-month-old, intact male German Shepherd weighing 33.5 kg was brought to the Vet Central Veterinary Hospital in Charneca de Caparica with signs of lingual and sublingual edema, accompanied by intense salivation. During a walk, the owners witnessed the animal coming into contact with a pine processionary caterpillar (Thaumetopoea pityocampa). The dog manipulated and partially ingested the caterpillar, which led to its immediate presentation to the emergency service due to the potential for severe reactions associated with this type of exposure.

**Initial clinical assessment**

During the initial clinical assessment, alterations were observed in the lingual and sublingual areas of the canine, such as erythema, edema, and desquamation along the median groove of the tongue (Fig. 1A), indicative of contact with Thaumetopoea pityocampa. Additionally, the patient exhibited tachypnea and respiratory difficulty attributed to sublingual edema, although the other vital signs remained within normal limits without any other evident clinical alterations.

**Laboratory tests**

A complete laboratory profile was requested for further evaluation of the animal's condition. This examination included a complete blood count, as well as measurements of glucose, urea, creatinine, alkaline phosphatase, alanine aminotransferase (ALT), and aspartate aminotransferase (AST). All laboratory results returned within reference values, indicating no additional abnormalities.

**Initial interventions**

Due to the observed respiratory distress, the canine was immediately referred to the emergency unit. Initially, a venous access was established in the right thoracic limb, followed by orotracheal intubation and administration of oxygen therapy. This intervention was maintained for a period of four days. Given the severity of the clinical condition and with the aim of alleviating pain and improving oxygenation, an induced coma regimen was established. The anesthetic protocol used included 1 mg/kg of ketamine (Ketamidor, Plurivet, Santarém, Portugal), 5 mcg/kg of fentanyl (Fentadon, Dechra, Barcelona, Spain), 0.3 mg/kg of methadone (Semfortan, Dechra, Barcelona, Spain), 0.2 mg/kg of midazolam (Midazolan, Labesfal, Tondela, Portugal), 0.3 mg/kg of dexmedetomidine (Asthenodex, Vetpharma Animal, Barcelona, Spain), and 0.5 mg/kg of propofol (Lipuro 2%, Braun, Barcarena, Portugal). For orotracheal intubation, periglotic anesthesia with 2 mL of lidocaine (Lidocaine 5%, Braun, Barcarena, Portugal) was performed. After induction, the patient was maintained under continuous infusion of propofol 0.5 mg/kg/h (Lipuro 2%, Braun, Barcarena, Portugal) and ketamine 1 mg/kg/h (Ketamidor, Plurivet, Santarém, Portugal). Additionally, a nasogastric tube was placed to

