



Complete Summary

GUIDELINE TITLE

Long-acting anticoagulant rodenticide poisoning: an evidence-based consensus guideline for out-of-hospital management.

BIBLIOGRAPHIC SOURCE(S)

Caravati EM, Erdman AR, Scharman EJ, Woolf AD, Chyka PA, Cobaugh DJ, Wax PM, Manoguerra AS, Christianson G, Nelson LS, Olson KR, Booze LL, Troutman WG. Long-acting anticoagulant rodenticide poisoning: an evidence-based consensus guideline for out-of-hospital management. Clin Toxicol (Phila) 2007;45(1):1-22. [PubMed](#)

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

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SCOPE

DISEASE/CONDITION(S)

Long-acting anticoagulant rodenticide (LAARs) poisoning

Note: This guideline applies to exposure to LAARs alone. Exposure to additional substances could require different referral and management recommendations depending on the individual or combined toxicities of the substances.

GUIDELINE CATEGORY

Evaluation
Management
Risk Assessment

CLINICAL SPECIALTY

Emergency Medicine
Family Practice
Internal Medicine
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Emergency Medical Technicians/Paramedics
Nurses
Pharmacists
Physicians

GUIDELINE OBJECTIVE(S)

To assist U.S. poison center personnel in the appropriate out-of-hospital triage and initial management of patients with a suspected exposure to long-acting anticoagulant rodenticides (LAARs) by:

- Describing the process by which an exposure to LAAR might be evaluated
- Identifying the key decision elements in managing cases of LAAR exposure
- Providing clear and practical recommendations that reflect the current state of knowledge
- Identifying needs for research

TARGET POPULATION

Adults and children with suspected exposures to long-acting anticoagulant rodenticides (LAARs)

INTERVENTIONS AND PRACTICES CONSIDERED

Evaluation

1. Assessment of key decision points for triage:
 - Patient intent
 - Route of exposure and estimated dose
 - Time since exposure and symptoms
 - Pattern of ingestion (acute or chronic)
 - Assessment of symptoms (bleeding, bruising)

Management

1. Referral to an emergency department

2. Measurement of prothrombin time (in patients taking anticoagulants therapeutically)
3. Evaluation by obstetrician or primary care provider of pregnant patients with unintentional ingestion of <1 mg long-acting anticoagulant rodenticides (LAARs)
4. Evaluation for coagulopathy at 48-72 hours after exposure
5. Routine cleansing with mild soap and water for dermal exposures
6. Home observation

Note: Gastrointestinal decontamination in the out-of-hospital setting with ipecac syrup, delay in transportation to an emergency department for administration of activated charcoal and administration of vitamin K were considered but not recommended.

MAJOR OUTCOMES CONSIDERED

- Signs and symptoms of toxicity
- Dose required for the development of toxicity

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Literature Search

The National Library of Medicine's PubMed database was searched (through 2004) using "brodifacoum or difenacoum or bromadiolone or chlorophacinone or diphacinone or pindone or valone or coumatetralyl or superwarfarin or rodenticide*" as textwords (title, abstract, Medical Subject Heading [MeSH] term, CAS registry), limited to humans. The CAS registry numbers for these compounds were also used as search terms. This same process was repeated in International Pharmaceutical Abstracts (1970 to 2004, excluding abstracts of meeting presentations), Science Citation Index (1977 to 2004), Database of Abstracts of Reviews of Effects (accessed December 2004), Cochrane Database of Systematic Reviews (accessed December 2004), and Cochrane Central Register of Controlled Trials (accessed December 2004). Reactions (1980 to 2004), the "Anticoagulants-long acting" poisoning management in Poisindex and the bibliographies of recovered articles were reviewed to identify previously undiscovered articles. Furthermore, North American Congress of Clinical Toxicology abstracts published in the Journal of Toxicology-Clinical Toxicology (1995 to 2004) were reviewed for original human data.

The chapter bibliographies in four major toxicology textbooks were reviewed for citations of additional articles with original human data. The Toxic Exposure Surveillance System database maintained by the American Association of Poison

Control Centers, was searched for deaths resulting from unintentional long-acting anticoagulant rodenticides (LAAR) poisoning or any deaths from LAAR poisoning in children.

Article Selection

The recovered citations were entered into an EndNote library and duplicate entries were eliminated. The abstracts of these articles were reviewed, looking specifically for those that dealt with estimations of exposure doses with or without subsequent signs or symptoms, time of onset of symptoms, and management techniques that might be suitable for out-of-hospital use (e.g., gastrointestinal decontamination). Articles were excluded that did not meet the preceding criteria, did not add new data (e.g., some reviews, editorials), or that exclusively described inpatient-only procedures (e.g., dialysis).

