Clinical Toxicology of Commercial Products

Fifth Edition

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Accurate indications, adverse reactions, and dosage schedules for drugs are provided in this book, but it is possible that they may change. The reader is urged to review the package information data of the manufacturers of the medications mentioned and the ingredients listed on the labels of consumer products.

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Preface

Concerning Poisons:

Alcohol, hashish, prussic acid, strychnine are weak dilutions; the surest poison is time.—*Ralph Waldo Emerson*

Cocaine isn't habit-forming, I should know—I've been using it for years.—*Tallulah Bankhead*

Concerning Consumers:

The consumer is not a moron. She (He) is your wife (husband).—*David Oglivy*

There is no safety in numbers, or in anything else.—*James Thurber*

Concerning Science:

There is something fascinating about science. One gets such wholesale returns of conjecture out of such trifling investments of fact.—*Samuel Longhorne Clemens*

Hindsight is the only exact science.—*Theo Kojak*

Concerning Truth:

As scarce as truth is, the supply has always been in excess of the demand.—*Henry Wheeler Shaw*

Concerning Books:

In this work, when it shall be found that much is omitted, let it not be forgotten that much likewise is performed.—*Samuel Johnson*

Books are helpful in bed. But they are not responsive.—*Mary Hemingway*

The original purpose of this book was to assist the physician in dealing quickly and effectively with acute chemical poisonings arising through misuse of consumer products. The book provides (*a*) a list of trade name products together with their ingredients, (*b*) addresses and telephone numbers of companies for use when descriptions of products are not available, (*c*) sample formulas of many types of products with an estimate of the toxicity of each formula, (*d*) toxicological information including an appraisal of toxicity of individual ingredients, and (*e*) recommendations for treatment and supportive care.

We suggest that the physician take time to understand the organization of the material in the seven sections of the book before an emergency arises. An illustrative chart, *How to Use This Manual*, appears inside the front cover. A study of this guide, with hypothetical cases in mind, is recommended. The contents of each section are briefly described below.

Over the years a second purpose of this reference manual has received increasing emphasis, namely to acquaint therapists and others with the pathophysiological mechanisms induced by various poisons, insofar as they are understood. The book now contains detailed documentation not only of published case reports but of clinical and experimental research papers as well, which should make this compilation more useful to the professional toxicologist. Such citations are now extensive in both Sections II and III and to some extent in Section IV (see below), but with few exceptions the literature coverage in this edition does not extend beyond 1982. We have taken pains to point out areas of uncertainty or disagreement where they exist because these areas represent important gaps in knowledge and therefore opportunities for future research. Although the primary emphasis is on acute toxicity, issues of chronic toxicity and teratogenic, carcinogenic and mutagenic effects have not been totally neglected.

SECTION I. FIRST AID AND GENERAL EMERGENCY TREATMENT

As a synopsis of the physician's role in chemical poisonings from the first phone call to the final disposition, this section outlines in sequence the general emergency procedures and precautions required in all cases of acute poisoning. Included are references to relevant material in other sections.

SECTION II. INGREDIENTS INDEX

This section contains an alphabetical list of chemical substances (ingredients) commonly found in commercial products used by the consumer in and around the home and farm. Ingredients are also indexed by CAS (Chemical Abstract Service) registry numbers. The acute toxicity of each ingredient has been estimated ("toxicity rating"). Included for almost every ingredient is a brief description of toxic effects and/or cross references to more detailed information in Sections III and IV. Consult the Introduction to Section II for more information.

SECTION III. THERAPEUTICS INDEX

Section III summarizes clinical and experimental data on 85 compounds (or classes of compounds) which are named "reference congeners" in Section II because each typifies a group of related substances. This section stresses toxic signs and symptoms and recommended programs of therapy.

SECTION IV. SUPPORTIVE TREATMENT

In this section techniques of supportive treatment are discussed, with particular emphasis on those problems encountered frequently in clinical toxicology.

SECTION V. TRADE NAME INDEX

Here are listed alphabetically over 15,000 trade names of products which might be ingested accidentally or suicidally. For almost all items the category of use is indicated, *e.g.*, rodenticide, silver polish, hair dye. In most cases the ingredients are stated, with asterisks marking those components expected to be responsible for harmful effects. With each product the manufacturer's name is given.

