Incidence of Clinical Signs in Poisoned Pets of Thailand: A Retrospective Study

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ABSTRACT

Clinical signs appear immediately or gradually in poisoned pets. Poisonous agents in pets, especially dogs and cats, have been reported to include human medications (acetaminophen), pesticides (organophosphate and carbamate), insecticides for veterinary use (ivermectin), and food (methylxanthines). The current study investigated the incidence of poisoning in dogs and cats residing in Rayong and Nakhon Ratchasima provinces as well as Bangkok, Thailand, during 2016-2020. The study found a total of 102 poisoned cases of dog and cat, including 58 dogs (56.86%) and 44 cats (43.14%). The poisoned dogs included 39 males (67.24%) and 19 females (32.26%), while poisoned cats consisted of 29 males (65.91%) and 15 females (34.09%). Poisoning was highly diagnosed in mixed breed dogs and domestic short-haired cats. The average age of poisoned dogs and cats was reported as 3.67 ± 1.92 and 3.02 ± 1.72 years, respectively. The most common poisonous agents found in dogs and cats were organophosphate-carbamate groups and acetaminophen. Tachycardia, hypersalivation, dyspnea, and facial swelling were the most common clinical signs observed in poisoned dogs and cats.

Keywords: Cat, Clinical signs, Dog, Poisoning

INTRODUCTION

The clinical signs of poisoning appear immediately or gradually in suspected pets. Toxicity can be divided into three types, including acute, sub-chronic, and chronic. The acute toxicity results from a single exposure or multiple exposures to a poisonous agent and the clinical signs appear within 24 hours. Regarding sub-chronic toxicity, pets present signs of toxicity after consecutive exposure to a low level of poisonous agents over about 1-3 months. In chronic toxicity cases, pets present signs of toxicity in several organ systems after receiving a low level of a poisonous agent for more than three months until toxicity develops (Gupta and Bhardwaj, 2012). In practice, it is difficult to diagnose instances of pet poisoning since most of the clinical signs are non-specific (Cortinovis et al., 2015). Therefore, diagnosis depends on the owner or caretaker’s report, complete physical examination, evidence from the scene, and laboratory examination (Cortinovis et al., 2015).

The detection of poisonous agents from serum, secretion, tissue, and content samples in the body is highly accurate and specific, however, it takes time to examine (Caloni et al., 2016). Examination methods for poisonous agents include Thin Layer Chromatography, High-Performance Liquid Chromatography, Gas Chromatograph-Mass Spectrometer, and Liquid Chromatography-Mass Spectrometry (De Siqueira et al., 2015; Lahmar et al., 2019; Avolio et al., 2021). To select an examination method, the veterinarian should know the type of samples and the type of suspected poisonous agents to be tested.

Poisonous agents in pets especially dogs and cats have been previously reported to include human medications (Acetaminophen), pesticides (Organophosphate and Carbamate), insecticides for veterinary use (Ivermectin), and food methylxanthines (Cortinovis et al., 2015; Avolio et al., 2021). Clinical signs in poisoned dogs and cats vary and are sometimes non-specific, such as vomiting, hypersalivation, seizure, ataxia, facial swelling, and blindness (Lahmar et al., 2019; Adekoya et al., 2020).

Nevertheless, a comprehensive study on poisonous agents in dogs and cats has not yet been undertaken in Thailand. The present study aimed to investigate the incidence of poisoning in dogs and cats in Rayong, and Nakhon Ratchasima provinces as well as those in Bangkok, Thailand, from 2016 to 2020.
MATERIALS AND METHODS

Ethical approval
The present study was approved by Suan Sunandha Rajabhat University-Institute Animal Care and Use Committee (SSRU-IACUC-002/2021).

Study period
The current retrospective study addressed the medical records of poisoned dogs and cats at four local animal clinics from January 2016 to December 2020 in Thailand.

Study area
The local animal clinics include two animal clinics in Rayong province in eastern Thailand, with the province covering an area of 3552 km², one animal clinic in Bangkok covering an area of 1569 km², and a clinic in Nakhon Ratchasima province.

Data collection
The present study was conducted only on the records of poisoned pets obtained from owner or caretaker reports, evidence from the scene, and a veterinarian who performed an approved examination. The pet details included species (dogs or cats), age, gender, breed, clinical signs, and poisoning agent (noticed by the owner, evidence of toxic substances brought to the clinic, and/or a veterinarian’s diagnosis). Substances with a similar structure and action were classified into anticoagulant rodenticides groups, organophosphate and carbamate groups, pyrethrin and pyrethroid groups.

