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REVIEW ARTICLE

Poisoning by Herbs and Plants: Rapid Toxidromic Classification and Diagnosis

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The American Association of Poison Control Centers has continued to report approximately 50,000 telephone calls or 8% of incoming calls annually related to plant exposures, mostly in children. Although the frequency of plant ingestions in children is related to the presence of popular species in households, adolescents may experiment with hallucinogenic plants; and trekkers and foragers may misidentify poisonous plants as edible. Since plant exposures have continued at a constant rate, the objectives of this review were (1) to review the epidemiology of plant poisonings; and (2) to propose a rapid toxidromic classification system for highly toxic plant ingestions for field use by first responders in comparison to current classification systems. Internet search engines were queried to identify and select peer-reviewed articles on plant poisonings using the key words in order to classify plant poisonings into four specific toxidromes: cardiotoxic, neurotoxic, cytotoxic, and gastrointestinal-hepatotoxic. A simple toxidromic classification system of plant poisonings may permit rapid diagnoses of highly toxic versus less toxic and nontoxic plant ingestions both in households and outdoors; direct earlier management of potentially serious poisonings; and reduce costly inpatient evaluations for inconsequential plant ingestions. The current textbook classification schemes for plant poisonings were complex in comparison to the rapid classification system; and were based on chemical nomenclatures and pharmacological effects, and not on clearly presenting toxidromes. Validation of the rapid toxidromic classification system as compared to existing chemical classification systems for plant poisonings will require future adoption and implementation of the toxidromic system by its intended users.

Key words: poisonous plants, poisonous herbs, intentional poisonings, unintentional poisonings, poisonous ingestions, poisonous foods

Introduction

Although serious plant ingestions are uncommon, the American Association of Poison Control Centers (AAPCC) has continued to report approximately 50,000 telephone calls or 8% of incoming calls annually related to plant exposures, mostly nonlethal plant ingestions in children.[1,2] Although the frequency of plant ingestions in children is related to the presence of popular species in households, adolescents may experiment with hallucinogenic plants, and trekkers and foragers may misidentify poisonous plants as edible.[3–6]

In a study designed to assess the ability of emergency department staff doctors and nurses to correctly identify poisonous plants, Harchelroad et al[4] reported that only 17% of the plants could be identified by their common names, and only 13% could be identified as poisonous. Because plant exposures have continued at a relatively constant rate and the misidentification of poisonous plants has continued among outdoor enthusiasts and medical providers alike, the objectives of this review were 1) to review the epidemiology of plant poisonings

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and their outcomes, and 2) to propose a rapid toxidromic classification system for highly toxic plant ingestions in comparison with current classification systems.

Methods

To identify peer-reviewed, published scientific articles on herbal and plant poisonings and to develop a simplified toxidromic classification system for rapid diagnosis and management of plant poisonings for first responders and other urgent healthcare providers, Internet search engines, including PubMed, Medline, Ovid, Google, Google Scholar, and Cochrane, were queried with several key words. The key words included the following terms: plants, herbs, poisonous; poisonings, intentional, unintentional; ingestions, poisonous; foods, poisonous.

Plant poisoning reports were stratified as poisonings by either herbs or plants. Herbs were defined as seed-bearing, flowering plants without year-round woody stems as compared with other plants, shrubs, and trees with perennial woody stems. Case reports, case series, poison control center surveillance system reports, review articles, and toxicological studies were reviewed. Table 1 lists the scientific articles selected for review and stratifies them by their manuscript types.

The inclusion criteria for selected scientific articles included unintentional and intentional plant poisoning cases that were reported as individual cases or case series. The unintentional plant poisoning cases included attempted and successful suicides after plant, herb, and seed ingestions, but did not include any homicidal plant poisoning cases. Other inclusion criteria included periodic analyses of AAPCC Toxic Exposure Surveillance System (TESS) databases and other statewide poison control databases for descriptive epidemiological reviews of plant poisonings during the reporting period, 1983–2012.[1,2,5–7] Exclusion criteria for plant poisoning cases included any plant poisonings in which the toxic plant or herb was not identified and all textbook chapters that were considered solicited, not peer-reviewed scientific publications. Textbook chapters, however, provided the two different plant poisoning classification schemes for comparison with the proposed rapid toxidromic classification system (Table 2).[8–10] The well-documented cases of plant and herbal poisonings and the descriptions of their toxidromes were then identified from the selected scientific articles and classified into 4 distinctly different resultant toxidromes: 1) cardiotoxic, 2) neurotoxic, 3) cytotoxic, and 4) gastrointestinal/hepatotoxic.

Table 1. Poisonous garden and wild plants capable of causing fatal toxicity

Types of scientific articles selected for review*	Number of scientific articles reviewed
Case reports	22
Case series	14
Surveillance studies, including Poison Control Center experiences	7
Reviews	6
Toxicological studies	1
Total articles selected and reviewed	50

* Solicited textbook chapters (n = 5) were used as references in this article, but were not considered peer-reviewed and were not selected as articles to be reviewed.

Results and Discussion

THE EPIDEMIOLOGY AND OUTCOMES OF PLANT POISONINGS

Krenzelok et al[5,6] have periodically analyzed the AAPCC TESS databases on plant poisonings for more than 20 years. During the decade 1985–1994, these authors analyzed 912,534 plant exposures to determine the most common plant exposures.[5] Garden and household *Philodendron* species were the most commonly ingested species, followed by *Dieffenbachia* (dumb cane) species, *Euphorbia pulcherrima* (poinsettia), *Capsicum annuum* (red pepper), and *Ilex* (holly) species.[5] During the decade 2000 to 2009, these authors analyzed 668,111 plant exposures as single-substance exposures with the age of exposed patients known in most (n = 611,708) of the cases.[6] Male patients accounted for 52.2% of the plant ingestions and more than 60% of the moderate and severe outcomes.[8] The most severe outcomes occurred in those who intentionally ingested plants for their hallucinogenic effects or to commit suicide.[6] Children younger than 5 years accounted for 81.2% of the plant exposures.[6] Within the pediatric exposure category during the decade 2000 to 2009, 57.8% of the plant exposures occurred in children younger than 1 year.[6] During the 26-year period, 1983 to 2009, there were 45 cases of fatal plant poisonings, with *Datura* species (family Solanaceae) and *Cicuta maculata* (water hemlock) responsible for 35.5% of the fatalities.[6]

In a more recent annual analysis of the AAPCC TESS database in 2012, there were 49,373 plant exposures reported, and plants were the 19th most frequently ingested substances in human exposures, responsible for 1.84% of all substance exposures and 2.30% of single-substance exposures.[2] Plants were the ninth most frequently ingested foreign substance in children 5 years and younger, responsible for 2.78% of all substance