SECTION VI. GENERAL FORMULATIONS

This section presents formulas for the diverse types of products listed in the Trade Name Index. These formulas are believed to be "basic," "typical," or "representative" and give some guidance to physicians when the trade name of an ingested substance is not known or when information about its ingredients cannot be obtained easily. A method of estimating a toxicity rating for each product is described in the introduction to this section.

SECTION VII. MANUFACTURERS' INDEX

The names, addresses and, when available, telephone numbers of all manufacturers of products appearing in the Trade Name Index are listed for the convenience of physicians who wish to phone or write for further information.

The products listed in this book represent a wide sampling of the many thousands of items available on the market and used in homes, on farms, in small businesses, in

institutions and industries—wherever toxic materials might be accessible to the public. Many of these products are relatively harmless, but are included because an attending physician needs assurance that an ingested substance is innocuous, if it is, as well as information concerning the ingredients of a product that is potentially poisonous.

Where to limit the list of trade name descriptions has been a problem. Our initial objective—to describe only products used in homes and on farms, which automatically excluded materials marketed solely for industrial use—has been modified somewhat. Many "industrial" products can now be purchased by do-it-yourself workers, hobbyists, and owners of small businesses, and so, in the absence of industrial health safeguards, become accessible to small children. On the other hand, the wide use of commercial products in institutional and industrial environments has greatly expanded the need of physicians for toxicological information about these products.

Many commercial commodities were deliberately excluded, *e.g.*, structural materials and objects which are hazardous only because of possible physical injury, *e.g.*, broken glass. Most poisonous plants and animal venoms have been omitted. Foods, food products, and dietary supplements are not listed unless the contents of vitamin A, vitamin D, or iron are high.

In preparing this material it was recognized that changes in formulas are frequent, that new products are marketed daily and old ones discontinued. To achieve some degree of accuracy in describing the merchandise presented in this index, contributing manufacturers were given repeated opportunities to edit descriptions of their products throughout the years between the publication of the last edition in 1976 and the appearance of the present volume. A similar procedure is planned to keep this index up to date.

The present volume represents the culmination of studies and work that have continued without interruption since the first edition was published. The authors recognize the limitations of a reference volume appearing once in five to eight years to deal with a subject that changes so rapidly. In years past we have attempted to cope with this problem by preparing monthly a bulletin with the same format as the parent volume *Clinical Toxicology of Commercial Products* (CTCP). Such a mechanism we now believe is an anachronism in this electronic and computerized age. Beginning with the 4th edition we prepared various parts of this manual in machine-readable form. These parts now include Section II, Section V and the bibliographies to each congener in Section III. This material we refer to as the *CTCP Data Base*. An earlier version of this data base constituted one of the modules of the NIH-EPA Chemical Information System (C.I.S.) which was available online nationwide and worldwide to subscribers who had access to the communications network Telenet. Other computerized versions of this data base are expected to be developed and marketed in the future.

The authors have often been told that their task is an impossible one. If the book were as all-inclusive as its title purports, *i.e.*, if the purpose were to describe all commercial products with toxic potentialities, we would heartily agree with our critics. The coverage is admittedly incomplete. The goal has been to list the hardy perennials and the current annuals and to omit the obsolescent and evanescent thousands. For instance, hundreds of cosmetic products come on and go off the market annually. Although most of these are not included by name, the book by no means neglects them; thus the ingredients in sample or prototype formulations are listed in Section VI, together with estimates of the toxicities of the products. Because there are many similarities in the formulas of such products as perfumes and cold wave lotions, whoever the manufacturer, the General Formulations Section seems to offer the best solution to the problem of saving space while providing physicians with needed information.

Material in all sections has been extensively revised and in many places completely rewritten. Toxicity data are more extensive and more intensive than in earlier editions.

As already noted, all product information has been brought up to date; final changes were introduced during 1983. The pages of each section are numbered in sequence separately from all other sections; the appropriate section number and title appearing at the top of each page serve to designate the section. This convention was adopted to simplify the printing process and so to reduce its cost. Citations to the medical and toxicological literature are located throughout Section II with references at the end of the section. References are given throughout Section III and occasionally in Sections IV and VI. In addition, general references useful in clinical toxicology are listed in Section I (pp. 17 and 18).