Statistical analysis
Descriptive analysis was used to describe gender, breed, and type of poisonous agent using percentage and mean ± standard deviation in age. Clinical signs were classified according to poisonous agents and species.

RESULTS
A total of 102 complete cases of poisoned dogs and cats were collected, including 58 dogs (56.86%) and 44 cats (43.14%). The suspected dogs included 39 male (67.24%) and 19 female cases (32.26%), while for cats there were 29 males (65.91%) and 15 females (34.09%). The average age of the poisoned dogs and cats were 3.67 ± 1.92 and 3.02 ± 1.72 years, respectively. Dog breeds included 34 mixed breed (58.63%), 5 Shih-tzu (8.62%), 3 Golden Retriever (5.17%), 3 Poodle (5.17%), 2 Thai ridgeback (3.45%), 2 Pomeranian (3.45%), 2 Chihuahua (3.45%), 2 Thai Bangkaew (3.45%), 2 Beagle (3.45%), 1 Yorkshire Terrier (1.72%), 1 Pug (1.72%), and 1 French Bulldog (1.72%). Cat breeds included 40 domestic short-haired (90.91%), 3 Persian (6.82%), and 1 British shorthair (2.27%).

The poisonous agents found in dogs were Organophosphate and Carbamate groups in 20 males and 4 females (45.45%), Acetaminophen in 1 male (1.72%), Ibuprofen in 1 male (1.72%), Acetaminophen in 1 male (1.72%), and Paraquat in 1 female (1.72%). Cat breeds included 40 domestic short-haired (90.91%), 3 Persian (6.82%), and 1 British shorthair (2.27%).

Clinical signs in the poisoned dogs included tachycardia in 40 dogs (68.9%), hypersalivation in 28 dogs (48.28%), fever in 25 dogs (43.10%), seizure in 22 dogs (37.93%), tremor in 21 dogs (36.21%), vomiting in 17 dogs (29.31%), depression in 14 dogs (24.14%), ataxia in 13 dogs (22.14%), diarrhea in 12 dogs (20.69%), weakness in 11 dogs (18.97%), dyspnea in 10 dogs (17.24%), tachypnoea in 9 dogs (15.52%), hematemesis in 9 dogs (15.52%), hypothermia in 8 dogs (13.79%), jaundice in 8 dogs (13.79%), hematuria in 3 dogs (5.17%), bloody diarrhea in 1 dog (1.72%), unconsciousness in 1 dog (1.72%), and 1 dog (Yorkshire Terrier) showed no clinical signs despite being poisoned (1.72%). Clinical signs of the poisoned cats included dyspnea in 31 cats (70.45%), facial swelling in 30 cats (68.18%), depression in 20 cats (45.45%), hypothermia in 16 cats (36.36%), tachycardia in 11 cats (25%), cyanosis in 8 cats (18.18%), hypersalivation in 6 cats (13.64%), tremor in 6 cats (13.64%), ataxia in 5 cats (11.36%), vomiting in 4 cats (9.09%), tachypnoea in 3 cats (6.82%), weakness in 3 cats (6.82%), blindness in 3 cats (6.82%), mydriasis in 3 cats (6.82%), seizure in 3 cats (6.82%), fever in 2 cats (4.55%), panting in 1 cat (2.27%), and mouth swelling in 1 cat (2.27%). The classifications of poisonous agents, clinical signs, and species are presented in Table 1.

Figure 1. Poisonous agents in 58 dogs during 2016-2020 in Rayong, Bangkok, and Nakhon Ratchasima provinces. The medical record found organophosphate and carbamate groups with the highest incidence.

Figure 2. Poisonous agents in 44 cats during 2016-2020 in Rayong, Bangkok, and Nakhon Ratchasima province. Acetaminophen had the highest incidence in cats.

