WILK, Joanna, KUBICKA, Magdalena, DĘBIEC, Paweł, SZYDŁOWSKI, Przemysław, MAKAREWICZ, Magdalena, PORZAK, Mikołaj and SZYŁKAJTIS, Natalia. Toxic substances in the household - cases of poisoning, therapy, complications. Journal of Education, Health and Sport. 2023;44(1):104-115. eISSN 2391-8306. http://dx.doi.org/10.12775/JEHS.2023.44.01.007
https://apcz.umk.pl/JEHS/article/view/45112
https://zenodo.org/record/8246040

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 17.07.2023 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences). Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 17.07.2023 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 16.07.2023. Revised:10.08.2023. Accepted: 14.08.2023. Published: 18.08.2023.

Toxic substances in the household - cases of poisoning, therapy, complications

Joanna Wilk[1], Magdalena Kubicka[2], Paweł Dębiec[3], Przemysław Szydłowski[4], Magdalena Makarewicz[5], Mikołaj Porzak[6], Natalia Szyłkajtis[7]

[1]Wojewódzki Szpital Specjalistyczny im. Stefana Kardynała Wyszyńskiego w Lublinie
[2]Wojewódzki Szpital Specjalistyczny im. Stefana Kardynała Wyszyńskiego w Lublinie
[3]Samodzielny Publiczny Zakład Opieki Zdrowotnej MSWiA w Lublinie
[4]Samodzielny Publiczny Zakład Opieki Zdrowotnej MSWiA w Lublinie
[5]Samodzielny Publiczny Szpital Kliniczny Nr 4 w Lublinie
[6]Wojewódzki Szpital Specjalistyczny im. Stefana Kardynała Wyszyńskiego w Lublinie
[7]Samodzielny Publiczny Zakład Opieki Zdrowotnej MSWiA w Lublinie

Corresponding author: Joanna Wilk
Email: wilk.joanna95@gmail.com
ORCID:0000-0001-7425-2006

Magdalena Kubicka

Email: magdalenakubickaa@wp.pl
ORCID: 0000-0002-1645-8943

Paweł Dębiec

Email: paweldebiec97@gmail.com
ORCID: 0000-0002-1184-5354

Przemysław Szydłowski

Email: przemo665037@gmail.com
ORCID: 0009-0004-4726-8933

Magdalena Makarewicz

Email: m.makarewicz.97@gmail.com
ORCID: 0000-0003-0485-8998

Mikołaj Porzak

Email: mikolaj.porzak@gmail.com
ORCID: 0000-0003-0548-1950

Natalia Szyłkajtis

Email: natalia.szylkajtis@gmail.com
ORCID: 0009-0000-6220-7187

ABSTRACT

There are many toxic substances used in our houses. Rodent poisons are not the most common group of substances, but cases of poisoning still occur. Long-acting anticoagulant rodenticides, also called superwarfarins, are known for their greater potency, longer half-life and delayed onset of symptoms. Cases of superwarfarin poisoning can pose a diagnostic and clinical challenge due to a wide array of presentations and prolonged severe coagulopathy requiring months of high-dose oral vitamin K therapy. The most common presentation of long-acting anticoagulant rodenticide poisoning is mucocutaneous bleeding, with other common presentations including haematuria, gingival bleeding, epistaxis and gastrointestinal bleeding.We discuss a case of self-poisoning with long-acting anticoagulant rodenticides with a little presentation of sympthoms and disscus about another cases based on the found articles.

KEYS WORDS: 'rodenticides poisoning', 'rodenticides toxicity'.

INTRODUCTION: A group of substances used in rodent control are anticoagulant rodenticides. In Poland, rodenticides of the second generation are used, as well as rodenticides containing warfarin. The most commonly used include:

- 0.5% warfarin sodium (Toxanox Plus),
- 0.75% warfarin sodium (Bros Professional liquid),
- brodifacoum (Rat Killer Kostka, Rat Killer Pasta, Rattox BB, Bros profesional cube, paste),

- difenacoum (Murin Dife sachets, Nocurat paste, sachets),
- bromandiolone (Rat Killer Super, Bros granules, cube, paste, grain),
- coumatetralyl (Racumin paste)
- chlorphacinone (Ratron GR).