Acknowledgments

To the many persons who assisted in the preparation of the four previous editions of CTCP, the authors acknowledge again their indebtedness. Many served generously and effectively in furnishing and helping to analyze material for this fifth edition. For both old and new services we are grateful.

Since the inception of this project, our efforts have brought us into contact with many informed and helpful people. Some of their names and manifold contributions to the present edition are listed in the Introductions to the various sections of this volume. It is a pleasure to acknowledge publically our gratitude to these many individuals; their contributions and collaborations were invaluable.

During the years of 1976 to 1981 this project was supported in part by a consortium of federal agencies through the mechanism of a contract administered by the Division of Poison Control, Bureau of Drugs, Food and Drug Administration. The participants in addition to the FDA included the Consumer Products Safety Commission, the Environmental Protection Agency, the National Institute of Environmental Health Sciences, the National Library of Medicine and the Occupational Safety and Health Administration. Since 1981 the FDA, EPA, CPSC and Waverly Press have provided financial assistance at various times. Royalties from the NIH-EPA Chemical Information System (see Preface) have also helped to defray operating expenses. We are particularly grateful to the many administrators in these organizations who helped us secure funds to sustain our project.

The preparation of this edition involved the collaboration of about 2300 manufacturers. With few exceptions, our many letters to manufacturers have been answered with unfailing courtesy and remarkable patience. As a rule the information we solicited was sent us, and valuable suggestions were often volunteered, such as reference sources and useful names and addresses. Especially valuable were toxicity data on products or their ingredients. Deeply appreciated were the words of commendation which appeared in hundreds of letters.

To the publisher and the printer of this complicated volume we give a special note of commendation for the vast amount of work undertaken and well done. Supervision has been ably provided by Toni M. Tracy, Vice President and Editor-in-Chief of Williams & Wilkins, who is in charge of this edition. We also acknowledge the contributions of William Vinck, Copy Editor, of Frederick Boone, Data Processing Manager, and of Raymond E. Reter, Book Production Sponsor.

Contents

SECTION I

First Aid and General Emergency Treatment

Summarized here are practical suggestions for the physician who receives an emergency call about an acute chemical poisoning. Assume that, by accident or by suicidal intent, a toxic substance has been ingested or inhaled at home or at work.

A. INSTRUCTIONS BY TELEPHONE

The first alert

When alerted by phone, the therapist must first decide whether his informant is competent to give reliable information and to receive instructions. Because the person calling for help is almost always excited, the physician should speak slowly, calmly and deliberately, and give as few instructions as practical. The following nine topics in order are usually relevant to the initial telephone call:

1. Is this a bona fide case of poisoning? With only second-hand information, this is often a hard question to answer. **If obvious physical signs and symptoms** are described, assume a toxic origin and **proceed directly to 2.**

A tentative prognosis

If the victim is asymptomatic, the first requirement is a realistic prognosis; it depends upon (*a*) the amount ingested (or inhaled) and (*b*) its inherent toxicity. To characterize the toxicity of a commercial mixture by the oral route, a numerical rating has been assigned to each of the many sample formulas listed in Section VI. As indicated in Table I-1, the higher the numerical rating the greater the acute toxicity. For a specific brand that does not match any of the formulas in Section VI, a toxicity rating can often be inferred by comparing the product's composition (Section V) with the known toxicity of its separate ingredients (Section II), according to principles outlined in the Introduction to Section VI. A phone call to a regional poison center may be especially useful in this respect because center personnel can often suggest a realistic prognosis promptly.

Although the absolute amount ingested is often unknown, approximations such as the number of swallows may sometimes be established. In a normal swallow the volume of liquid ingested (water) varies from an average of about 14 ml. for women to 21 ml. for men. Children in age group 1¼ to 3½ years average approximately 4.5 ml. (of water) per swallow or the equivalent of 1 teaspoonful. There is a relatively constant ratio of fluid volume per swallow to body weight; this ratio averages about 0.27 ml./kg. Calculations based on such estimates may be useful in prognosis (Jones and Work, 1961).