Table 1. Classification of poisonous agents, clinical signs, and species

<table>
<thead>
<tr>
<th>Poisonous agents</th>
<th>Species</th>
<th>Breeds</th>
<th>Clinical signs</th>
<th>Places</th>
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</thead>
<tbody>
<tr>
<td>Amitraz</td>
<td>dogs</td>
<td>Mixed (n = 3)</td>
<td>Tachycardia, tremor, and ataxia</td>
<td>Bangkok (n = 3)</td>
</tr>
<tr>
<td>Anticoagulant rodenticides groups</td>
<td>dogs</td>
<td>Mixed (n = 6), Golden Retriever (n = 2), Thai ridgeback (n = 1), Poodle (n = 1)</td>
<td>Depression, vomiting, fever, diarrhea, tachycardia, weakness, hypothermia, jaundice, and hematemesis</td>
<td>Rayong (n = 2), Nakhon Ratchasima (n = 8)</td>
</tr>
<tr>
<td></td>
<td>cats</td>
<td>Domestic Short-Haired (n = 2)</td>
<td>Fever and tachycardia</td>
<td>Bangkok (n = 2)</td>
</tr>
<tr>
<td>Bufotoxin (toad poison)</td>
<td>cat</td>
<td>Domestic Short-Haired (n = 1)</td>
<td>Hypersalivation, tachycardia, and mouth swelling</td>
<td>Bangkok (n = 1)</td>
</tr>
<tr>
<td>Chocolate</td>
<td>dogs</td>
<td>Yorkshire Terrier (n = 1), French Bulldog (n = 1)</td>
<td>Vomiting, diarrhea and no indication of signs</td>
<td>Bangkok (n = 1), Nakhon Ratchasima (n = 1)</td>
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<td>Fipronil</td>
<td>cats</td>
<td>British shorthair (n = 1), Domestic Short-Haired (n = 1)</td>
<td>Hypersalivation, tachycardia, and tachypnea</td>
<td>Bangkok (n = 2)</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>dog</td>
<td>Golden Retriever (n = 1)</td>
<td>Vomiting, diarrhea, tremor, weakness, ataxia, tachycardia, and tachypnea</td>
<td>Bangkok (n = 1)</td>
</tr>
<tr>
<td>Organophosphate and Carbamate groups</td>
<td>dogs</td>
<td>Mixed (n = 18), Pug (n = 1), Chihuahua (n = 2), Thai Bangkaew (n = 2), Thai ridgeback (n = 1)</td>
<td>Hypersalivation, fever, tremor, seizure, tachycardia, tachypnea, dyspnea, and unconsciousness</td>
<td>Bangkok (n = 3), Nakhon Ratchasima (n = 11), Rayong (n = 10)</td>
</tr>
<tr>
<td>Paraquat</td>
<td>dog</td>
<td>Shih-tzu (n = 1)</td>
<td>Depression, vomiting, tachycardia, tachypnea, and weakness</td>
<td>Rayong (n = 1)</td>
</tr>
<tr>
<td>Ivermectin</td>
<td>dogs</td>
<td>Mixed (n = 2), Poodle (n = 2), Shih-tzu (n = 4), Beagle (2), Pomeranian (n = 2)</td>
<td>Tremor, hypersalivation, vomit, fever, tachycardia, ataxia, tachypnea, and hematemesis</td>
<td>Bangkok (n = 7), Rayong (n = 5)</td>
</tr>
<tr>
<td></td>
<td>cats</td>
<td>Domestic short-haired (n = 8), Persian (n = 1)</td>
<td>Depression, hypersalivation, panting, tachycardia, tachypnea, dyspnea, tremor, ataxia, seizure, blindness, and mydriasis</td>
<td>Bangkok (n = 4), Nakhon Ratchasima (n = 5)</td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>cats</td>
<td>Domestic short-haired (n = 29), Persian (n = 1)</td>
<td>Depression, facial swelling, tachycardia, cyanosis, dyspnea, hypothermia, and weakness</td>
<td>Bangkok (11), Nakhon Ratchasima (5), Rayong (14)</td>
</tr>
<tr>
<td></td>
<td>dog</td>
<td>Mixed (n = 1)</td>
<td>Vomiting and bloody diarrhea</td>
<td>Bangkok (n = 1)</td>
</tr>
<tr>
<td>Pyrethrins and Pyrethroids groups</td>
<td>dogs</td>
<td>Mixed (n = 4)</td>
<td>Hypersalivation, tachycardia, fever, tremor, vomit, diarrhea, and ataxia</td>
<td>Bangkok (n = 3), Rayong (n = 1)</td>
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</table>
Amitraz is a poison involving an α2-adrenergic receptor antagonist and a Monoamine Oxidase Inhibitor that affects the nervous system and causes cardiovascular system disorder (Cortinovis et al., 2015). In Thailand, dog and cat poisoning is rarely reported and published. During 2020-2016, the obtained results of the present study indicated that the most poisonous agents for dogs were Organophosphate and Carbamate groups (41.38%). This finding was similar to those previously reported in Tunisia, having the highest number of dog poisoning cases, 71.4% (Lahmar et al., 2019). In Italy, the most commonly used poisonous agents for dogs (79.2%) were reported as Anticoagulant rodenticides groups (Avolio et al., 2021). Considering cat poisoning cases, the most common poisonous agent found in the current study was Acetaminophen (68.18%), which differs from reports from Italy with Anticoagulant rodenticides groups as primarily poisoning agents (Avolio et al., 2021).