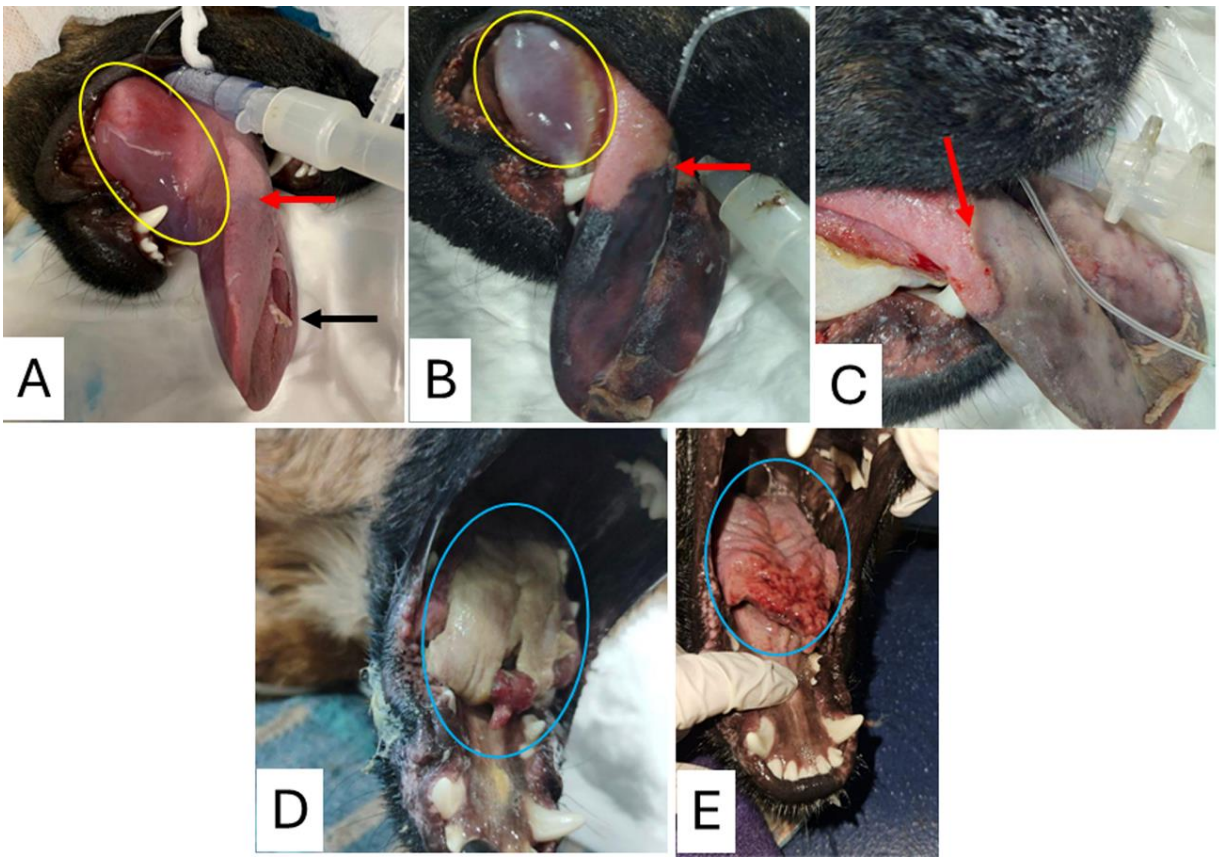
ensure the animal's continued feeding, administering 1169 Kcal/day of Recovery (Royal Canin, Algés, Portugal).

Furthermore, fluid therapy with Ringer's Lactate at a rate of 48 ml/hour, methylprednisolone 1 mg/kg BID (Solu-Medrol, Hospwork, Azores, Portugal), ampicillin 22 mg/kg TID (Ampicillin, Labesfal, Tondela, Portugal), and metronidazole 10 mg/kg BID (Metronidazole, Braun, Barcarena, Portugal) were instituted. The oral region was subjected to therapy with hot water bags every 12 hours to reduce edema. Lavages were performed every hour using a 30% glucose solution followed by a 7.5% NaCl saline solution. The objective of these lavages was to clean the caterpillar's hairs and help reduce the lingual edema. However, the necrotic lesion on the tongue continued to progress, with blackening of the rostral portion of the tongue (Fig. 1B).

**Progress and complications**

After four days of intensive treatment, it was decided to discontinue the patient's induced coma as the sublingual region was free of edema (Fig. 1C), and the animal no longer showed signs of respiratory difficulty. However, about 5 hours after awakening from the coma, a deterioration in the general clinical condition was observed, characterized by vomiting, hematuria, and reduced urinary output. To manage these symptoms, supportive therapy for emesis and gastrointestinal tract protection was instituted, which included continuous infusion of metoclopramide at 0.04 mg/kg/hour (Metoclopramide, Labesfal, Tondela, Portugal), ondansetron 0.25 mg/kg BID (Ondansetron, Eugia Pharma, Floriana, Malta), omeprazole 1 mg/kg BID (Omeprazole, Laboratório Azevedo, Alcabideche, Portugal), and sucralfate 5 g per animal BID (Ulcermin, Recordati, Oeiras, Portugal). Additionally, enrofloxacin 2.5 mg/kg BID (Enrocill, HifarmaX, Domingos de Rana, Portugal) was administered. Urethral catheterization with a No. 6 catheter was performed for bladder lavage using sterile 0.9% NaCl solution. These interventions were necessary due to hematuria and reduced urinary output resulting from the systemic inflammatory response caused by contact with the pine processionary caterpillar. Additionally, the use of 0.5 mL of antiseptic (Actea Oral, Candioli Pharma, Beinasco, Turin) BID was included to complement the treatment of the oral wound.

