

## Organophosphate Intoxication in Dogs

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### Abstract

*This paper presents 32 cases of poisoning from the organophosphate (OPs) group of pesticides reported in dogs at veterinary clinics and hospitals during the month of November 2022 in Albanian cities, including Tirana, Korca, Fieri, Durres, and Vlora. Poisonings resulted from dogs accidentally ingesting OPs or due to the carelessness of their owners, who used insecticides with OPs action. There are also suspicions of malicious actions by individuals who deliberately poisoned food with OPs. Out of the 32 recorded cases, 14 (43.75%) resulted in the death of dogs due to a lack of timely intervention.*

*The paper describes one case of poisoning, detailing the onset of clinical signs to the calming and stabilization of the dog's condition, step by step. The aim is to provide guidance for dog owners and clinic veterinarians. The case involves Rudi, a 7-year-old male Maltese weighing 8 kg, who ingested OPs-poisoned sausage during an afternoon walk in Tirana. Within 15-20 minutes of consuming the sausage, Rudi exhibited initial clinical signs in different interval of time, such as hypersalivation, bronchorrhea, lacrimation, urination, defecation, dyspnea, diarrhea, miosis, cough, bradycardia, tremors, weakness, anxiety, depression, twitching and seizures.*

*Prompt intervention by veterinary doctors at Vet Hospital, starting therapy within 30 minutes of the first clinical symptoms, contributed to Rudi's full recovery. The treatment protocol included Atropine, apomorphine, benzodiazepines, and fluid therapy. Clinical signs improved rapidly, and Rudi fully recovered within 3-4 hours. Rudi was fortunate, unlike 43.75% of cases that resulted in the death of dogs.*

**Keywords:** Intoxication, Organophosphate (OPs), pesticides, dogs, acetylcholine, Atropine

### INTRODUCTION

More than 30,000 organophosphosphate (OPs) insecticides are known. Chemically, these substances are organic esters of phosphoric acids ( $H_3PO_4$ ), such as Dichlorphos (Nogos, DDVP) of thiophosphoric acid ( $H_3PO_3S$ ) derivatives like: Parathion (Agrofos), Methylparation (Vofatox), Diazinon, and of dithiophosphoric acid like: Malathion (Karbofos, Metatox), Dimethoate (Rogor) (Gupta, 2006; Wang et al., 2007; WHO, 2009; Gupta and Milatovic, 2012, Mshelia et al., 2019). Organophosphates and carbamates pose a major public health risk, being commonly used pesticides and important intoxicants for humans and animals (Marrs, 1993; Bardin et al., 1994; Peter et al., 2008; Vale and Lotti, 2015; Fomnya et al., 2021; Wise et al., 2022).

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Organophosphates compounds can enter the body through various routes, including ingestion, inhalation, skin, and mucous membranes. OPs insecticides constitute one of the most classic examples of the action of poisonous substances at the enzymatic level, inhibiting their activity in a competitive manner. Specifically, they act on the acetylcholinesterase enzyme by inhibiting its action on acetylcholine. For this reason, they constitute the most powerful group of anticholinesterases (Srebocan et al., 2003).

**MATERIAL AND METHODS**

Clear cases of organophosphate intoxications were collected from veterinary clinics and hospitals in some Albanian cities during November 2022. All poisoning cases were carefully assessed based on anamnesis and clinical signs and followed up to facilitate a differential diagnosis and treatment.

**RESULTS**

**Table 1. The number of intoxicated dogs and mortality rates in different Albanian cities during November 2023.**

Cities	Nr of dogs intoxicated	Dead dogs	% of mortality
Tirana	21	10	47.62
Vlora	5	2	40
Fieri	4	1	25
Korca	2	1	50
Total	32	14	43.75

In conjunction with the information presented in Table 1, out of the 32 recorded cases, 14 of them (43.75%) resulted in the death of dogs due to a lack of timely intervention (Table 2).