The incidence of poisoning was more in dogs than cats (56.8% and 43.14%), which was in accordance with previous studies in Italy and Brazil as reporting more cases of poisonings in dogs than cats (Caloni et al., 2014; Zang et al., 2018). Among the poisoned cases, the number of males was more than females (66.67% and 33.33%). However, a retrospective study on small animal poisoning during 2010-2016 in Brazil indicated that females were more than males (Zang et al., 2018). This could be due to the difference in the study area as well as owners' preferences (for the animal and the gender) and affordability. Regarding the age, the average age of the poisoned dogs and cats was 3.67 ± 1.92 and 3.02 ± 1.72 years, which was in agreement with a previous study indicating poisoning was more common among younger dogs and cats (Berny et al., 2010; Zang et al., 2018). Although mixed dog breeds and domestic short-haired cats were the most suspicious breeds of poisoning, a study by Adekoya et al. (2020) indicated more poisoning cases with exotic breeds than local breeds. This may be related to differences in areas and breeds commonly found in that region.

The most common clinical signs in poisoned dogs were tachycardia (68.97%) and hypersalivation (48.28%), while dyspnea (70.45%) and facial swelling (68.18%) were more apparent in poisoned cats. Poisoning of the Organophosphate and Carbamate groups could result in neuropathy (Avolio et al., 2021). In dogs (n = 24), poisoning showed clinical signs similar to previous reports (Avolio et al., 2021), including hypersalivation, fever, tremor, seizure, dyspnea, and unconscious. Toxicity in the Organophosphate and Carbamate groups depends on the chemical substance types, such as malathion, the oral toxicity of which in dogs is 500 mg/kg (Bell et al., 1955). Acetaminophen causes hemolysis and methemoglobinemia (Cortinovis et al., 2015). Poisoned cats (n = 30) showed clinical signs, including facial swelling, dyspnea, and cyanosis. In contrast, dogs (n = 1) showed clinical signs of vomiting and bloody diarrhea. The reported poisonous dose of this agent is less than 60 mg/kg for cats and over 300 mg/kg for dogs (Lascelles et al., 2007). Acetaminophen is commonly provided by cat owners rather than dog owners to their pets. Dogs (n = 12) poisoned by Ivermectin presented tremor, hypersalivation, vomiting, hematemesis, and ataxia, while cats (n = 9) indicated tremor, hypersalivation, blindness, and mydriasis. Previous reports found that Ivermectin toxicity in dogs and cats was related to the status of the P-glycoprotein transport system (P-GP) individual (Gwaltney-Brant et al., 2018). The P-GP is a protein coded by the ATP-binding cassette subfamily B member 1 (ABCB1) formerly multidrug resistance protein 1 (MDR1), while normal P-GP is tolerant to the toxin (Gwaltney-Brant et al., 2018). In some previous studies, Ivermectin had oral toxicity of 1 mg/kg in cats and 80 µg/kg (ABCB1 defective) and 0.2-1 mg/kg (ABCB1 normal) in dogs (Gwaltney-Brant et al., 2018). For the Anticoagulant rodenticides groups, this poisoning involves blood coagulopathy. Poisoned dogs (n = 10) presented jaundice, hematemesis, vomiting, fever, and diarrhoea, while cats (n = 2) presented fever and tachycardia. Toxicity depends on the Anticoagulant rodenticide type, such as warfarin, which has oral toxicity of 11-323 mg/kg in dogs and 20-50 mg/kg in cats (Valchev et al., 2008). Poisoning involving Pyrethrin and Pyrethroids groups decreases the intracellular voltage potential, resulting in cellular hyperexcitability (Ensley, 2018). Dogs poisoned with Pyrethrin and Pyrethroids groups (n = 4) showed hypersalivation, tachycardia, fever, tremor, diarrhea, and ataxia. According to the previous report of the toxicity in dogs, clinical signs depend on the Pyrethrin and Pyrethroids type, such as commercial flea and tick spray products containing 0.09% fenvalerate and 9% diethyltoluamide (DEET) with oral toxicity of 4 mg/kg (Anadón et al., 2009). Amitraz is a poison involving an alpha 2-adrenergic agonist and a Monoamine Oxidase Inhibitor that affects the nervous system and causes cardiovascular