**Figure 1:** Images of the oral region of a dog with lesions caused by contact with the Pine Processionary Caterpillar (Thaumetopoea pityocampa). In image "A," the oral region on the day of initial presentation is observed, with sublingual edema, erythema in the rostral portion of the tongue, and a small area of mucosal detachment. Image "B" shows the oral region 48 hours after the induction of the coma and the initial treatment, with worsening of the lingual lesion, evidenced by blackening of the rostral portion of the tongue and persistence of the sublingual edema. Image "C" was obtained immediately after the patient was taken out of the coma, showing a significant reduction in sublingual edema and initial signs of necrosis in the sublingual region and the rostral portion of the tongue. Image "D" was captured on the eighth day of treatment, when the proximal portion of the tongue had already detached, and the lingual mucosa showed signs of necrosis. Image "E" was obtained seven days after the start of home treatment, demonstrating that the entire necrotic area of the tongue had already been debrided, with a large part of the lingual mucosa re-epithelialized. The yellow circles show the sublingual region, the red arrows indicate the transition between the healthy and the lesioned area, the black arrow shows the initial area of mucosal detachment, and the blue circles show the portion of the tongue that was able to recover after treatment.



Approximately 12 hours after the suspension of the induced coma, the animal's clinical condition further deteriorated, manifesting edema and phlebitis in the right thoracic limb, where the venous access was established. The area was cleaned with a 2% chlorhexidine antiseptic, followed by washing with 0.9% isotonic NaCl solution and the application of dressings every 8 hours. A new venous access was established in the left thoracic limb.

Two days after waking from the coma and the institution of the previously described treatment, the animal showed improvement in the reduced urinary output, returning to normal diuresis but still with hematuria and began to show signs of sepsis. The patient was hypotensive, with a systolic pressure of 100 mmHg, diastolic pressure of 47 mmHg, and mean pressure of 62 mmHg. Hyperthermia of 40.5°C, hypoglycemia of 54 mg/dL, and evident signs of necrosis in the lingual region, characterized by darkening of the entire tongue, were also observed. Additionally, it became necessary to establish a new venous access in the right pelvic limb due to the presence of edema and hyperemia adjacent to the venous access site in the left thoracic limb. Ampicillin 22 mg/kg TID (Ampicillin, Labesfal, Tondela, Portugal) was then added, and treatment for hypotension was instituted with dopamine hydrochloride (Dopamine 5 mg/mL, Dechra, Barcelona, Spain) at 40 mg in 500 mL of Ringer's Lactate, with an infusion rate of 2 mL/kg/h, and 50% glucose diluted in a 1:1 solution, administered in an intravenous bolus of 0.5 mL/kg. For the treatment of the oral lesion, an antimicrobial spray based on hypochlorous acid (HOCl) (Effivet Oral Spray, Plurivet, Vale dos Moinhos, Sorrento) was used. To control the limb lesions, cold compresses were used, followed by cleaning the area with 2% chlorhexidine antiseptic, washing with 0.9% isotonic NaCl solution, and the application of dressings every 8 hours.

Within the following 24 hours, an abscess developed in the axillary region of the animal's right thoracic limb. A total of 180 mL of pus was drained from this abscess. The area was cleaned using a 2% chlorhexidine antiseptic, followed by washing with 0.9% isotonic NaCl solution and the application of sugar dressings to the lesion area every 4 hours for 3 days. This resulted in positive wound healing, with a reduction in edema and hyperemia, and a decrease in the lesion's borders.

Three days after the addition of the new treatment protocol and abscess drainage, the patient's overall condition improved significantly. The lesion in the lingual region showed a much better appearance, with detachment of the rostral portion of the tongue and superficial necrosis of the entire epithelium (Fig. 1D).

