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ORIGINAL RESEARCH

Evidence of a sudden increase in α-chloralose poisoning in dogs and cats in the Netherlands between 2018 and 2021

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Abstract

Background: After changes in European Union biocide legislation, the Dutch Poisons Information Center observed a strong increase in information requests concerning dogs and cats exposed to α-chloralose. To investigate whether α-chloralose-based rodenticides are safe for non-professional use, additional information regarding poisoning scenarios and clinical course was collected.

Methods: Veterinarians reporting α-chloralose exposure over a 2.5-year period were contacted by mail for follow-up information concerning exposure scenario, product formulation, clinical course and treatment, and outcome. In total, information was collected for 96 dogs and 41 cats.

Results: Fifty-three of 96 dogs and 17 of 19 cats known to have been exposed to α-chloralose-based rodenticides developed signs of central nervous system (CNS) depression or sensory-induced CNS excitation. Mortality in dogs and cats following exposure was 1% and 18%, respectively. An additional 22 cats presented with clinical signs suggestive of α-chloralose poisoning, with a mortality of 5%.

Limitations: Exposure to α-chloralose was not confirmed by biochemical analyses.

Conclusion: Dogs and especially cats were at risk of poisoning from α-chloralose. If criteria such as acute toxicity and risk of (secondary) poisoning are applied during the approval of α-chloralose-based rodenticides, similar to anticoagulant-based rodenticides, it can be concluded that α-chloralose is also not safe for non-professional use.

KEYWORDS
canine poisoning, feline poisoning, rodenticide, toxicology, α-chloralose

INTRODUCTION

Based on changes in European Union (EU) biocide legislation, the Dutch Board for the Authorisation of Plant Protection Products and Biocides announced in the autumn of 2018 that registration of rodenticides based on anticoagulants will not be renewed for use by non-professionals in the Netherlands.[1] The motivation for this change in legislation was based on the consideration that anticoagulants are poisonous for non-targeted species, persistent in the environment, and may lead to secondary poisoning of predators such as birds of prey and companion animals. Furthermore, due to frequent use, rodent resistance to anticoagulants is increasing in certain areas in the EU.[1,2] In the Netherlands, this legislative change will result in the prohibition of anticoagulant-based rodenticides for private use from 2023 onwards.[1] As a consequence, the use of α-chloralose-based rodenticides will likely increase as it will become the only rodenticide available for use by non-professionals.

α-Chloralose, a general anaesthetic, is widely used as a rodenticide. When α-chloralose is ingested in lower doses, central nervous system (CNS)

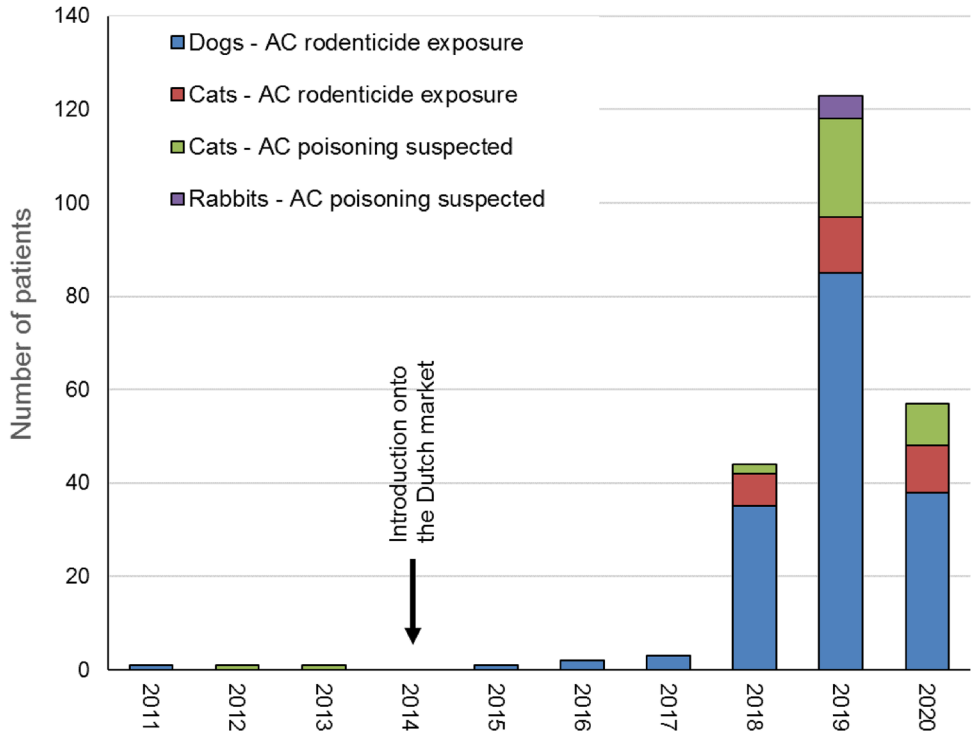

FIGURE 1 Number of information requests made to the Dutch Poisons Information Center between 2011 and 2020 concerning dogs,cats and rabbits exposed to α-chloralose (AC)-based rodenticides