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Levels of Evidence

Level of Evidence	Description of Study Design
1a	Systematic review (with homogeneity) of randomized clinical trials
1b	Individual randomized clinical trials (with narrow confidence interval)
1c	All or none (all patients died before the drug became available, but some now survive on it; or when some patients died before the drug became available, but none now die on it.)
2a	Systematic review (with homogeneity) of cohort studies
2b	Individual cohort study (including low quality randomized clinical trial)
2c	"Outcomes" research
3a	Systemic review (with homogeneity) of case-control studies
3b	Individual case-control study
4	Case series, single case reports (and poor quality cohort and case control studies)
5	Expert opinion without explicit critical appraisal or based on physiology or bench research
6	Abstracts

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Data Extraction

All articles that were retrieved from the search were reviewed by a single abstractor. Each article was examined for original human data regarding the toxic effects of long-acting anticoagulant rodenticides (LAARs) or original human data directly relevant to the out-of-hospital management of patients with LAAR toxicity or overdose. Relevant data (e.g., dose, resultant effects, time of onset of effects, therapeutic interventions or decontamination measures given, efficacy or results of any interventions, and overall patient outcome) were compiled into a table and a brief summary description of each article was written. This full evidence table is available at

<http://www.aapcc.org/DiscGuidelines/LAAR%20evidence%20table.pdf>. The completed table of all abstracted articles was then forwarded to the panel members for review and consideration in developing the guideline. Every attempt was made to locate significant foreign language articles and have their crucial information extracted, translated, and tabulated. Copies of all of the articles were made available for reading by the panel members on a secure American Association of Poison Control Centers (AAPCC) website.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

An expert consensus panel was established to develop the guideline (see Appendix 1 in the original guideline document). The American Association of Poison Control Centers (AAPCC), the American Academy of Clinical Toxicology (AACT), and the American College of Medical Toxicology (ACMT) appointed members of their organizations to serve as panel members. To serve on the expert consensus panel, an individual had to have an exceptional record in clinical care and scientific research in toxicology, board certification as a clinical or medical toxicologist, significant U.S. poison center experience, and be an opinion leader with broad esteem. Two specialists in poison information were included as full panel members to provide the viewpoint of the end-users of the guideline.

Guideline Writing and Review

A guideline draft was prepared by the lead author. The draft was submitted to the expert consensus panel for comment. Using a modified Delphi process, comments from the expert consensus panel members were collected, copied into a table of comments, and submitted to the lead author for response. The lead author responded to each comment in the table and, when appropriate, the guideline draft was modified to incorporate changes suggested by the panel. The revised guideline draft was again reviewed by the panel and, if there was no strong objection by any panelist to any of the changes made by the lead author, the draft was prepared for the external review process.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

The rating scheme for the strength of the recommendation (A-D, Z) is directly tied to the level of evidence supporting the recommendation.

Grade of Recommendation	Level of Evidence
A	1a
	1b
	1c
B	2a
	2b
	2c
	3a
	3b
C	4
D	5
Z	6

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

External review of the second draft was conducted by distributing it electronically to American Association of Poison Control Centers (AAPCC), American Academy of Clinical Toxicology (AACT), and American College of Medical Toxicology (ACMT) members and the secondary review panel. The secondary review panel consisted of representatives from the federal government, public health, emergency services, pediatrics, pharmacy practice, and consumer organizations (see Appendix 3 in the original guideline document). Comments were submitted via a discussion thread on the AAPCC web site or privately through email communication to AAPCC staff. All submitted comments were stripped of any information that would identify their sources, copied into a table of comments, and reviewed by the expert consensus panel and the lead author. The lead author responded to each comment in the table and his responses and subsequent changes in the guideline were reviewed and accepted by the panel. Following a meeting of the expert consensus panel, the final revision of the guideline was prepared.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Definitions for the weight of the evidence (A-D, Z) and classes of recommendations (1a-6) can be found at the end of the "Major Recommendations" field.