The numerical toxicity ratings in Table I-1 are really lethality ratings. A dose as small as ⅒ the lethal dose is often capable of inducing a severe and debilitating illness. If the toxicity rating implies a poor or equivocal prognosis with respect to mortality or morbidity, even the asymptomatic person should be examined as soon as possible. This is important even if the alleged exposure occurred many

Table I-1
Numerical Toxicity Rating Definitions

Toxicity Rating or Class	Probable Oral LETHAL Dose (Human)	
	Dose	For 70-kg. person (150 lb.)
6 Super toxic	Less than 5 mg./kg.	A taste (less than 7 drops)
5 Extremely toxic	5–50 mg./kg.	Between 7 drops and 1 teaspoonful (tsp)
4 Very toxic	50–500 mg./kg.	Between 1 tsp. and 1 ounce
3 Moderately toxic	0.5–5 gm./kg.	Between 1 oz. and 1 pint (or 1 lb.)
2 Slightly toxic	5–15 gm./kg.	Between 1 pt. and 1 quart
1 Practically nontoxic	Above 15 gm./kg.	More than 1 quart (2.2 lb.)

hours before. Some toxic agents produce severe sequelae after long periods of latency. A situation like this represents a challenging opportunity to the therapist.

Induce vomiting

2. Has the patient vomited? If the poison is thought to have been ingested and if extensive vomiting has not already occurred, suggest one of the following emetic stimuli. None of these measures should be attempted if the patient is unconscious or rapidly losing consciousness, or if he is convulsing or shows pre-convulsive signs. The induction of emesis is also contraindicated if the ingested poison is thought to have been a strong alkali, corrosive acid, kerosene or a kerosene-like hydrocarbon. Severe heart disease and pregnancy are sometimes valid contraindications. Even when the induction of emesis is safe, it may be faster to inactivate a rapidly acting poison (such as bichloride of mercury) by giving activated charcoal than to remove it by provoking emesis (see instructions 3 and 4 below). If in doubt, phone a poison control center for advice. If the decision is against the induction of emesis, proceed directly to instruction 3 below.

a. If available (and it is available today in many homes), **ipecac syrup (USP)** may be administered by mouth. The conventional emetic dose is now 15 ml. in children (including toddlers) and 30 ml. in adolescents and adults. Vomiting under these circumstances is not immediate. In various clinical trials, the mean latency ranged from 14 to 25 minutes, with an average of about 15 minutes in those who vomited after the first dose (Corby *et al.*, 1968; Easom and Lovejoy, 1979; MacLean, 1973; Manoguerra and Krenzelok, 1978; Robertson, 1962). Reid (1970) and others have recommended 10 to 15 ml. ipecac syrup by mouth to young children, followed by 6 ounces of water or clear fluid (no milk). The 6 ounces of water, however, is not necessary and may or may not play a useful role. At least the latency of the emetic response is the same whether fluids are forced before or after the administration of ipecac syrup (Bukis *et al.*, 1978). All therapists recommend a second full dose of ipecac syrup to those few patients (about 10 to 15%) who fail to vomit within 20 to 30 minutes after the first dose. With this regimen about 93% of pediatric patients eventually experience emesis (Easom and Lovejoy, 1979). The same is true of adult patients, even including those who have ingested antiemetic drugs such as the phenothiazine tranquilizers, tricyclic antidepressants, etc. (Manoguerra and Krenzelok, 1978; Thoman and Verhulst, 1966). The duration and intensity of induced emesis are highly

variable (MacLean, 1973), but vomiting is usually limited to 2 to 4 paroxysms over a period of 10 to 15 minutes, rarely over an hour.

b. When compared to ipecac syrup, all **other recognized emetic stimuli** are less safe, less effective or less generally available in the home. For example, sodium chloride (table salt) and copper sulfate have been employed as irritant emetics in treating accidental ingestions, but neither dependably empties the stomach and both have produced systemic poisonings and deaths (see Section II). Eliciting the gag reflex by stroking the patient's throat with a finger or other blunt object only rarely results in productive vomiting, even in children, who are believed to have a more sensitive gag reflex than adults (Dabbous *et al.*, 1965). The drug apomorphine is certainly effective (see below), but it is not available except at treatment centers. An old-fashioned emetic available in some homes is powdered black mustard (a light olive-brown powder). A teaspoonful freshly mixed in warm water and swallowed acts as a nauseant, presumably because it releases the irritant allyl isothiocyanate (see Section II). Prepared mustard is inactive. The emetic effectiveness of mustard powder, however, does not appear to have been studied adequately. Granular laundry detergents are present in most American homes, and several formulations administered by stomach tube as aqueous pastes or slurries in single doses of 40 to 75 mg./kg. caused prompt and effective vomiting in dogs (Weaver and Griffith, 1969). Episodes reported to poison centers establish that these products are also effective emetics in young children who mouth and swallow them. Until their safety is demonstrated in humans, however, laundry detergents and hand dishwashing liquids cannot be recommended as household emetics, except possibly as a last resort in poisonings with unusually grim prognoses.