excitation is observed, which is often characterised by sensory-induced myoclonic movements and generalised seizures. However, at higher doses, α-chloralose induces CNS depression, varying from drowsiness to coma.[3,4] The exact mechanism of action is not fully elucidated. α-Chloralose is hydrolysed to chloral. According to some reports, chloral is reduced to trichloroethanol, which can cause CNS depression; however, other reports suggest that trichloroethanol is not a metabolite of α-chloralose.[4-8] Elimination of α-chloralose primarily takes place by renal excretion, either unchanged or after glucuronidation.[5,9]

α-Chloralose causes death by hypothermia during long lasting anaesthesia. In the Netherlands, rodenticides based on α-chloralose were first introduced onto the market for private use in 2014.[10] The ready-to-use products contain 3.4%–4.0% α-chloralose and are packaged in 10 g bags either as a non-spill wax block or coated grain formulation. When used correctly, the bags are placed in a tamper-resistant and securely closed bait box.[10] Despite these containment measures, the early warning system of the Dutch Poisons Information Center (DPIC) detected a rise in information requests concerning α-chloralose from August 2018 onwards (Figure 1). Following this rise, the DPIC began to monitor the veterinary information requests more closely. Additional information regarding the circumstances surrounding the poisoning and ensuing clinical course was collected in order to investigate whether α-chloralose-based rodenticides are safe for non-professional use. In this surveillance study, we report the results of follow-up information provided by veterinarians contacting the DPIC for dogs and cats exposed to α-chloralose over a 2.5-year period.

MATERIALS AND METHODS

Data collection

All veterinarians reporting cases of α-chloralose exposure in dogs and cats to the DPIC between 15 August 2018 and 15 February 2021 were contacted. During this period, veterinarians were often not familiar with α-chloralose-based rodenticides as a potential poisonous cause for CNS-related clinical signs. Therefore, veterinarians reporting cases concerning animals with clinical signs suggestive of α-chloralose poisoning, for example, CNS depression with alternating signs of sensory-sensitive CNS excitation, were also contacted. Those animals were suspected to be poisoned with α-chloralose as well.[4,5] After the standard communication protocol of the centre was completed, veterinarians were informed of the study and participation was requested by the DPIC representative (oral informed consent). The centre's standard communication protocol includes a risk analysis based on calculation of the estimated dose ingested in milligram of α-chloralose per kilogram of bodyweight (information concerning amount of actual rodenticide product ingested by the patient and its bodyweight is provided by the veterinarians, and detailed product information including α-chloralose concentration is available at the DPIC), information on the potential health impact of the toxin and general poison-related and toxin-specific information on treatment. Within a week of the initial contact with the DPIC, the veterinarians were contacted by email and follow-up information was requested. Cases for which additional information concerning the exposure scenario, product information (including product formulation [i.e.,

wax or coated grain-based bait]), estimated exposure dose, clinical course, treatment and outcome were collected were evaluated based on their likelihood of exposure. Animals that proved to have no or negligible α-chloralose exposure, those that had clinical signs not related to α-chloralose and those that were not examined by the veterinarian were excluded from further analysis. The most severe clinical signs observed during the entire clinical course are reported and used for further analysis.

Data analysis

Before analysis, the study data were cleared of any potential patient identifying information, including exact dates, treatment facilities (e.g., veterinary practice or clinic) and healthcare worker (e.g., veterinarian) information. The data were considered anonymous and in agreement with General Data Protection Regulation rules.

Data are presented using descriptive statistics, and median and range were used if not stated otherwise. Statistical tests were conducted in SPSS (IBM SPSS statistics, version 26). Mann–Whitney *U*-test was used to test for significance between dogs with and without clinical signs and between cats exposed to α-chloralose-based rodenticides and suspected of α-chloralose poisoning. A *p*-value less than 0.05 was considered significant.

RESULTS

Patient selection

During the study period, the DPIC received 199 information requests by telephone concerning (suspected) α-chloralose poisoning in 150 dogs, 55 cats and five rabbits. After applying the exclusion criteria, follow-up information for 96 dogs (response rate: 64%) and 41 cats (response rate: 78%) was used for further analysis (Figure 2).