system disorder (Yilmaz and Yildizdas, 2003). The oral toxicity has been reported in dogs at 100 mg/kg (Filazi and Yurdakok-Dikmen, 2018). In the current study, dogs poisoned with Amitraz (n = 3) presented tachycardia, tremor, and ataxia as was expected for the dogs orally received Amitraz quantities greater than 100 mg/kg. Fipronil is used in veterinary medicine to prevent and eliminate external parasites, such as ticks, fleas, or mites (Gupta and Anadón, 2018). The mechanism of toxicity inhibition is at the gamma-aminobutyric acid (GABA) receptor-chloride complex (Gupta and Anadón, 2018). In the present study, cats poisoned with Fipronil (n = 2) presented hypersalivation, tachycardia, and tachyphoea which is consistent with a previous report of Fipronil as a moderately toxic substance indicating skin contact alone produces little or no toxicity (Suzuki et al., 2021). The clinical signs of oral toxicity of Fipronil appear when the substance is given in large quantities and over several months Australian Authority Pesticides and Veterinary Medicines (0.2-0.5 mg/kg/day, AAPVM, 2011). The current study indicated that two dogs were poisoned with chocolate given by their owners, one of which (French Bulldog)
presented clinical signs, including vomiting and diarrhea, while the other (Yorkshire Terrier) presented no clinical signs after ingestion. The poisoning substance of chocolate is theobromine which primarily affects the central nervous system, cardiovascular system, and respiratory system (Cortinovis and Caloni, 2016). Clinical signs have been reported to appear in dogs after chocolate ingestion of 20 mg/kg (Cortinovis and Caloni, 2016). Ibuprofen poisoning was found in one dog (Golden Retriever) which presented clinical signs of vomiting, diarrhea, tremor, weakness, and ataxia. This substance inhibits cyclooxygenases and decreases the production of prostaglandins (Bolfer et al., 2014). Previous reports found that Ibuprofen toxicity in dogs can be seen at 50 mg/kg (Cortinovis et al., 2015). Paraquat poisoning was found in one dog (Shih-tzu) with clinical signs of depression, vomiting, tachycardia, tachypnoea, and weakness, which was in accordance with the previously reported effects of superoxide radical and cell death (Fukushima et al., 2002). Although the oral toxicity of Paraquat is unknown in dogs, it is still higher in dogs than cats (35-50 mg/kg in cats, Cope, 2004). Bufotoxin (toad poison) was found in one cat and the clinical signs included hypersalivation, tachycardia, and mouth swelling. Previous reports found clinical signs in dogs, including gastrointestinal, cardiac, and neurological problems, but low mortality was observed after intoxicated (Barbosa et al., 2009). In the current study, medical records of clinical signs in poisoned dogs and cats included factors causing discrepancies, such as examinations by different veterinarians, period of exposure to the poisoning agent, the amount of poisoning agents received, and pet health status before the poisoning. As far as the authors are concerned, the current study is one of the first on the incidence and clinical signs of poisoned pets in Thailand.

CONCLUSION

In the present study, organophosphate-carbamate groups and acetaminophen were highly reported as poisonous agents in dogs and cats between January 2016 and December 2020. Poisoning was mostly diagnosed in mixed breed dogs and domestic short-haired cats. Tachycardia, hypersalivation, dyspnea, and facial swelling were the most common clinical signs in dogs and cats.

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Competing interests

The authors declare that there is no competing interests.

Ethical consideration

Ethical issues such as plagiarism, misconduct, information fabrication and/or falsification, consent to publish, double publication and/or submission, and redundancy have been verified by the authors

Authors’ contribution

Athip Lorsirigool collect and analyze data, wrote a manuscript, and submission. Athip Lorsirigool, Yuttana Sudjaroen, and Narong Kulnides read and approved the final manuscript.

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