c. As a useful emetic, ipecac syrup has one major rival, the drug **apomorphine.** The latter is clearly superior to ipecac in terms of its much shorter latency (Corby *et al.*, 1968; MacLean, 1973); vomiting occurs in 2 to 15 minutes with a mean latency of only 4 minutes (Hanson, 1967). In dogs (Abdallah and Tye, 1967; Corby *et al.*, 1967) and perhaps in children (Corby *et al.*, 1968), the stomach is emptied more completely in apomorphine-induced emesis than ipecac-induced emesis. In contrast to the 10 to 15% failure rate with single doses of ipecac syrup, apomorphine in the recommended dose (0.07 mg./kg. or 0.03 mg./lb., either subcutaneously or intramuscularly) induces vomiting in almost everyone. The few exceptions are individuals under the influence of centrally acting antiemetic drugs such as chlorpromazine. The major disadvantage of apomorphine is its inactivity by mouth. Parenteral routes require sterile solutions, which are usually prepared from hypodermic tablets because apomorphine solutions tend to be unstable. A second disadvantage is drowsiness and other signs of central depression that apomorphine sometimes produces (Berry and Lambdin, 1963). Apomorphine narcosis can be corrected by narcotic antagonists such as naloxone (see MORPHINE, Section III). Central depression and protracted vomiting are often mentioned as problems in using apomorphine, but except for mild drowsiness, they

are seldom encountered (Corby *et al.*, 1968). Presumably all such complications could be eliminated by using smaller doses and the intravenous route of administration. For example, an intravenous dose as small as 10 to 30 μg./kg. in dogs elicits almost immediate vomiting, which lasts only 1 to 2 minutes, and is followed by no untoward reactions (Wang and Borison, 1952). Some admittedly unsatisfactory clinical evidence has been cited (Gosselin and Smith, 1966) to suggest that humans (at least adults) respond to intravenous apomorphine like the dog. We believe that clinical toxicologists at treatment centers should use apomorphine more often and more effectively, but this drug will never displace ipecac syrup as the favored household emetic.

Activated charcoal

3. As soon as productive vomiting has finished, or in about 30 minutes if it does not occur by then, administer by mouth **powdered activated charcoal in water**, if available. Small bottles of this material can now be found in some homes and in essentially all pharmacies (see Table I-3 on p. I-13). It is contraindicated in many of the same situations as syrup of ipecac (ingestion of strong acids, alkalis, kerosene and other hydrocarbon solvents), not because it is dangerous but because it is generally ineffective against these poisons (but see later with respect to kerosene). In general, activated charcoal should not be presented before ipecac syrup has had an opportunity to provoke emesis because charcoal can inactivate ipecac (Cooney, 1978); this problem does not exist with parenteral apomorphine, and so charcoal can be given immediately after (or before) apomorphine (Decker *et al.*, 1969).

The usefulness of activated charcoal as a nonspecific antidote in clinical toxicology is based on its large capacity to adsorb and retain a remarkable variety of organic and inorganic molecules and ions, including many of the common poisons (Andersen, 1946; Chin *et al.*, 1973; Corby *et al.*, 1970; Holt and Holz, 1963; Picchioni, 1970; Smith *et al.*, 1967). In the adsorbed state, a toxin produces neither local nor systemic injury, and it is eventually eliminated with the charcoal in feces. As noted in Sections II and III, however, not every poison is adsorbed to a useful degree; for example, activated charcoal is essentially useless against ethyl and methyl alcohols, strong mineral acids and alkalis, cyanide (although this 1946 observation of Andersen should be confirmed), probably most water-soluble substances (such as DDT) and others (Corby *et al.*, 1970; Decker *et al.*, 1968; Picchioni, 1970; Smith *et al.*, 1967). On the other hand, the medicinal alkaloids and many diverse synthetic drugs are well adsorbed *in vitro* and *in vivo*. In view of kerosene's low water solubility, it is surprising that kerosene blood levels were lower in charcoal-treated rats than in untreated ones (Chin *et al.*, 1969), but in general activated charcoal is not used in human cases of kerosene ingestion. Some grades of activated charcoal are superior to others (see Table I-3 on p. I-13), and charcoals that are not activated, such as burnt toast, are useless as adsorbents. As an antidote, activated charcoal is more effective the sooner it is swallowed, but it may be worthwhile to try it even several hours after the ingestion of substances which have low solubilities in gastrointestinal fluids (*e.g.*, phenytoin), which delay gastric emptying or which inhibit the propulsive activity of the gut (Easom and Lovejoy, 1979).