Dogs

In this study, according to information provided by the owners, all dogs consumed rodenticides containing α-chloralose. Two-thirds of the dogs ingested a wax-based α-chloralose rodenticide (64/96, 67%), and coated grain products were ingested by 24 dogs (25%). This information was not available in eight cases. Twenty-nine dogs did not receive gastrointestinal decontamination, while 67 dogs did (Table 1). Emesis was induced with apomorphine in 65 dogs, and in 55 cases (85%) rodenticide (the content of the bags or [ruptured] bags) was present in the vomitus. In the non-decontaminated group, five dogs vomited spontaneously, and traces of the ingested rodenticide were present in the vomitus in four cases (80%).

Fifty-three dogs developed clinical signs of α-chloralose-induced poisoning, while 43 dogs did not. The characteristics of the poisoned dogs, including the estimated ingested dose, are presented in Table 1. Dogs with clinical signs showed CNS depression and excitation, with both states often alternating (Table 2). The predominant signs were ataxia (62%) and mild tremors (43%), seen at a minimum estimated ingested dose of 26.7 and 12.9 mg/kg, respectively. With lower doses, tremors often started at the head, while more severely poisoned dogs developed myoclonic contraction (n = 8, 15%) at a minimum estimated ingested dose of 25.8 mg/kg and generalised seizures (n = 8, 15%). One non-decontaminated dog developed persistent generalised seizures after ingesting 300 mg/kg α-chloralose 2 hours earlier. Twelve dogs (23%) were drowsy for less than 4 hours and six dogs (11%) for more than 4 hours at a minimum dose of 25.8 mg/kg. Six dogs were comatose after ingesting 57.7 mg/kg or more. Depending on the dog's neurological status, hypothermia (13%) and hyperthermia (9%) were observed. Respiratory depression was noted in one dog displaying generalised seizures. Vision-related clinical signs, such as miosis (n = 2, 4%), mydriasis (n = 2, 4%), nystagmus (n = 1, 2%) and abnormal pupillary-related reflexes (n = 3, 2%), were noted in six dogs (6%).

Biochemical analyses (e.g., glucose, electrolytes, kidney and/or liver function) were performed in 14 dogs, and no abnormities were found except for hypokalaemia (2.8 mmol/L) in the dog with persistent seizures.

In 11 dogs, treatment with benzodiazepines, propofol or other anticonvulsant or sedative medications was necessary to control CNS excitation. In all other cases (n = 42), keeping the dog under close observation in a quiet, dark environment was sufficient. Seventy percent of the dogs with clinical signs (n = 37/53) recovered within 12 hours after arrival at the veterinary clinic. All other dogs except two, recovered within 48 hours. At the beginning of the study period, a 10-year-old dog (2.8 kg, crossbreed) developed generalised seizures after the ingestion of 143 mg/kg α-chloralose and was euthanased. According to the veterinarian, it was presumed that this dog had a poor prognosis and therefore euthanasia was suggested to the owner. Including this case, the overall mortality in dogs was 1% (n = 1).

Cats

The age, bodyweight and estimated ingested dose of the cats included in this study are presented in Table 3. Nineteen cats had a known exposure to α-chloralose-based rodenticides, after which 89% developed clinical signs (17/19). Fourteen cats had eaten the non-spill wax block formulation (14/19, 74%), two cats had eaten coated grain (10%) and this information was not available in three cases (16%). Another 22 cats were presented at the veterinary clinic with clinical signs suggestive of α-chloralose without witnessed