**Table 2. The number of dogs treated early or late and the mortality.**

Cities	Dogs treated early	% in the total	The number of dead dogs	% of mortality	Nr of late treated dogs	% of the total	Nr of dead dogs	% of mortality
Tirana	8	38,09	2	25%	13	61,91	8	61,54%
Vlora	2	40%	0	0	3	60%	2	66,66%
Fieri	2	50%	0	0	2	50%	1	50%
Korca	1	50%	0	0	1	50%	1	100%
Total	13	40,63%	2	15,38%	19	59,37%	12	63,16%

In table number 2, we have separated the cases according to the timing of the treatment process. This is mainly done based on the anamnesis and clinical signs. Of the 32 dogs that were treated, 13 of them (40.63%) arrived at the clinic early (less than 4 hours), and their treatment was done immediately. Only 2 small dogs (15.38%) out of the total 13 dogs ended up dying due to their very difficult situation. 19 dogs or 59.37% of the total number of dogs that were intoxicated with organophosphate reached the clinic after 24 hours, and 12 of them or 59.37% ended up dying.

The clinical signs in all dogs were acute and hyperacute. You can see in figures 1 and 2 the dog (Rudi) 30 minutes after intoxication.



Fig 1



Fig. 2

**Figures 1 and 2. Clinical signs by Organophosphate (POs) intoxication, before intervention.**

In Fig. 1 and 2, the images depict the condition of the dog (Rudi) 30 minutes after intoxication. Rudi ingested a POs-poisoned sausage during an afternoon walk in Tirana. Within 15-20 minutes after consuming the sausage, the first clinical signs emerged, including salivation, bronchorrhea, lacrimation, urination, defecation, dyspnea, gastrointestinal hypermotility, diarrhea, followed by miosis, tremors, muscle spasm, weakness, anxiety, depression, twitching and seizures.



Fig 3



Fig 4

**Figures 3 and 4. Clinical Signs and Rudi's Reaction 30 Minutes after Intervention (3) and Miosis (4).**

In Fig. 3, the dog does not respond to its owner, indicating a change in behavior after intervention. Figure 4 illustrates the occurrence of miosis, suggesting an issue with the eyes.



Fig 5



Fig 6

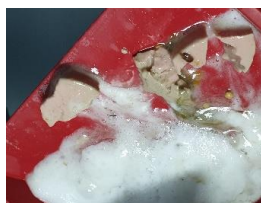


Fig 7

**Figures 5, 6 and 7. The content of vomiting after the use of apomorphine.**

Treatment and Medication Protocol: Atropine, benzodiazepine, apomorphine, combined with fluid therapy, were administered. The clinical signs showed rapid improvement, and the dog achieved complete relaxation within 2-3 hours, aligning with observations made by other authors (Michael et al., 2008; Mshelia et al., 2019).



Fig 8



Fig 9

**Figures 8 and 9: Normalization of Rudi 3 hours (Fig. 8) and 6 hours after treatment (Fig. 9).**

Three hours post-treatment, Rudi's condition normalized, and after 6 hours, every parameter returned to normal. This included total relaxation of salivation, the respiratory and cardiovascular system, as well as the cessation of diarrhea and muscle tremors.

## DISCUSSION

The data in Table 1 represents the number of intoxicated dogs and the associated mortality rates in various Albanian cities during November 2022. Out of the 32 reported cases of poisoning in different cities of Albania, the intoxication of dogs resulted from accidental ingestion of organophosphates (POs), either due to the carelessness of animal owners using insecticides with POs action or suspected malicious actions by individuals who poisoned food with POs. In table number 2, we have separated the cases according to the timing of the treatment process, from the time of the organophosphorus poisoning to the arrival time of the animal in clinic for treatment. This is mainly done based on the anamnesis and clinical signs. Of the 32 dogs that were treated, 13 of them (40.63%) arrived at the clinic early (less than 4 hours), and their treatment was done immediately. Only 2 small size dogs (15.38%) out of the total 13 dogs ended up dying due to their very difficult situation. 19 dogs or 59.37% of the total number of dogs that were intoxicated with organophosphates reached the clinic after 24 hours, and 12 of them or 59.37% ended up dying. According to those data, we can mention the importance of early intervention for a good prognosis of animal intoxication. To provide a detailed understanding of the clinical course, one specific case will be described.

Rudi, a 7-year-old male Maltese weighing 8 kg, ingested a POs-poisoned sausage during an afternoon walk in Tirana. Within 15-20 minutes after consuming the sausage, Rudi exhibited initial clinical signs such as hypersalivation, bronchorrhea, lacrimation, urination, defecation, dyspnea, gastrointestinal hypermotility, diarrhea, miosis, cough, bradypnea and bradycardia. Those clinical signs are parasympathetic (muscarinic) overstimulation.