Rodenticides are typically targeted at domestic rodents, i.e. rats, mice. Controlling the number of rodents is necessary as they are vectors for the spread of diseases as well as crop or grain damage.Acute poisoning with anticoagulant rodenticides is mostly related to accidental poisoning of domestic animals, although there have also been cases of conscious and intentional administration of rodenticides to animals. To minimize the risk of accidental poisoning of children and adults, bitter-tasting substances are added to most of the preparations. This article is about the case of a patient admitted to the Department of Toxicology and Cardiology after poisoing of rodenticides and ethanol, including a description of symptoms, management and treatment results, as well as information on other rodenticide poisonings selected from other scientific publications.

THE PURPOSE OF THE REASERCH WORK: The purpose of the research work was to describe a case of rodenticide poisoning, treatment procedures and the results of therapy useful in medical practice.

MATERIALS AND METHODS: The case of a patient admitted to the Toxicology and Cardiology Department of the WSS in Lublin and scientific publications in the Pubmed database were used to write the article. The base was searched on July 13, 2023. using phrases: 'rodenticides poisoning', 'rodenticides toxicity'. After reading the titles of the found articles, 21 items were selected to prepare the article.

A CASE REPORT

A 49-year-old man was hospitalized in the Department of Toxicology and Cardiology due to ingestion of rat poison containing bromadiolone and an additional three-day alcohol course. The patient reported that the rat poison was stored in a soft drink bottle and he had ingested a small amount by mistake under the influence of alcohol. The patient

experienced redness of the face, throat, narrow pupils without reaction to light. and speech impediments. The blood pressure on the day of admission was 158/100 mmHg, the heart rate was 100 beats per minute. Laboratory tests showed elevated D-dimers (636ng/ml), no abnormalities in prothrombin time (PT), activated partial thromboplastin time (APTT) and international normalized ratio (INR), no evidence of liver damage. In the following days, the diagnostics was extended and a radiological examination of the chest was performed, where no possible pathology was noticed. The patient's blood pressure was elevated, reaching a value of up to 164/100mmHg. Toxicological diagnostics were performed, but no signs of poisoning were found in standard toxicological tests. The patient complained only of sore throat, nausea and vomiting.

Phytomenadione, Kalium Chloratum, Lignocainum, Magnesium, IPP were used in the treatment. The patient's symptoms subsided over time and there were no other signs of organ damage. The patient's case shows that there are still accidental poisonings with anti-rodent substances. The patient experienced only local irritation of the throat with the substance, which subsided after a few days of treatment. Fortunately, the toxicological impact of the substance was insignificant.

In the found articles, the authors discuss the substances, symptoms and procedures in poisoning with rodenticides in more detail. The most common patients with poisoning are children after oral ingestion and adults with the intention of committing suicide. Typical symptoms include hematuria, haemoptysis, nosebleeds, abdominal pain, easy bruising or petechiae. The most important thing is to identify the substance ingested. Toxicity is classified by the amount of poison needed to cause death in 50% of those exposed, known as lethal dose 50 or LD50.

The management consists in maintaining airway patency and maintaining cardiorespiratory capacity. According to the American Academy of Toxicology, gastric lavage and activated charcoal are not indicated for acute poisoning. There are limited data showing a decrease in morbidity and mortality. In acute gastrointestinal disorders, the use of antiemetics and hydration to correct electrolyte disturbances may be beneficial.

The prognosis depends on the specific rodenticide ingested as well as the amount. In general, a better prognosis is associated with early treatment.

Based on Carol D'Silva and Bhuvan Krishna's article on rodenticide poisoning, we note that the most common route of poisoning is ingestion of the toxic substance. Accidental poisonings are observed in children. Rarely a toxic substance can be poisoned by inhalation or contact with the skin and mucous membranes. Symptoms of poisoning may develop within 48-72 hours.

Yellow or white phosphorus, which smells like garlic, is used in rodenticides, fertilizers, as well as in fireworks and ammunition. These preparations are often available in the form of pastes containing 2-5% of yellow phosphorus, which is why yellow phosphorus poisoning is common in the pediatric age group, because the paste is mistaken for toothpaste.

Yellow phosphorus is a toxin that affects the digestive, cardiovascular and urinary systems. It leads to fatty liver and damage kidneys and brain. The lethal dose is about 1mg/kg, and fulminant poisoning occurs at doses exceeding 1-2g.