The optimal dose of activated charcoal cannot be stated with any useful precision; presumably it depends upon many factors that cannot be assessed in actual emergencies. In controlled studies on

rats (Chin *et al.*, 1973), the most favorable outcome was achieved when the dose of charcoal exceeded the dose of test drug by a factor of 8:1. In clinical practice, one offers the patient as much activated charcoal powder as he will consume, with a minimal goal of 0.5 to 1.0 gm./kg. To assure that the full dose is delivered, the powder should be stirred more or less continuously in a few ounces of water, while the mixture is drunk. To avoid eliciting prompt emesis it may have to be consumed slowly. It is often difficult but usually possible to coax young children to swallow this slurry. The rejection is based on the unsightly black color, gritty feeling and lack of flavor, all of which make it difficult to swallow. Many attempts have been made to improve the palatability of charcoal suspensions by adding flavoring agents, thickeners, etc. (for references, see Scholtz *et al.*, 1978). In general it is not difficult to enhance acceptability, but many of the excipients in the formulas tested were partly adsorbed by the charcoal and so reduced its adsorptive capacity for poisons. Thus ice cream and other milk products are definitely contraindicated. Some promising results have been reported with suspensions of activated charcoal in sorbitol gels (Scholtz *et al.*, 1978), but more studies of the stability, acceptability and efficacy of these processed suspensions are needed. Until then, a simple slurry in water is the best way to present powdered activated charcoal for ingestion.

Once a poison in the stomach or upper bowel is fully adsorbed on the charcoal particles, it is innocuous unless desorption occurs during its transit down the alimentary canal. Apparently desorption is not a major problem under these circumstances, although more data on this point are needed (Chin *et al.*, 1969). In practice, the therapist who administers charcoal to a poison victim is not obliged to remove it by inducing emesis or by aspirating the stomach contents, although it may be safer to do so if the poison is known to be highly toxic. To minimize the time available for desorption, it is probably useful to speed transit of the charcoal-poison complex through the bowel. A saline cathartic such as sodium sulfate or magnesium citrate, administered with water by mouth or by stomach tube, is effective (see p. I-12), apparently without provoking significant desorption (Chin and Picchioni, 1979; LaPierre *et al.*, 1981).

Other useful adsorbents

4. If activated charcoal is not available, any of several other adsorbents may be used, although probably none is so generally effective as a good grade of charcoal. For example (Chin *et al.*, 1969; Smith *et al.*, 1967), a highly adsorptive clay known as montmorillonite is more palatable than powdered charcoal and rivals it in binding organic basic drugs (*e.g.*, amphetamine) *in vitro* and *in vivo*; it is, however, inferior to charcoal in adsorbing acidic drugs (*e.g.*, salicylic acid). Whereas highly adsorptive clays are not available in the home, one can almost always find some food protein in solution, notably milk or, in the absence of fresh milk, undiluted evaporated milk, gelatin solution, beaten egg whites, flour and water paste, etc. These proteins can adsorb and precipitate some poisons (*e.g.*, notably alkaloids and heavy metal ions), and they also serve to delay gastric emptying into the duodenum. In these ways the passage of poisons into the blood stream can sometimes be retarded (Chin *et al.*, 1969). Because these proteins are hydrolyzed by digestive enzymes in the stomach and duodenum, the protection is likely to be transitory. Therefore attempts should be made to remove the poison by emesis or gastric aspiration as soon as possible. Unfortunately emetine, the active constituent in syrup of ipecac, is one of the alkaloids that

appears to bind to milk proteins. Drinking 8 ounces of milk instead of water before syrup of ipecac delays the emetic response in adults by about 10 minutes (Varipara and Oderda, 1977).