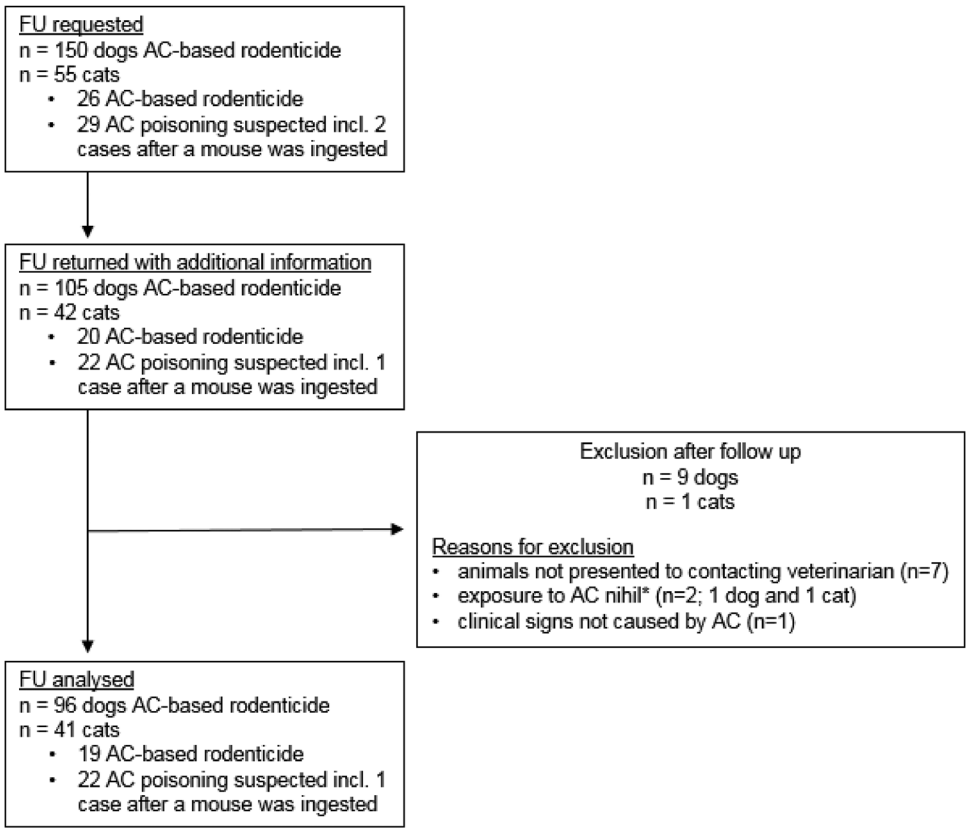

FIGURE 2 Stepwise exclusion chart for dogs and cats included in this follow-up (FU) study on α-chloralose (AC) poisoning. *Nihil refers to animals with no or negligible exposure to α-chloralose

TABLE 1 Characteristics and overview of gastrointestinal decontamination performed in α-chloralose-poisoned dogs with and without clinical signs

	Dogs without clinical signs ($n = 43$)	Dogs with clinical signs ($n = 53$)
Age (year)	1.0[a] (0.3–11.5; $n = 25$)	5.0[a] (0.4–15.0; $n = 38$)
Bodyweight (kg)	12.2[b] (3.4–45.0; $n = 42$)	7.5[b] (2.5–31.0; $n = 52$)
Estimated dose (mg/kg)	14.34[c] (1.0–246.2; $n = 40$)	57.1[c] (2.5–300.0; $n = 49$)
Decontamination	$n = 36$	$n = 31$
Emesis	26 (72%)	22 (71%)
Emesis + activated charcoal	10 (28%)	7 (23%)
Rodenticide in vomitus	28 (78%)	27 (93%)
(Ruptured) bags	9	13
Activated charcoal	0 (0%)	2 (6%)

Note: Median and range are given. Significant differences are indicated with letters in superscript.
[a] $p = 0.014$.
[b] $p = 0.007$.
[c] $p < 0.0001$.

ingestion. Several of these cats (n = 10) were found outside, hypothermic and in comatose state. One cat (12 years, 3 kg) was seen eating an α-chloralose-sedated mouse, and within 15 minutes it developed signs of poisoning (an unsteady gait, muscle cramps and lethargy) and was fully unconscious 30 minutes later. In response to touch, light and noise, the muscle cramps worsened. The cat recovered without sequelae after 12 hours. Cats that were known to have ingested rodenticides were significantly younger than cats with clinical signs suggestive of α-chloralose poisoning, while their bodyweight was not significantly different.

Decontamination measures were taken in six cats. In the group of cats exposed to α-chloralose-based rodenticides, traces of rodenticide were present in the vomitus in one case and two non-decontaminated cats vomited spontaneously with remnants of rodenticide bags present in the vomitus. After emesis was induced, one cat remained with no clinical signs at an estimated initial ingested dose of 11 mg/kg. In non-decontaminated cats, ataxia and myoclonic contractions were seen at a dose of 34 mg/kg, and generalised seizures were noted at an estimated dose of 50 mg/kg.

