Belladonna Alkaloid Intoxication: The 10-Year Experience of a Large Tertiary Care Pediatric Hospital

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The belladonna alkaloids can be isolated from a number of plants, which contain hallucinogens that represent a serious danger to infants, children, and adolescents. Roots, leaves, and fruits of the plant contain the alkaloids atropine, hyoscyamine, and scopolamine, which can lead to an anticholinergic toxidrome; however, not all characteristics of the toxidrome are necessarily present in each case of poisoning. A retrospective chart review of all children seen following anticholinergic ingestions, between April 2001 and November 2010, at the Hospital for Sick Children in Toronto. Ten children, with a mean age of 15.5 years (range, 15–18 years), were identified; 5 had used jimsonweed and the others had a variety of tablets containing atropine. All 10 presented with severe anticholinergic symptoms and 2 with suicide attempts. Treatments included charcoal, benzodiazepines, haloperidol, and physostigmine, and 2 patients were intubated. Ingestion and subsequent severe anticholinergic toxidrome occurred exclusively in adolescents. It is important to educate this age group regarding the toxicity and potential risks associated with the recreational use of these plants and substances. Physostigmine can help in both the diagnosis and management of patients intoxicated with these substances.

Keywords: Atropa belladonna, anticholinergic toxidrome, physostigmine, belladonna alkaloids

INTRODUCTION

The belladonna alkaloids, including the tropane alkaloids atropine, hyoscyamine, and scopolamine, are found in a number of plants. Consumption of any part of the plant can result in a severe anticholinergic toxidrome consisting of mydriasis, blurred vision, photophobia, dry mouth, dry skin, extreme thirst, dry mucous membranes, tachycardia, decreased bowel sounds, difficulty swallowing and speaking, hyperthermia, hypertension, seizures, loss of consciousness, and coma. Other manifestations include confusion, agitation, and combative behavior. Not all the characteristics of anticholinergic toxidrome are necessarily present in each poisoning, but the clinical picture is often dominated by a toxic psychosis with hallucinations, disturbances of orientation, and psychomotor agitation, aggression, or anxiety. Children have a special susceptibility, and even small amounts can produce central nervous system manifestations; however, it is mainly adolescents who experiment recreationally with these plants for their hallucinogenic and euphoric effects.

Although Atropa belladonna, also known as deadly nightshade, is perhaps the most well-known example in this group of plants, Datura is another plant that contains tropane alkaloids, primarily in its seeds and flowers. It has been used in some cultures for centuries, both as a poison and as a hallucinogen. There are 9 species, one of which is jimsonweed (Datura stramonium), also called locoweed. Jimsonweed grows wild in warm and...
moist areas of the world, and in southern Canada and the United States, where it is also used as an ornamental plant. It has been used to treat “madness,” epilepsy, and depression in addition to being used as a hallucinogenic. Ingestion of any part of the plant can result in severe anticholinergic toxicity. Jimsonweed parties are becoming more common, so that multiple teenagers are usually involved when exposure occurs.

The manifestations of jimsonweed poisoning include the classic anticholinergic symptoms, and death can occur from central nervous system depression, circulatory collapse, and hypotension. Coingestion of other central nervous system depressants can increase the toxicity of jimsonweed.

Angel’s trumpet, also known as devil’s weed, thorn apple, tolguacha, Jamestown weed, stinkweed, Datura, or moonflower, is another plant that has increasingly been used for its hallucinogenic effect, mainly because it is cheap and easily available. Confusingly, moonflower is also a name given to several plants, such as *Datura inoxia*, which was responsible for the anticholinergic poisoning of more than a dozen adolescents in one series.

We have reviewed all anticholinergic intoxications at our institution over a 10-years period and describe the clinical manifestations and treatments used.