We don't know antidote for yellow phosphorus poisoning. Gastric lavage with a 1:1000 solution of potassium permanganate is intended to delay further absorption as it oxidizes phosphorus to less toxic phosphoric acid and phosphates. Gastric lavage can also be performed with saline. However, gastric lavage in case of phosphide poisoning may accelerate the breakdown of the pesticide and increase toxicity.

In laboratory examinations, we see prolonged prothrombin time (PT) and international normalized ratio (INR) usually appearing 48 hours after exposure and may persist for several days, depending on the compound ingested. Factors II, V, VII, IX, X can be measured to help make a diagnosis. These results only indicate the possibility of poisoning. Delay in diagnosis is common, especially in cases of unintentional consumption.

The use of N-acetylcysteine may favorably improve the prognosis of a patient with acute

liver failure in case of rodenticide poisoning, but further research is needed.

Treatment is mainly supportive, due to the tendency to multiple organ failure and the associated high mortality, patients are usually treated in an intensive care unit. Treatment includes mechanical ventilation, use of vasoactive drugs, maintenance of organ function, and correction of dyselectrolyteemia and hypoglycemia, if indicated.

In article, Wai Yan Na and Chor Kwan Ching present the results of research of rodenticide poisoning in Hong Kong. In the research period from 2010 to 2014, the laboratory received 76 requests to perform anticoagulant tests of rodenticides. Forty-one cases tested positive and were included in the study. Superwarfarin was the most common group of anticoagulant-type rodenticides. Bromadiolone was the most common superwarfarin, followed by brodifacoum.

A history of exposure was present for 31 patients, one pediatric patient had accidental rodenticide exposure, all others were adult patients with intentional rodenticide ingestion. Regarding the types of use of rodendicides, 28 patients took solid rat poison. All patients with a known history of exposure presented within 48 hours of rodenticide exposure and none presented with coagulopathies. During hospital stay, 20 patients (64.5%) remained asymptomatic with normal INR (PSS grade 0). The remaining 11 patients (35.5%) developed coagulopathy without clinical bleeding. Five persons had grade 1 PSS with an INR >1.5 and ≤ 2.5 and the remaining six had Grade 2 PSS with a median INR of 5.52. All patients with no history of exposure experienced bleeding including mucosal bleeding (e.g. epistaxis, oral bleeding, hematuria and gastrointestinal bleeding), petechiae, hematomas and peritoneal haemorrhage. All had significantly elevated INR above the upper reporting limit (>6.0) and were therefore classified as PSS Grade 3 poisoning.
Coagulopathy-related mortality was not reported in this study. The diagnosis of poisoning with anticoagulant rodenticides was made in all patients with a known history of exposure at the first visit. However, in the group of patients with no history of exposure at the first consultation, 60% of them were not diagnosed with coexisting coagulopathy as the cause of bleeding events. Three of these were diagnosed as minor bleeds (such as nosebleeds, gingival bleeding, and hematuria) and were discharged to the emergency department. The diagnosis was made only after re-admission with more severe bleeding.

For the remaining three patients, their initial symptoms were classified as surgical or orthopedic complaints, including abdominal pain, black vomit, and swelling of the extremities. They were subsequently diagnosed with peritoneal hematoma, gastrointestinal bleeding associated with coagulopathy, and limb hematoma, respectively. Vitamin K1 therapy was used to treat poisoning in patients with bleeding (PSS grade 3 or higher) and prophylactically in all patients with coagulopathy without clinical bleeding.
In conclusion, the authors point out that superwarfarin poisoning is a potentially life-threatening but under-diagnosed condition, leading to delayed treatment and initiation of treatment. Clinicians should be alert to these rare poisonings in patients with unexplained coagulopathy.

RESULTS AND DISCUSSION

Rodenticide poisoning can be differentiated from other diseases on the basis of coagulation test values and rebound coagulopathy. Such poisoning requires treatment with high doses of vitamin K, since the half-life of anticoagulant rodenticides is 10 to 70 days, which is 10-50 times longer than the half-life of warfarin. The dosage of phytomenadione, i.e. vitamin K, depends on the value of the coagulation test (PT/INR) and bleeding resistant to treatment. Psychiatric evaluation is recommended for patients with intentional exposure to prevent re-use. In this patient, abstinence from alcohol, drug addiction treatment, and pharmacological treatment: phytomenadione and ramipril are recommended due to elevated blood pressure in the patient.