TABLE 2 Clinical signs in dogs poisoned with α-chloralose

	Dogs ($n = 53$)
Gastrointestinal tract	
Vomiting	5 (9%)
Rodenticide in vomitus	4 (80%)
Salivation	1 (2%)
CNS depression	
Ataxia	33 (62%)
Drowsiness	18 (34%)
Drowsiness/not alert (≤4 hours)	12 (67%)
Drowsiness/not alert (>4 hours)	6 (33%)
Lethargy/sopor	3 (6%)
Stupor/coma	6 (11%)
Respiratory distress	1 (2%)
CNS excitation	
Vocalisation	1 (2%)
Disorientation—restlessness	13 (23%)
Tremors (mild)	23 (43%)
Myoclonic contractions	8 (15%)
Head tilt	1 (2%)
Generalised seizures	8 (15%)
Persistent seizures	1 (2%)
Body temperature[a]	
Hypothermia (≤37.0°C)	7 (13%)
Hyperthermia (≥39.5°C)	5 (9%)
Eye[b]	
Miosis	2 (1%)
Mydriasis	2 (1%)
Nystagmus	1 (7%)
Abnormal eye-related reflexes[c]	3 (21%)
Blindness (temporary)	1 (7%)
Estimated recovery time[d]	
≤12 hours	37 (70%)
12–24 hours	9 (17%
24–48 hours	1 (2%)
48–72 hours	2 (4%)
Unknown	4 (8%)
Survival rate	52/53 (98%)

Abbreviation: CNS, central nervous system.
[a]Measured in 30 dogs. Minimum temperature recorded was 35.5°C and maximum temperature was >40.0°C for 2 hours.
[b]Measured in 14 dogs.
[c]Pupillary light reflexes and/or menace response and dazzle reflex were (temporarily) impaired.
[d]After arrival at the veterinary clinic.

The majority of the cats with clinical signs showed CNS excitation and CNS depression, with both states often alternating (Table 4). Signs of excitation started with tremors at the ears and were most severe at the head. Many veterinarians reported that tactile, auditory and visual stimuli started or worsened the signs of CNS excitation. During CNS excitation, hyperthermia and mydriasis were observed, and during CNS depression, hypothermia and miosis were observed. Vision-related clinical signs were noted in 16 cats, and respiratory distress in four comatose cats (10%).

Biochemical analyses (e.g., glucose, electrolytes, kidney and/or liver function) were performed in 10 cats (five cats in each group), and hypokalaemia was seen in three long-term comatose cats (3.4, 3.5 mmol/L and value unknown). All other parameters were within normal limits.

CNS excitation was treated by keeping the affected cats under close observation in a quiet and dark environment. In 25 cats (61%), additional anticonvulsive treatment was necessary. CNS excitation was treated with benzodiazepines ($n = 22$, 56%), propofol ($n = 5$, 13%), dexmedetomidine with ketamine and xylazine (both $n = 1$, 2.6%). In two cats, intravenous lipid emulsion was administered with limited, transient effects.

After ingestion of α-chloralose-based rodenticide, 53% of the cats recovered within 24 hours, while three cats did not survive the poisoning (Table 4). An 8-week-old kitten (0.6 kg) and a 9-month-old cat (3.0 kg) died within 24 hours of α-chloralose ingestion. A 4-year-old cat (4.5 kg) died 5 days after the initial exposure, probably due to secondary complications. In the group of cats suspected of α-chloralose poisoning, 59% of the cats recovered within 24 hours, and one 9-year-old cat (3 kg) did not survive the intoxication.

DISCUSSION

Rodenticide exposure in dog and cats

In this study, dogs and young adult cats were predominantly exposed to non-spill wax block rodenticides authorised for use by non-professionals. The consumption of α-chloralose-based rodenticides was not confirmed by analysis of body fluids but based on information provided by the owners and veterinarians. This information contradicts the general belief that cats are more picky and less experimental in eating unfamiliar foods than dogs. The non-spill wax block formulation is designed to reduce the risk of primary poisoning in grain-eating birds, because birds are highly susceptible to α-chloralose.[4,8,11] Rodenticides may be very attractive to dogs and cats, as palatable agents are added to some products. Dogs and cats are especially at risk when rodenticides are incorrectly used. In this study, the poison or the rodenticide bags (often ruptured) were present in the vomitus of many dogs and some cats, but no plastics. This suggests that non-professionals tend to use the rodenticide bag without the designated plastic bait box.

With an anaesthetic dose of 40–100 mg/kg bodyweight,[4,12] dogs with a bodyweight less than 8.5–10.0 kg and cats may become fully sedated for 6–10 hours when they ingest one single 10 g rodenticide bag containing 340–400 mg α-chloralose. A partially ingested bag contains enough to poison cats and small dogs because, according to the findings in this study, the first signs of CNS excitation (mild tremors) and ataxia (as a sign of CNS depression) develop in dogs

TABLE 3 Characteristics of cats exposed to α-chloralose-based rodenticide (exposed) and cats with clinical signs suggestive of α-chloralose poisoning (suspected)

	Exposed (*n* = 19)	**Suspected (*n* = 22)**
Age (year)	0.7[a] (0.1–19, *n* = 16)	2.4[a] (0.3–12.0; *n* = 13)
Bodyweight (kg)	3.0 (0.5–4.5, *n* = 19)	3.79 (2.00–5.00; *n* = 15)
Estimated dose (mg/kg)	77.8 (11.4–320.0, *n* = 10)	n.a.