The lesion on the right thoracic limb responded positively to the sugar dressing treatment, as evidenced by the approximation of the lesion's borders. Additionally, the left thoracic limb showed a reduction in edema and hyperemia in response to cold compress treatment. Urinary output was restored, and hematuria ceased. Systolic and diastolic blood pressure, blood glucose levels, and body temperature normalized, indicating the patient's stable condition. Home treatment was recommended with omeprazole 1 mg/kg SID, amoxicillin with clavulanate 15 mg/kg BID, nutritional supplement 5 mL SID (Nutriplus Gel, Virbac, Sintra, Portugal), and oral antiseptic BID (Actea Oral, Candioli Pharma, Beinasco, Turin). For the dressings of the lesion on the right limb, 2% chlorhexidine antiseptic was indicated, followed by washing with 0.9% isotonic NaCl solution and the application of dressings.

### Case outcome

One week after discharge, the patient was requested to return for reevaluation and follow-up, which revealed almost complete healing of the oral lesions (Fig. 1E) and complete healing of the limb wound. Systemic medications were discontinued, and only topical oral treatment was maintained until complete healing. After 5 days, the owners returned with the animal, and upon evaluation, complete healing of the lingual lesion was observed, leading to the patient's definitive discharge.

## DISCUSSION

The pine processionary caterpillar, *Thaumetopoea pityocampa*, is named for the procession they form during feeding and searching for pupation sites in the soil. They have orange-brown urticating hairs located between the first and eighth abdominal segments of the larva (Bruchim et al., 2005; Pouzot-Nevorete et al., 2017). These hairs, which serve as a form of protection, number approximately 120,000, varying in length from 100 to 250 µm and having sharp backward-facing tips. Inside the hairs, the protein thaumetopoein is primarily responsible for triggering clinical signs in contaminated organisms (Oliveira et al., 2003; Vega et al., 2011; Bonamonte et al., 2013).

In this case, exposure to the urticating hairs of the caterpillar *Thaumetopoea pityocampa* resulted in a series of severe clinical reactions in the canine patient, demonstrating its significant toxicity. When released by the caterpillar as a defense

mechanism, the hairs come into contact with the animal's mucosa, causing mechanical injuries and releasing the protein thaumetopoein, which is highly irritating and toxic. This protein is known to induce IgE-mediated mast cell degranulation, releasing histamine and other inflammatory substances that lead to a rapid inflammatory response (Oliveira et al., 2003; Bonamonte et al., 2013).

The presence of hairs with backward-facing tips facilitates their attachment to the mucosa, aggravating inflammation and complicating their removal. This specific case showed severe clinical progression, with local manifestations of erythema, edema, and lingual necrosis, as well as systemic complications such as vomiting and sepsis. Therapeutic management included both the mechanical removal of the hairs and intensive symptomatic treatment, including the use of corticosteroids, antibiotics, and nutritional support. The literature supports the efficacy of these interventions in cases of urticating caterpillar envenomation, highlighting the need for early diagnosis and aggressive treatment to mitigate the toxic effects (Bruchim et al., 2005; Pouzot-Nevorete et al., 2017).

This case highlights the importance of preventive measures and awareness of the risks associated with processionary caterpillars, especially in areas where they are prevalent. It is recommended that pet owners be vigilant during the months of peak activity of these caterpillars and take precautions to avoid direct contact. Additional studies on the mechanisms of action of thaumetopoein and more effective treatment strategies are necessary to improve the clinical management of such intoxications (Vega et al., 2011).

The movement of the larvae occurs at the end of winter and the beginning of spring, between February and April, when the caterpillar is in the L5 larval stage, with a greater number of hairs and, consequently, at its most venomous stage (Bruchim et al., 2005). Their envenomation affects humans and animals, with young individuals being the most vulnerable in all species due to their curiosity about the environment (Pouzot-Nevorete et al., 2017). This was observed in the described case, which involved a puppy whose accident with the pine processionary caterpillar occurred in February.