The usual recommendation is to postpone the ingestion of all adsorbents and demulcents until syrup of ipecac has had an opportunity to empty the stomach. We believe, however, that the converse is preferable under some circumstances. Admittedly the circumstances have not been well established and may be uncommon, but with rapidly acting poisons such as bichloride of mercury, which is quickly and tightly bound to gastrointestinal mucosa, the delayed emesis produced by ipecac is likely to be futile. When toxic and corrosive heavy metals are ingested, it seems advisable to attempt first to trap them in the lumen with adsorbents such as activated charcoal, milk or any other available protein solution and to empty the stomach later by injecting apomorphine (p. I-3) or by performing gastric aspiration and lavage (p. I-10). Two concerns about milk and similar fluids as "antidotes" relate to their volume and to their fat content. The ingestion of digestible fats is widely held to increase the intestinal absorption of lipid-soluble substances. Thus milk and cream are and should be avoided after swallowing a fat-soluble poison. The issue of volume is not so clear. Whereas water and bland aqueous solutions have often been recommended as "diluents" in cases of accidental ingestion, laboratory studies with mice (Ferguson, 1962) and rats (Henderson *et al.*, 1966) demonstrate that water alone enhances the toxicity and elevates the blood levels of many orally administered systemic poisons. The relevance of these demonstrations, however, is unclear, since the dilution volumes used in these rodent studies were equivalent to 1.2 to 3.0 liters in an adult human. We believe that a glassful or two of milk is not likely to promote gastrointestinal absorption, especially if its use is restricted to water-soluble poisons that may bind to lactalbumin or other milk proteins.

Decontaminate skin and eyes

5. Was any toxic material spilled in the patient's eyes, on his skin, or on his clothing? Discard any contaminated or suspected garments. Toxic liquids on the skin should be removed by blotting with any absorbent material. Then **rinse** all involved skin areas **with copious amounts of running water.** If the inhalation of a toxic gas or vapor is suspected, remove the patient (and everyone else) from the contaminated area. A chemically injured eye should be flushed immediately with water. Because of pain and spasm this seldom can be done effectively unless someone assists the victim by holding his eyelids open while a gentle stream of tap water irrigates all surfaces, preferably for several minutes. If no other facilities are available, dunk the face in a pail or pan of water while the eye is pried open.

6. In the large majority of accidental ingestions reported by poison centers, the prognosis is so favorable that additional therapeutic measures are judged to be unnecessary. Thus, the induction of emesis, with or without the subsequent use of activated charcoal or other adsorbents, together with simple decontamination of skin, eyes, mouth and clothing, offers adequate protection to most asymptomatic persons who have inadvertently tasted or swallowed a small amount of a nonedible consumer product. If, however, toxic signs and symptoms persist or if the prognosis (p. I-1) is equivocal or unfavorable with respect to mortality or morbidity even in the absence of current symptoms, proceed immediately to **arrange transportation to the most convenient site with medical facilities.** It is usually faster and more satisfactory to have the patient brought to the hospital,

Get patient to treatment center

clinic, or office than for the doctor to speed to the home. Professional ambulance service or the police can frequently provide transportation, but a member of the family or a neighbor with a car is usually the quickest solution. This is generally a practical solution unless the victim has sustained severe physical injury as well as a toxic one, or unless he has stopped breathing.

Bring poison and container for identification

7. Have a member of the household **collect any of the unused poison in its normal container.** A sample of any vomitus should be put in a clean bottle or jar. Insist that these **specimens are brought to the hospital or clinic** with the patient, when possible.

Emphasize the need for speed

8. If the patient can be brought for examination and treatment promptly (*e.g.*, within 15 to 30 minutes), do not delay his trip by making additional requests or suggestions. Even instructions about inducing emesis may be better omitted if these measures are expected to delay professional treatment appreciably.