Note: Median and range are given.
Abbreviation: n.a., not applicable.
[a]Significant difference: $p = 0.01$.

TABLE 4 Clinical signs of cats exposed to an α-chloralose-based rodenticide (exposed) and those with signs suggestive of α-chloralose poisoning (suspected)

	Exposed (*n* = 17)	**Suspected (*n* = 22)**
Gastrointestinal tract		
Vomiting	2 (12%)	0 (0%)
Rodenticide in vomitus	2 (100%)	0 (0%)
Salivation	1 (6%)	0 (0%)
CNS depression		
Ataxia	6 (35%)	6 (27%)
Drowsiness	2 (12%)	3 (14%)
Lethargy/sopor	1 (6%)	5 (23%)
Stupor/coma	4 (24%)	12 (55%)
Respiratory distress	0	4 (18%)
CNS excitation		
Vocalisation	0 (0%)	1 (5%)
Disorientation—restless	4 (24%)	1 (5%)
Tremors (mild)	8 (47%)	11 (50%)
Myoclonic contractions	6 (35%)	10 (45%)
Head tilt	1 (6%)	2 (9%)
Generalised seizures	3 (18%)	2 (9%)
Body temperature[a]		
Hypothermia (≤37.5°C)	7 (58%)	13 (72%)
Hyperthermia (≥39.5°C)	1 (8%)	1 (6%)
Eye[b]		
Miosis	1 (25%)	12 (80%)
Mydriasis	2 (50%)	4 (27%)
Abnormal eye-related reflexes[c]	1 (25%)	4 (27%)
Blind (temporary)	0 (0%)	2 (13%)
Estimated recovery time[d]		
≤12 hours	2 (12%)	4 (18%)
2–24 hours	7 (41%)	9 (41%
24–48 hours	5 (29%)	3 (14%)
48–72 hours	0 (0%)	4 (18%)
Unknown	0 (0%)	1 (5%)
Survived	14 (82%)	21 (95%)

Abbreviation: CNS, central nervous system.
[a]Measured in 12 cats exposed to an α-chloralose-based rodenticide and 18 cats with signs suggestive of α-chloralose poisoning. Minimum temperature recorded was <32°C and maximum temperature was >41.0°C for 2 hours.
[b]Measured in four cats exposed to an α-chloralose-based rodenticide and 15 cats with signs suggestive of α-chloralose poisoning.
[c]Pupillary light reflexes and/or menace response and dazzle reflex were (temporarily) impaired.
[d]After arrival at the veterinary clinic.

at an estimated ingested dose of 13 and 27 mg/kg, respectively. Myoclonic contractions were reported at a dose of 26 mg/kg. Annas et al. also reported reduced consciousness and seizures in a dachshund at a dose of 34 mg/kg.[13] A wide range of oral lethal doses are reported for dogs and cats in the literature: 100 mg/kg (LD_{low} cat),[4] 400–600 mg/kg (LD_{50} dogs and cats)[3,4] and even 600–1000 mg/kg (LD_{low} dogs).[4] Comparable

with the present study, dogs with estimated ingestions of 290–363 mg/kg have recovered without sequela.[13] Dogs, and possibly cats, can survive doses up to 300–400 mg/kg and perhaps even higher if the exposure is discovered early on, before hypothermia has progressed, and supportive veterinary treatment is implemented.

In this study, mortality after α-chloralose-based rodenticide ingestion was low in dogs (1%) but high in cats (18%). In a retrospective case series of confirmed α-chloralose poisonings in 33 dogs and 13 cats, mortality was 3% in dogs and 15% in cats.[7] The reason for this difference in mortality between dogs and cats is likely multifactorial. Cats lack or have a limited capacity for conjugation with glucuronic acid, resulting in a slow metabolisation of α-chloralose into glucuronic acid conjugates. This increases the elimination half-life of α-chloralose and potentially prolongs the duration of the poisoning.[14-16] Furthermore, their smaller bodyweight-to-surface ratio makes them more susceptible to developing hypothermia.[7] Many cats live outdoors, away from the watchful eyes of the owner, which could make cats even more susceptible to the consequences of α-chloralose ingestion due to delayed detection of illness. The latter is supported by the many cats with clinical signs suggestive of α-chloralose poisoning that were found hypothermic and comatose outside during this study period. In the study by Segev et al., the animals were exposed to poisoned bait and the estimated ingested dose was unknown.[7] The dogs and cats experienced more severe signs of poisoning, compared with the present study, with almost 40% of the dogs and over 50% of the cats developing seizures. Coma was seen in almost half of the cats, and 90% of the cats were hypothermic. Another difference worth mentioning is the high percentage of dogs with salivation (30.3%).[7] In the present study, no true salvation was noted. Treatment of α-chloralose poisoning is essentially supportive as no antidote is available.[4] Anticonvulsant or sedative medications used to treat CNS excitation may also contribute to the sedation observed in the later stage of the α-chloralose poisoning; therefore, it is advised to administer medication with a short half-life, starting with benzodiazepines and, if this has insufficient effect, propofol (continuous rate infusion).[7]