Although the species of caterpillar that caused the accident in this case report does not exist in Brazil, there are other caterpillars in the country that can provoke similar or even identical clinical signs to those caused by the pine processionary caterpillar. Therefore, it is essential to understand the described case to correlate it with possible accidents involving Brazilian caterpillars. The main species that can cause similar

reactions are *Lonomia obliqua*, *Megalopyge lanata*, and *Premolis semirufa* (Sánchez et al., 2019). The assassin caterpillar, *Lonomia obliqua*, is responsible for accidents in the southern states of the country. Its urticating hairs, besides causing local irritation at the contact site, release anticoagulant properties that can cause cutaneous hemorrhages and may even affect vital organs. Its hairs are shaped like pine trees with white spots intertwined with brown bands (Alvarez Flores et al., 2021). *Megalopyge lanata*, known as "puppy caterpillar, hairy caterpillar, fire caterpillar" due to its hair-like setae, is responsible for accidents in the southeastern states of the country. Its urticating hairs cause a burning sensation when in contact with the skin. Its body is composed of wide white segments, separated by narrow dark-colored bands, containing tufts of long, fine, reddish-brown setae that hold the toxin-bearing spines (Sánchez et al., 2019). *Premolis semirufa*, known as "pararama," is responsible for accidents in the Amazon region of the country. Its setae cause an intense itching sensation followed by acute inflammation, and in cases of multiple contacts with the same caterpillar, it can even cause chronic inflammation, leading to osteoarthritis due to synovial thickening caused by its toxins. Its body is a mix of black, yellow, red, and white colors with brown and silver setae containing its toxin (Siqueira et al., 2021).

Although the patient in this case report had direct contact with the caterpillar, this is not the only form of intoxication. When threatened, *Thaumetopoea pityocampa* can release its hairs into the air to deter potential threats. The most affected organs are the oral, ocular, and respiratory mucosa. Thaumetopoein is the main toxin present in the hairs, secreted by trichogen cells located at the base of the hairs. This toxin causes IgE-independent mast cell degranulation, which triggers the release of histamine and initiates an inflammatory reaction at the contact site (Kaszak, Planelas, and Dworecka-Kaszak, 2015). In some cases, these reactions depend on anti-thaumetopoein IgE (Tha p1), which also cause nonspecific mast cell degranulation. The clinical manifestations of these reactions, both independent and dependent on anti-thaumetopoein IgE (Tha p1), occur between 1 and 12 hours after contact with the pine processionary caterpillar (Aguiar e Correia, 2016).

In the described case, the animal arrived at the hospital with an erythematous, edematous, and desquamative oral region. According to Oliveira et al. (2003), one of the most evident clinical signs in dogs is oral inflammation, manifesting as stomatitis with hyperemic regions and angioedema, which may or may not present with papules that can later cause desquamation, followed or not by lingual necrosis. This necrotic stomatitis is

triggered by microinfarctions generated after vasculitis caused by the local inflammatory reaction, potentially resulting in the loss of the affected part. In the described case, the animal presented with necrosis and loss of the tongue, as reported by the authors.

Although the animal in this report did not present ocular and respiratory clinical signs, Trincão et al. (2012) describe an ocular inflammatory response caused by the hairs and thaumetopoein. This response includes an immediate immunological reaction in the cornea, resulting in hyperemia, conjunctival, and palpebral edema. Aguiar e Correia (2016) report that respiratory system infections are less common, but when they occur, they are associated with the inhalation of caterpillar hairs. These hairs are released into the air when the caterpillars feel threatened and can penetrate as far as the trachea and primary bronchial zones, causing respiratory pathologies such as interstitial pneumonia and presenting symptoms such as rhinitis, cough, dyspnea, and dysphagia.

As there are no specific pathognomonic signs for contact with the pine caterpillar, it is crucial to establish differential diagnoses that include other causes of hypersensitivity, such as food reactions, medications, gastrointestinal parasites, foreign bodies, or other venomous animals (Oliveira et al., 2003). In the present case, the diagnosis was not challenging because the owners observed the animal's contact with the caterpillar, allowing for immediate treatment, which consists of removing the urticating hairs and controlling the allergic reactions (Pouzot-Nevoret et al., 2017).

In more severe cases, where the animal presents significant respiratory distress, orotracheal intubation may be performed (Kaszak, Planelas, and Dworecka-Kaszak, 2015). In the present study, to stabilize the respiratory pattern, the animal was kept intubated, in an induced coma, with adequate pain control. Due to the edema and necrosis in the oral region, assisted nutrition via nasogastric tube was chosen, although esophageal tubing could also be considered if necessary.