9. **If transportation is not immediately available** (for example, while waiting for an ambulance), it may be desirable to offer (by phone) **one or more of the following instructions:**

Additional first-aid suggestions for the layman (optional)

a. **If the patient is unconscious** and particularly if he has vomiting or retching movements while unconscious, **keep him on his side** with the trunk and head sloping slightly downward, so that the head is a few inches below the rest of the body.

b. In most neighborhoods it is possible to **locate someone with formal training in first aid.** If such a person is available, ask him to stand by. His services may become essential if the patient stops breathing before professional therapists arrive.

c. **If a convulsion occurs,** do nothing except to prevent the patient from falling or otherwise injuring himself.

d. **Do not exhaust the victim** by overzealous attempts at first aid. The use of blankets, wet compresses, and gentle massage are harmless ways to keep the family busy.

e. **Avoid home remedies** which involve the administration of drugs.

f. **Do not throw away the poison.** Keep a sample but clean up any spilled toxic material which may constitute a hazard to another member of the household (for example, a child or pet animal).

g. **If the patient becomes drowsy,** give strong tea or black coffee by mouth. Tea is probably the more useful beverage and can be given freely to children under these circumstances.

B. AWAITING THE PATIENT'S ARRIVAL

This occasion offers you (the physician) an invaluable opportunity to make necessary preparations.

Use this manual
. . . to identify toxic ingredients
. . . to learn about specific symtomatology and treatment
. . . to locate manufacturer for more information

1. If you were told the name of the product responsible for the poisoning, **consult this book to find the product's ingredients.** Use Section V if the brand name or trademarked name is known; use Section VI if only the general nature of the substance was revealed. With a knowledge of the exact or probable ingredients, Section II (Ingredients Index) is consulted. For each toxic ingredient Section II outlines expected toxic symptoms and recommended programs of treatment or else directs the reader to the appropriate information in Section III (Therapeutics Index). **Study carefully specific symptomatology and treatment in Sections II and III.**

If you fail to find listed in this manual the product responsible for

the intoxication, **a prompt telephone call to the manufacturer** may elicit valuable information about the identity and toxicity of the ingredients. The **addresses** of many manufacturers are listed **in Section VII.** Useful information or advice may also be obtained from a local or regional poison center.

Notify staff

2. Alert nurses and resident physicians at the hospital, clinic, or office. Plan to reach the hospital before the patient in order to check on preparations. If this is impractical, authority must be delegated. Leave specific instructions when possible.

Notify police

3. Notify the medical examiner, police, or other representative of the law as soon as any suspicion arises that the poisoning may involve homicidal intent or criminal negligence.

Consult colleagues

4. Arrange for consultations with professional colleagues if their help is expected to be necessary at any time. For example, a psychiatrist's advice may be invaluable in the management of a patient who has just attempted suicide. If the need is anticipated, an anesthesiologist, pediatrician, analytical chemist, clinical toxicologist, or some other specialist may make an essential contribution to the recovery of a severely poisoned patient. Such experts can sometimes be located by telephoning a local or regional poison center.

Check equipment and drugs

5. Check preparations and equipment in the treatment room. Special equipment and drugs that are used frequently in clinical toxicology are listed below in Tables I-2 and I-3; most, if not all, of them should be available in a well supplied emergency treatment center. An equipment checklist, like Table I-2, is desirable. In addition, many drugs should be on hand. The therapeutic agents listed in Table I-3 are particularly useful in clinical toxicology (pp. I-13–16)

C. GENERAL EMERGENCY TREATMENT BY THE PHYSICIAN

The initial physical examination

1. Are the signs and symptoms consistent with the history? With the presumed identity of the toxic ingredient? With the alleged dose? Try to **write at least brief notes concurrently with the examination** and treatment because all cases of poisoning are potentially medicolegal problems.

Collect and preserve specimens for analysis

2. Save all specimens. Examine carefully any of the unused poison, its container and the commercial label, when available. Any specimen brought in with the patient should be properly labeled by a responsible assistant and saved for future study. Also save the first urine specimen, all vomitus, the first gastric washings, and a blood sample, when indicated. Refrigerate specimens when necessary, but never use a chemical preservative.

Gastric lavage, indications and contraindications

3. Emptying the stomach by emesis (see p. I-2) or by gastric aspiration and lavage to remove unabsorbed poison is often the first therapeutic procedure and usually the most worthwhile one if the patient's vital signs are normal. Of course, severe respiratory distress and circulatory collapse must be corrected first (see Section IV). Emptying the stomach *per os* is generally worthwhile **any time within 3 hours after ingestion** of a poison—and perhaps even longer if large amounts of milk or cream were ingested. Intubation and the induction of emesis are impractical and **dangerous after the ingestion of strong corrosive agents** like alkali (lye, concentrated ammonia water) or mineral acids, although with appropriate caution experienced operators have performed esophageal endoscopy