**MATERIALS AND METHODS**

We performed a retrospective chart review of all patients aged <18 years with confirmed anticholinergic intoxication seen from April 2001 to July 2010 at the Hospital for Sick Children, Toronto, Ontario, Canada. Charts were identified using the specific ICD 10 codes T44.3 (“Other parasympatholytics (anticholinergics and antimuscarinics) and spasmyloytics, not elsewhere classified”) and X 69 (intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances-plants-jimsonweed poisoning). Inclusion criteria for the study were presentation to the emergency department or admission to an inpatient unit or the intensive care unit, of a pediatric patient with intoxication involving anticholinergic seeds, tablets, or teas. No exclusion criteria, other than age limit, were used. Data were extracted by 2 independent investigators using a structured form. Clinical outcomes, such as the extent and duration of clinical manifestations, treatments employed, clinical responses, and outcomes were collected and analyzed. Concomitant medications and other toxic exposures were recorded. Encephalopathy was accepted when at least 2 of the following symptoms were present: altered states of consciousness, altered cognition or personality, and seizures. The study was approved by the Institutional Research Ethics Board at the Hospital for Sick Children, Toronto, University of Toronto, Canada.

**RESULTS**

The medical records of 10 patients meeting inclusion criteria were reviewed. Toxicological examination was obtained in all patients. Ages ranged from 15 to 18 years (Table 1). In most cases, hospitalization occurred within the first 12 hours after ingestion. Also, in most of the cases, the patients or their parents do not know the ingested amount of the belladonna alkaloids. The commonest presentations were changes in the level of consciousness, visual hallucinations, aggression, psychosis, psychomotor agitation, and mumbling speech. Symptoms subsided within 24 hours except for 1 patient in whom agitation persisted for 2 days. Physical examination showed dilated pupils, dry mucous membranes, and skin redness. There were no accidental ingestions: 8 were for recreational purposes and 2 were suicide attempts. The teenagers received different treatments (Table 1), including charcoal, fluids, midazolam, and haloperidol. The 2 patients who attempted suicide were treated with midazolam and the antidote physostigmine.

**DISCUSSION**

All 10 of our patients, with ingestions leading to anticholinergic toxidromes, were significantly ill adolescents who needed, at the very least, treatment and a period of observation in the emergency department. Although 8 patients presented after recreational experimentation, 2 were attempted suicides.

Five patients presented after the use of jimsonweed, *Datura stramonium*, which has been known to produce hallucinogenic effects for centuries. It is easily obtained and abused by adolescents, especially because the Internet has provided a widespread and popular vehicle for the rapid and facile sharing of information. Many herbal hallucinogens are now widely available via unregulated Web sites that sell these products purely for recreational use.

Belladonna alkaloids need to be considered, along with drugs such as amphetamine, cocaine, phencyclidine (PCP), in any patient presenting with delirium or psychosis. Other causes of altered mental status and hallucinations include hypoglycemia, which must be urgently excluded, encephalitis, meningitis, intracerebral hemorrhage, thyrotoxicosis, sepsis, psychiatric illness, withdrawal, and other toxic exposures. Diagnosis can be difficult because of the wide range of signs and symptoms associated with anticholinergic toxicity.
Table 1. Characteristics of pediatric patients with anticholinergic intoxication over 10 years at The Hospital for Sick Children (N = 10).