1. Patients with exposure due to suspected self-harm, abuse, misuse, or potentially malicious administration should be referred to an emergency department immediately regardless of the doses reported **(Grade D)**.
2. Patients with symptoms of long-acting anticoagulant rodenticide (LAAR) poisoning (e.g., bleeding, bruising) should be referred immediately to an emergency department for evaluation regardless of the reported doses **(Grade C)**.
3. Patients with chronic ingestion of LAAR should be referred immediately to an emergency department for evaluation of intent and potential coagulopathy **(Grade B)**.
4. Patients taking anticoagulants therapeutically and who ingest any dose of a LAAR should have a baseline prothrombin time measured and then again at 48 to 72 hours after ingestion **(Grade D)**.
5. Patients with unintentional ingestion of less than 1 mg of LAAR active ingredient can be safely observed at home without laboratory monitoring. This includes practically all unintentional ingestions in children less than 6 years of age **(Grade C)**.
6. Pregnant patients with unintentional exposure to less than 1 mg of LAAR active ingredient should be evaluated by their obstetrician or primary care provider as an outpatient. Immediate referral to an emergency department or clinic is not required.
7. Patients with unintentional ingestion of 1 mg or more of active ingredient and are asymptomatic should be evaluated for coagulopathy at 48–72 hours after exposure **(Grade B)**.
8. Physicians' offices or outpatient clinics must be able to obtain coagulation study results in a timely manner, preferably in less than 24 hours, for patients who require outpatient monitoring **(Grade D)**.
9. Gastrointestinal decontamination with ipecac syrup is not recommended **(Grade D)**.
10. Transportation to an emergency department should not be delayed for administration of activated charcoal **(Grade D)**.
11. Patients with dermal exposures should be decontaminated by washing the skin with mild soap and water **(Grade D)**.
12. The administration of vitamin K is not recommended prior to evaluation for coagulopathy **(Grade D)**.

Definitions:

Grades of Recommendation and Levels of Evidence

Grade of Recommendation	Level of Evidence	Description of Study Design
A	1a	Systematic review (with homogeneity) of

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		randomized clinical trials
	1b	Individual randomized clinical trials (with narrow confidence interval)
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B	2a	Systematic review (with homogeneity) of cohort studies
	2b	Individual cohort study (including low quality randomized clinical trial)
	2c	"Outcomes" research
	3a	Systemic review (with homogeneity) of case-control studies
	3b	Individual case-control study
C	4	Case series, single case reports (and poor quality cohort and case control studies)
D	5	Expert opinion without explicit critical appraisal or based on physiology or bench research
Z	6	Abstracts

CLINICAL ALGORITHM(S)

An algorithm is provided in Appendix 4 of the original guideline document: for triage for long-acting anticoagulant rodenticides (LAARs) ingestion.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate out-of-hospital triage and initial management of patients with suspected exposure to long-acting anticoagulant rodenticides

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- This guideline is based on an assessment of current scientific and clinical information. The expert consensus panel recognizes that specific patient care decisions may be at variance with this guideline and are the prerogative of the patient and the health professionals providing care, considering all of the circumstances involved. This guideline does not substitute for clinical judgment.
- This guideline has been developed for the conditions prevalent in the U.S. While the toxicity of common long-acting anticoagulant rodenticides (LAARs) is not expected to vary in a clinically significant manner in other nations, available formulations and active ingredients may differ for some LAAR products. In addition, out-of hospital conditions could be much different. This guideline should not be extrapolated to other settings unless it has been determined that the conditions assumed in this guideline are present.

Limitations of the Published Data

The strength of evidence for this guideline is limited to prospective case series, two uncontrolled prospective drug trials, retrospective case series, and case reports. Level 4 data do not provide a sound basis for toxic dose estimation or triage recommendations. The case reports and case series varied widely in the level of clinical detail presented, severity of clinical effects of the poisoning, timing of interventions, co-ingestants, estimated dose, and treatments administered.

The lack of precision in dose measurement is a major limitation of this literature analysis. The estimates are subject to many assumptions. Data for amount ingested are often inaccurate or incomplete. Parents might under- or overestimate the ingested dose because of denial or anxiety. Poison center staffs often record the dose taken as the worst case scenario in order to provide a wide margin of safety. Estimating the amount ingested from examining most packets or boxes of LAARs is unreliable. In most case reports and case series the estimates of exposure were not independently verified. Confirmation of exposure by measuring serum LAAR concentrations was rarely obtained.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Clinical Algorithm

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Caravati EM, Erdman AR, Scharman EJ, Woolf AD, Chyka PA, Cobaugh DJ, Wax PM, Manoguerra AS, Christianson G, Nelson LS, Olson KR, Booze LL, Troutman WG. Long-acting anticoagulant rodenticide poisoning: an evidence-based consensus guideline for out-of-hospital management. *Clin Toxicol (Phila)* 2007;45(1):1-22. [PubMed](#)

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2006 Apr 19

GUIDELINE DEVELOPER(S)

American Association of Poison Control Centers - Professional Association

SOURCE(S) OF FUNDING

Health Resources and Services Administration, U.S. Department of Health and Human Services

GUIDELINE COMMITTEE

Not stated

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

There are no potential conflicts of interest reported by the expert consensus panel or project staff regarding this guideline.

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the [American Association of Poison Control Centers](#).

Print copies: Available from the American Association of Poison Control Centers, 3201 New Mexico Avenue NW, Suite 330, Washington, DC 20016

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI on November 29, 2006. The information was verified by the guideline developer on December 13, 2006.

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