CONCLUSIONS

Rodenticide poisoning is a major health problem with a high mortality rate. The easy availability in stationary or online stores and the lack of antidotes to rodenticides are a serious problem. The presented case of a patient consuming alcohol and taking a rodenticide by mistake shows how low social awareness is in terms of mortality. Close monitoring of the sale and use of rodenticides could help avoid poisoning.

Rodenticide poisoning can be difficult to identify due to long half-life, delayed onset of symptoms, different routes of exposure (oral, inhalation, transdermal) and unawareness of intentional exposure. A patient with suspected rodenticide-related disorders should be

treated in an interdisciplinary manner, and making a proper diagnosis requires the cooperation of a toxicologist, psychologist, psychiatrist and hematologist.

Wkład autorski

Konceptualizacja: Joanna Wilk; metodologia: Magdalena Kubicka, Paweł Dębiec, pisanie – recenzja i redakcja: Przemysław Szydłowski, Mikołaj Porzak, Magdalena Makarewicz,Natalia Szyłkajtis; zasoby: Paweł Dębiec, Mikołaj Porzak, nadzor: Magdalena Kubicka, Joanna Wilk. Wszyscy autorzy przeczytali i zgodzili się z opublikowaną
wersją manuskryptu.

Oświadczenie o finansowaniu.
Artykuł nie otrzymał dofinansowania.

Oświadczenie instytucjonalnej komisji rewizyjnej.
Nie dotyczy.

Oświadczenie o świadomej zgodzie.
Nie dotyczy.

Oświadczenie o dostępności danych.
Nie dotyczy.

Oświadczenie o konflikcie interesow.
Artykuł nie stanowi konfliktu interesow.

REFERENCES:

1. B.Isackson; L.Irizarry, Rodenticide Toxicity, StatPearls Publishing; 2022 January
2. C. D'Silva, B. Krishna, Rodenticide Poisoning, Indian J Crit Care Med. 2019 December, S272–S277.
3. D.Reimer, M.Smith, S.Ali, Deliberate self-poisoning with long-acting anticoagulant rodenticides, BMJ Case Rep. 2017-222170

4. Wai Yan Ng, Chor Kwan Ching, Yeow Kuan Chong, Retrospective Study of the Characteristics of Anticoagulant-Type Rodenticide Poisoning in Hong Kong, J Med Toxicol, 2018 September; 14(3): 218–228.

5. Mishima E, Ito J, Wu Z, Nakamura T, Wahida A, Doll S, Tonnus W, Nepachalovich P, Eggenhofer E, Aldrovandi M, Henkelmann B, Yamada KI, Wanninger J, Zilka O, Sato E, Feederle R, Hass D, Maida A, Mourão ASD, Linkermann A, Geissler EK, Nakagawa K, Abe T, Fedorova M, Proneth B, Pratt DA, Conrad M. A non-canonical vitamin K cycle is a potent ferroptosis suppressor. Nature. 2022 Aug;608(7924):778-783. doi: 10.1038/s41586-022-05022-3. Epub 2022 Aug 3. PMID: 35922516; PMCID: PMC9402432.

6. Roberts JR, Karr CJ; Council On Environmental Health. Pesticide exposure in children. Pediatrics. 2012 Dec;130(6):e1765-88. doi: 10.1542/peds.2012-2758. Epub 2012 Nov 26. Erratum in: Pediatrics. 2013 May;131(5):1013-4. PMID: 23184105; PMCID: PMC5813803.

7. Parsons BJ, Day LM, Ozanne-Smith J, Dobbin M. Rodenticide poisoning among children. Aust N Z J Public Health. 1996 Oct;20(5):488-92. doi: 10.1111/j.1467-842x.1996.tb01627.x. PMID: 8987218.

8. Nakayama SMM, Morita A, Ikenaka Y, Mizukawa H, Ishizuka M. A review: poisoning by anticoagulant rodenticides in non-target animals globally. J Vet Med Sci. 2019 Feb 28;81(2):298-313. doi: 10.1292/jvms.17-0717. Epub 2018 Dec 27. PMID: 30587672; PMCID: PMC6395208.

9. Bentley EW. A review of anticoagulant rodenticides in current use. Bull World Health Organ. 1972;47(3):275-80. PMID: 4568146; PMCID: PMC2480728.