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (yr)</th>
<th>Anticholinergic ingested</th>
<th>Clinical manifestations</th>
<th>Disposition</th>
<th>Treatment in emergency department</th>
<th>Cause of ingestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>Jimsonweed</td>
<td>Agitation, Hallucinations, Tachycardia, Mydriasis, Slurred speech</td>
<td>3 days hospitalization</td>
<td>Charcoal, Benzodiazepines</td>
<td>Social</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>Tablets</td>
<td>Agitation, Hallucinations, Hyperthermia</td>
<td>Discharged from emergency department</td>
<td>Benzodiazepines, Physostigmine</td>
<td>Social</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>Tablets</td>
<td>Drowsiness</td>
<td>2 days hospitalization</td>
<td>Charcoal, Fluids</td>
<td>Social</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>Jimsonweed</td>
<td>Hallucinations, Tachycardia, Incoherent speech, Dry mouth, Redness, Hyperthermia</td>
<td>3 days hospitalization</td>
<td>Benzodiazepines</td>
<td>Social</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>Jimsonweed</td>
<td>Hallucinations, Tachycardia, Incoherent speech, Disorientation, Dilated pupils</td>
<td>Not reported</td>
<td>Charcoal, Fluids</td>
<td>Social</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
<td>Tablets</td>
<td>Hallucinations, Tachycardia, Drowsiness</td>
<td>ICU admission</td>
<td>Benzodiazepines</td>
<td>Suicidal</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>Jimsonweed</td>
<td>Hallucinations, Flushed face, Drowsiness, Mydriasis</td>
<td>3 days hospitalization</td>
<td>Haloperidol</td>
<td>Social</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td>Jimsonweed</td>
<td>Agitation, Hallucinations, Tachycardia, Mydriasis, Hyperthermia</td>
<td>ICU admission</td>
<td>Benzodiazepines</td>
<td>Unknown</td>
</tr>
<tr>
<td>9</td>
<td>16</td>
<td>Tablets</td>
<td>Agitation, Hallucinations, Tachycardia, Mydriasis, Hyperthermia</td>
<td>ICU admission</td>
<td>Midazolam</td>
<td>Social</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td>Tablets</td>
<td>Agitation, Hallucinations, Tachycardia, Mydriasis, Hyperthermia</td>
<td>3 days hospitalization</td>
<td>Midazolam, Physostigmine</td>
<td>Suicidal</td>
</tr>
</tbody>
</table>
Belladonna Alkaloid Intoxication

and the difficulties associated with obtaining an accurate history in recreational drug ingestions.12

Not all the characteristics of anticholinergic toxicity are necessarily present in each case.2 Clinical manifestations are caused by central or peripheral nervous system effects or both. The central effects are dose and agent dependent, and it may present in infants as ataxia, seizure, or coma, making diagnosis difficult when the history of ingestion is not so clear15 and when fever is present. No clinical laboratory tests are routinely available to detect or prove anticholinergic toxicity, and the diagnosis is generally based on history, physical findings, and symptoms. Jimsonweed intoxication should be considered in patients presenting with unexplained peripheral and central anticholinergic symptoms, including delirium, agitation, and seizures, especially among younger patients and partygoers.3

Atropine is a competitive central and peripheral antimuscarinic agent and the most well-studied belladonna alkaloid; 2 mg in adults produce noticeable dryness, a subjective feeling of warmth, slight flushing, and tachycardia. At doses of 3–5 mg symptoms worsen with hyperthermia, tachycardia, drowsiness, and decrease in gastrointestinal tone. Doses >10 mg lead to incapacitation with hot, dry, flushed skin, dilated pupils, blurred vision, dry mouth, tachycardia, urinary retention, constipation, hallucinations, delirium, coma, and potentially death. The dimethicone/homatropine combination has been used for infantile colic and can produce basal ganglia disturbances in infants less than 2 months old.16 Scopolamine is approximately 10 times more potent than atropine, whereas homatropine is at least one-tenth as potent. The estimated lethal dose of atropine in humans is >10 mg and that of scopolamine is >2–4 mg.17

Toxicity usually occurs within 60 minutes of ingestion, and clinical symptoms may persist for 24–48 hours. The elimination half-lives of atropine, hyoscyamine, and scopolamine are 2.5, 3.5, and 8 hours, respectively. Anticholinergic effects delay gastric emptying, resulting in a prolonged duration of action.

Each jimsonweed seed contains approximately 0.1 mg of atropine. Although all parts of the plant can lead to intoxication, the leaves and seeds contain the highest concentration of atropine, hyoscyamine, and scopolamine. Although the roots and seeds of angel’s trumpet contain the highest alkaloid concentrations, users most often brew the blossoms into a tea. Each blossom contains approximately 0.3 mg of atropine and 0.65 mg of scopolamine.

It is very important for adolescents, especially, to be made aware of the toxicities and potential risks associated with the recreational use of these plants and substances. For this reason, it is very important for individuals to become educated on the toxicities and potential risks associated with the recreational use of these plants.

REFERENCES


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