The animal's oral cavity was washed with 30% glucose followed by 7.5% NaCl saline solution to remove the caterpillar's hairs. Both solutions have an osmotic action, which can help in the treatment of sublingual edema.

In cases where the animal presents systemic manifestations, as in the patient of this report, systemic antibiotic therapy is necessary to control bacterial translocation. Ampicillin is indicated as a broad-spectrum antibiotic, often associated with metronidazole for the control of anaerobic bacteria (Kaszak, Planellas, and Dworecka-Kaszak, 2015). The inclusion of enrofloxacin was instituted in this patient to aid in the control of urinary infection and sepsis.

The use of corticosteroids, such as dexamethasone or methylprednisolone, as reported in this case, is justified by the presence of severe hypersensitivity reactions. In less severe cases, the use of antihistamines, aimed at reducing mast cell degranulation, is an option (Pouzot-Nevoret, 2017).

As described by Kaszak, Planellas, and Dworecka-Kaszak (2015), one of the systemic changes that can occur is gastrointestinal alterations. Therefore, metoclopramide and ondansetron were used, which are useful for controlling emesis, while the use of omeprazole and sucralfate is essential for controlling gastritis.

The use of Actea Oral, an oral antiseptic, is justified in the treatment of oral wounds and in aiding the management of stomatitis.

The decrease in urine output is a severe sign that may be associated with acute kidney injury and/or hypotension resulting from sepsis, with poor renal perfusion being a possible cause of this injury. Fortunately, the use of vasopressors and antibiotics allowed for the recovery of renal function. Sepsis-induced shock generally leads to renal blood flow alteration and dysfunction, as observed in the patient of this report. Vasopressors such as norepinephrine and vasopressin are commonly used in these cases (Schetz, 2002; Chagnon et al., 2008). Norepinephrine can help maintain renal blood flow, glomerular filtration rate, and urine output (Schetz, 2002). Vasopressin is another alternative in the management of septic shock, as it can increase urine output, creatinine clearance, and improve renal function, possibly through its effects on vasopressin receptors and immune modulation (Chagnon et al., 2008).

The edema, phlebitis, and development of the axillary abscess are associated not only with the septic condition but also with the immunosuppression resulting from the multiple lesions sustained by the patient. It is also important to emphasize the need for analgesic control of the animal, as the lesions observed in this case report are quite painful, which can negatively interfere with the patient's recovery. In this case, methadone was chosen; however, the use of opioid patches, such as butorphanol or fentanyl, has been indicated for patients with persistent pain (Niza et al., 2012).

Considering the condition presented by the patient in this case report and the sequelae resulting from the unwanted contact, it is evident that the accident with the pine caterpillar can have severe consequences for the patient, with preventive measures being the best way to address the problem. As a preventive measure, the destruction of caterpillar nests by carefully cutting and burning them with appropriate protection and

the use of insecticides for caterpillar control are highlighted (Kaszaki, Planellas, and Dworecka-Kaszak, 2015).

Given the facts in this case report and the literature consulted, it is evident that there is a lack of specific treatment for the toxins of the pine caterpillar, necessitating further studies on more effective ways to treat caterpillar intoxication.

## CONCLUSION

The described case highlights the severe consequences of dogs coming into contact with the pine processionary caterpillar (*Thaumetopoea pityocampa*), emphasizing the need for rigorous preventive measures and the importance of prompt and effective treatment. It was observed that the appropriate management of allergic and inflammatory reactions, including the mechanical removal of urticating hairs, the use of corticosteroids, antibiotics, and nutritional support, are crucial for the animal's recovery. Raising awareness among pet owners and implementing preventive strategies, such as the destruction of nests and the use of insecticides, are essential to prevent similar incidents.

## ACKNOWLEDGMENTS

We would like to express our gratitude to the Vet Central Veterinary Hospital for providing the essential data for this work. We thank PIBIC-Fapemig, PAPG-Fapemig, and PIBIC-CNPq for granting scholarships to students Pamella Eduarda and Keitt Emanuelle. Our sincere appreciation also goes to CAPES-Prosup for granting master's scholarships and to CAPES-PDPG 3/4 (Programa de Desenvolvimento da Pós-Graduação) Emergency Strategic Consolidation of Academic Graduate Programs.

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