10. Murray MH, Sánchez CA. Urban rat exposure to anticoagulant rodenticides and zoonotic infection risk. Biol Lett. 2021 Aug;17(8):20210311. doi: 10.1098/rsbl.2021.0311. Epub 2021 Aug 11. PMID: 34376077; PMCID: PMC8355682.

11. Lin WL, Chen KH, Liao CP, Tseng HY. Short-term exposure of anticoagulant rodenticides leads to the toxin accumulation from prey (Rattus losea) to predator

(Elanus caeruleus). Ecotoxicol Environ Saf. 2022 Mar 15;233:113361. doi: 10.1016/j.ecoenv.2022.113361. Epub 2022 Feb 28. PMID: 35240503.

12. Gabriel MW, Woods LW, Poppenga R, Sweitzer RA, Thompson C, Matthews SM, Higley JM, Keller SM, Purcell K, Barrett RH, Wengert GM, Sacks BN, Clifford DL. Anticoagulant rodenticides on our public and community lands: spatial distribution of exposure and poisoning of a rare forest carnivore. PLoS One. 2012;7(7):e40163. doi: 10.1371/journal.pone.0040163. Epub 2012 Jul 13. PMID: 22808110; PMCID: PMC3396649.

13. Chong YK, Mak TW. Superwarfarin (Long-Acting Anticoagulant Rodenticides) Poisoning: from Pathophysiology to Laboratory-Guided Clinical Management. Clin Biochem Rev. 2019 Nov;40(4):175-185. doi: 10.33176/AACB-19-00029. PMID: 31857739; PMCID: PMC6892705.

14. Freixo A, Lopes L, Carvalho M, Araújo F. Intoxicação por Supervarfarina [Superwarfarine Poisoning]. Acta Med Port. 2015 May-Jun;28(3):389-92. Portuguese. Epub 2015 Jun 30. PMID: 26421794.

15. Long J, Peng X, Luo Y, Sun Y, Lin G, Wang Y, Qiu Z. Treatment of a long-acting anticoagulant rodenticide poisoning cohort with vitamin K1 during the maintenance period. Medicine (Baltimore). 2016 Dec;95(51):e5461. doi: 10.1097/MD.0000000000005461. PMID: 28002326; PMCID: PMC5181810.

16. Wardrop D, Keeling D. The story of the discovery of heparin and warfarin. Br J Haematol. 2008 Jun;141(6):757-63. doi: 10.1111/j.1365-2141.2008.07119.x. Epub 2008 Mar 18. PMID: 18355382.

17. Huić M, Francetić I, Bakran I, Macolić-Sarinić V, Bilusić M. Acquired coagulopathy due to anticoagulant rodenticide poisoning. Croat Med J. 2002 Oct;43(5):615-7. PMID: 12402407.

18. Bahouth MN, Kraus P, Dane K, Plazas Montana M, Tsao W, Tabaac B, Jasem J, Schmidlin H, Einstein E, Streiff MB, Shanbhag S. Synthetic cannabinoid-associated coagulopathy secondary to long-acting anticoagulant rodenticides: Observational case series and management recommendations. Medicine

(Baltimore). 2019 Sep;98(36):e17015. doi: 10.1097/MD.0000000000017015. PMID: 31490385; PMCID: PMC6739027.

19. Lu A, Yuan F, Yao Y, Wen W, Lu H, Wu S, Wang L. Reversible leukoencephalopathy caused by 2 rodenticides bromadiolone and fluoroacetamide: A case report and literature review. Medicine (Baltimore). 2021 Mar 5;100(9):e25053. doi: 10.1097/MD.0000000000025053. Erratum in: Medicine (Baltimore). 2021 Jul 16;100(28):e26668. PMID: 33655984; PMCID: PMC7939157.

20. Card DJ, Francis S, Deuchande K, Harrington DJ. Superwarfarin poisoning and its management. BMJ Case Rep. 2014 Oct 13;2014:bcr2014206360. doi: 10.1136/bcr-2014-206360. PMID: 25312896; PMCID: PMC4195219.

21. Piatkov I, Rochester C, Jones T, Boyages S. Warfarin toxicity and individual variability-clinical case. Toxins (Basel). 2010 Nov;2(11):2584-92. doi: 10.3390/toxins2112584. Epub 2010 Oct 28. PMID: 22069565; PMCID: PMC3153177