α-Chloralose suspected poisonings in cats

During this 2.5-year study, a marked increase in suspected cases of α-chloralose poisoning in cats was noted. This suspicion was not confirmed by analysis of body fluids. Many of these cats were found hypothermic and comatose outside, suggesting they were found later in the course of the poisoning. They may have been exposed to poisoned bait or were victims of secondary poisoning. During the same period, an increase in feline and canine cases of suspected α-chloralose poisoning was noted in Norway and Sweden. In both the countries, α-chloralose was detected in patients' blood and urine samples and in the organs of deceased cats, confirming the diagnosis.[15,17]

According to the EU-directive 98/8/EC Assessment Report Alpha-Chloralose, there is no issue of secondary poisoning.[18] On the other hand, mice were found in the digestive system of deceased cats that presented with clinical signs of α-chloralose poisoning prior to death, and α-chloralose was detected in the body fluids and organs of these cats.[15] Although ingestion of one α-chloralose-sedated mouse is probably not enough to induce signs of poisoning, it has been calculated that ingestion of four mice can deliver a dose of 8–50 mg/kg α-chloralose to a 3 kg cat.[15] This dose is enough to induce poisoning and can be potentially fatal if supportive veterinary treatment is not administered on time.[15] Cats are particularly prone to being victims of secondary poisoning by easy-to-catch α-chloralose-sedated or killed rodents. It also raises concerns about the secondary poisoning of other predators such as birds of prey, as birds are considered more susceptible to α-chloralose poisoning.[4,11]

In the Netherlands, the number of α-chloralose poisonings reported to the DPIC decreased in 2020. This could be caused by the removal of rodenticide refill sachets for non-professional use from the Dutch market and/or veterinarians having become more familiar with α-chloralose poisoning and subsequently contacting the DPIC less frequently. In Sweden and Norway, in response to the increasing numbers of α-chloralose poisonings and the risk of secondary poisoning, the Swedish (Swedish Chemicals Agency, Kemi) and Norwegian (Norwegian Environment Agency) bodies of biocidal authorisation prohibited, in December 2019 and spring 2020, respectively, the sale of rodenticide products containing α-chloralose to non-professionals. They also took further risk mitigation measures, for example, the product label must state that the product should not be used in environments in which cats may be expected to be present and dead mice are to be collected.[19,20]

CONCLUSION

This prospective surveillance study revealed that α-chloralose poisoning of dogs and cats increased in the Netherlands after changes in EU legislation. Dogs and cats are typically exposed to rodenticides via a non-spill wax formulation registered for use by the general public, but cats are also presented at the veterinary clinics with clinical signs suggestive of α-chloralose poisoning without witnessed ingestions. From this study, we conclude that the prognosis of α-chloralose poisoned dogs is good with early discovery and supportive veterinary care. The patients usually recover without any sequelae. However, the overall mortality in cats was 10% (4/41), suggesting that the consequences of α-chloralose poisoning are more severe for cats. If similar criteria are applied in the approval of α-chloralose-based rodenticides as compared to anticoagulant-based rodenticides, it should be

concluded that these products are also not suitable for non-professional use.

AUTHOR CONTRIBUTIONS

Marieke A. Dijkman performed the data collection, analysis and was the lead manuscript author. All co-authors had equal input and contribution in the process of analysing the data and writing the manuscript.

CONFLICT OF INTEREST

The authors declare they have no conflicts of interest.

FUNDING INFORMATION

The authors received no specific funding for this work.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on reasonable request from the corresponding author.

ETHICS STATEMENT

This surveillance study was retrospective and observational, and no study-related intervention was imposed upon the animals. Therefore, ethical approval was deemed unnecessary.