The rapid onset of clinical signs in cases of intoxication by organophosphate insecticides is a result of the mechanism of action. Specifically, they act on the acetylcholinesterase enzyme, inhibiting its action on acetylcholine. Consequently, they constitute the most potent group of anticholinesterases (Fukuto, 1990; Srebocan et al., 2003; Ola-Davies et al., 2018). Except muscarinic clinical signs in Rudi's case and other intoxication animals by POs are Nicotinic and CNS clinical signs.

Nicotinic clinical signs are as result of neuromuscular junction synaptic overstimulation, and appears by tremors, muscle spasm, weakness, and in some cases

spastic paralysis. Central Nervous System (CNS) clinical signs occur last, including anxiety, restlessness, hyperactivity, depression, twitching, seizures, and in difficult cases depression of the respiratory center and coma (Gupta and Milatovic, 2012)

According to Klainbart et al. (2022), anticholinesterase intoxication can induce various neurological syndromes, including acute cholinergic crisis-ACC; type-1 syndrome (Bardin 1994; Gupta and Milatovic, 2012), intermediate syndrome-IMS; type-2 syndrome (Schmid et al., 2023), and organophosphate-induced delayed polyneuropathy, myopathy, and central nervous system (CNS) impairment (Jokanović et al., 2011). In Rudi's case, the clinical signs were indicative of ACC, type-1 syndrome, which is commonly observed in dogs (Klainbart et al. 2019), occurring within minutes to hours post-exposure (Gupta and Milatovic, 2012).

Thanks to the swift intervention of veterinary doctors from Vet Hospital, therapy commenced within 30 minutes of Rudi's first clinical symptoms. The diagnosis was based on anamnesis, other cases brought to the hospital, and clinical signs.

The treatment protocol for Rudi started with Diazepam 1mg/kg (Plumb, 2008) and Atropine to address tremors, salivation, and bronchial secretions. Atropine sulfate 0.1% was administered at a dosage of 0.2 mg/kg intramuscularly and intravenously (Arnot et al., 2011). Apomorphine 0,04 mg/kg was injected IV some minutes later to induce vomiting (Jokanovic, 2009). Adequate atropinization was achieved when the pupils dilated, salivation ceased, and the patient appeared to be recovering. Over-dosage with atropine can cause behavioral excitability, so attention to proper dosage and administration methods is crucial (Eddleerson et al., 2004; Jokanovic, 2009; Mshelia et al., 2019).

Adequate atropinization was achieved when the pupils dilated, salivation ceased, and the patient appeared to be recovering. Over-dosage with atropine can cause behavioral excitation, hypermotility, and signs of delirium (Eddleerson et al., 2004).

Figures 5, 6, and 7 clearly illustrate excessive drooling, a typical sign of POs poisoning, along with pieces of sausage swallowed by the dog. Clinical signs improved rapidly, and Rudi was relaxed within 3 hours (Figure 8). After 6 hours, all parameters returned to normal.

While some authors advocate for specific antidotes like oximes (Johnson et al., 2000; Peter et al., 2008; Alavanja), more commonly used in human therapy, the success of treatment in POs intoxications in dogs largely depends on the promptness of intervention. Out of 32 recorded cases of POs intoxication in dogs, 14 (43.75%) ended in death due to delayed intervention. 8 of the dead dogs was street dogs, with our care from a person. Fortunately, Rudi was not part of this statistic and recovered successfully.

## CONCLUSIONS

Poisonings of dogs by POs are the result of accidental ingestion or due to the carelessness of animal owners using insecticides with POs action, but it is also suspected of malicious actions organized by special people who have used food poisoned with POs.

The success of treatment depends on the time of intervention. Out of 32 recorded cases, 14 of them (43.75%) ended in the death of the dogs as a result of delayed intervention. Rudi was lucky and was not part of this statistic. Of the 32 dogs that were treated, 13 of them (40.63%) arrived at the clinic early (less than 4 hours), and their treatment was done immediately. Only 2 dogs (15.38%) out of the total 13 dogs arrived at the clinic early, ended up dying. 19 dogs or 59.37% of the total number of dogs

intoxicated with organophosphorus reached the clinic late, after 24 hours, and 12 of them or 59.37% ended up dying. According to those data, we can mention the importance of early diagnosis of intoxication by POs and fast intervention for a good prognosis of animal intoxication.

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