REFERENCES

1. Board for the Authorisation of Plant Protection Products and Biocides. News items (Ctgb) IPM-system. Available from: https://www.ctgb.nl/actueel/nieuws/2018/10/02/middelen-tegen-ratten-en-muizen-alleen-binnen-ipm-systeem. Accessed July 2021.
2. European Biocidal Products Forum (EBPF). Sustainable use of rodenticides as biocides in the EU. Cefic—The European Chemical Industry Council, Brussel. Available from: https://specialty-chemicals.eu/biocides-for-europe/. Accessed Jan 2022.
3. Balis GU, Monroe RR. The pharmacology of chloralose. A review. Psychopharmacologia. 1964;6(1):1–30.
4. Lees P. Pharmacology and toxicology of alpha chloralose: a review. Vet Rec. 1972;91(14):330–3.
5. Thomas HM, Simpson D, Prescott LF. The toxic effects of alpha-chloralose. Hum Toxicol. 1988;7(3):285–7
6. Kintz P, Jamey C, Mangin P. Trichloroethanol is not a metabolite of alpha chloralose. Int J Legal Med. 1996;108(4):191–3.
7. Segev G, Einat YN, Shlosberg A, Aroch I. Alpha-chloralose poisoning in dogs and cats: a retrospective study of 33 canine and 13 feline confirmed cases. Vet J. 2006;172(1):109–13.
8. Grau-Roma L, Stephens A, Wessmann A, Carmichael N, de Brot S. α-Chloralose poisoning in a cat. Vet Rec Case Rep. 2016;4:e000313.
9. Savin S, Cartigny B, Azaroual N, Humbert L, Imbenotte M, Tsouria D, et al. 1H NMR spectroscopy and GC-MS analysis of alpha-chloralose. Application to two poisoning cases. J Anal Toxicol. 2003;27(3):156–61.
10. Board for the Authorisation of Plant Protection Products and Biocides. Authorisations (Ctgb). Available from: https://toelatingen.ctgb.nl/nl/authorisations. Accessed July 2021.
11. Loibl MF, Clutton RE, Marx BD, McGrath CJ. Alpha-chloralose as a capture and restraint agent of birds: therapeutic index determination in the chicken. J Wildl Dis. 1988;24(4):684–7.
12. Holzgrefe HH, Everitt JM, Wright EM. Alpha-chloralose as a canine anesthetic. Review Lab Anim Sci. 1987;37(5):587–95.
13. Annas A, Norrvik F, Johansson LM. Alphachloralose poisoning in dogs: a case series. Clin Tox. 2017;55(5):411.
14. Court MH. Feline drug metabolism and disposition: pharmacokinetic evidence for species differences and molecular mechanisms. Vet Clin North Am Small Anim Pract. 2013;43(5):1039–54.
15. Norwegian Veterinary Institute. Alpha-chloralose poisoning in cats and dogs in Norway—a project. Report 16b-2020. Available from: https://www.vetinst.no/rapporter-og-publikasjoner/rapporter/2020/alpha-chloralose-poisoning-in-cats-and-dogs-in-norway-a-project. Accessed July 2021.
16. Lautz LS, Jeddi MZ, Girolami F, Nebbia C, Dorne JLCM. Metabolism and pharmacokinetics of pharmaceuticals in cats (*Felix sylvestris* catus) and implications for the risk assessment of feed additives and contaminants. Toxicol Lett. 2021;338:114–27.
17. Windahl U, Lundgren S, Sprycha M, Tegner C, Dreimanis K, Tevell Åberg A. Development and validation of a quantitative UHPLC-MS/MS method for the determination of alpha-chloralose in feline blood and application on blood samples collected from cats with symptoms of alpha-chloralose poisoning. J Anal Toxicol. 2022;46:651–7.
18. Directive 98/8/EC concerning the placing biocidal products on the market. Assessment report. Alphachloralose: product-type 14 (rodenticide). 2008. Available from: https://circabc.europa.eu/sd/a/0a566792-98a3-4b34-8c6f-62bb51d23af8/Alphachloralose_final%20AR.pdf. Accessed July 2021.
19. Lodi SAS. European Chemicals Agency (ECHA) Europa. Amendment to the authorization of alphachloralose grain. No. 2019-0181. 2020. Available from: https://echa.europa.eu/documents/10162/0315f1cd-d6b1-bc2f-d852-dc804be41055. Accessed July 2021.
20. Swedish Chemical Agency. 2019. Available from: https://www.kemi.se/arkiv/nyhetsarkiv/nyheter/2019-12-18-anvandningsvillkoren-skarps-for-musmedel-med-alfakloralos. Accessed Dec 2021.

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