CLINICAL TOXICOLOGY REVIEW

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DATURA Plant Poisoning

Datura is an alkaloid-containing plant from the Nightshade family, *Solanaceae* (Latin for "quieting"), which has recently been gaining increasing popularity amongst gardeners. The large shrubs can grow 10-15 feet high with large, ovate-oblong leaves and huge, pendulous, trumpet shaped flowers. The exotic, showy flowers can grow to 10" in length and are known for their powerful musky fragrance that becomes stronger at night. The seeds from the plant are similar to tomato seeds; they are brown, flat disks about 1/8 inches in diameter.[1] Its various species were originally native to tropical climates such as Mexico, India, and South America.[2] All parts of the plant are toxic.

Like many members of the family *Solanaceae*, Datura contains alkaloid tropanes and has a history of ritualistic usage. The leaves can be smoked or the seeds can be crushed and used in drinks. *Datura suaveolens* ("Angel's Trumpet") and *Datura metel* are two of the more common species found in gardens throughout the United States today. *Datura stramonium*, also known as Jimson Weed, is a commonly abused, dangerous hallucinogen that is widespread in temperate regions. *Datura suaveolens* was previously used in its native Mexico by Yaqui bruhos to achieve divination through its hallucinogenic powers, while *Datura metel* was used in the past by the Thuggee cult in India for the purpose of drugging sacrificial victims. Today Datura seeds are most commonly crushed and consumed for intentional intoxication. In 1994 there was a ten-fold increase in reported ingestions throughout Florida alone.[4] Causes of intoxication include herbal medication overdose, misuse as edible vegetables, and accidental food contamination; there have also been cases of accidental contamination of Datura seed in soybean seed, linseed, and some cereals.[5]

Clinical Pharmacology

The active constituents in the Datura plant include scopolamine, atropine, hyoscyamine and other tropanes. Scopolamine is present in higher concentrations than hyoscyamine in all varieties of Datura.[6]

Atropine: Atropine is an antimuscarinic agent; it competitively binds muscarinic receptors, thus interrupting *parasympathetic* innervation. It also blocks the few *sympathetic* cholinergic neurons, such as those innervating sweat glands. It does not block nicotinic receptors, consequently, there is little or no action at skeletal muscular junctions or autonomic ganglia. The postganglionic receptor sites are located in autonomic receptor cells found in smooth muscle, cardiac muscle, sinoatrial (SA) and atrioventricular (AV) nodes, and exocrine glands. It is both a central and peripheral muscarinic blocker and its actions last approximately four hours. It is used therapeutically to reduce activity in the gastrointestinal tract, to reduce hypermotility of the bladder, to decrease salivation, and to dilate the pupil.

Atropine can produce varying effects on the cardiovascular system depending on the dosage. At low doses (< 0.5 mg) it causes bradycardia; this effect is likely due to blockage of M1 receptors on inhibitory pre-junctional neurons, which allows for increased acetylcholine release. Higher doses of atropine (>1 mg) induce tachycardia due to the blockage of SA node cardiac receptors. Atropine is also employed as an antidote to cholinesterase inhibitors, such as organophosphate pesticides and muscarine. It is also an antiarrhythmic agent often used in the esuscitation of patients with symptomatic brady-arrhythmias. Its elimination half-life is 2.5 hours.

Scopolamine: Scopolamine, like atropine, is another belladonna alkaloid and antimuscarinic agent that produces similar peripheral effects. In contrast to atropine, it is a central nervous system (CNS) depressant at therapeutic dosages. It is commonly used to prevent motion sickness and can be absorbed transdermally. It also has the unusual effect of blocking short-term memory and can be used during anesthetic procedures. Other therapeutic indications include use as a gastrointestinal antispasmodic, and as an antidysmenorrheal, urinary antispasmodic, antiemetic, and antiarrhythmic agent. It has an elimination half-life of eight hours. Adverse effects include blurred vision, dry mouth, flushed appearance, anxiety, irritability, and insomnia.

Hyoscyamine: Hyoscyamine is an antimuscarinic agent also similar to atropine but more potent in its peripheral and central effects. It is used as an adjunct in the management of peptic ulcer disease and Zollinger-Ellison syndrome, often in patients whom have failed standard therapies. It too is used as an antidote to cholinesterase inhibitors, and as a cholinergic adjunct. Its elimination half-life is 3.5 hours.[7]

Clinical Toxicology

Ingestion of Datura will induce delirium. The combination of hyoscyamine, atropine and scopolamine causes CNS stimulation at low doses and depression at higher doses. Intoxication with Datura often manifests as psychic exhilaration along with panic attacks and vivid hallucinations. Scopolamine specifically can produce a state of excitement followed by a state of depression, and it is during this transition that hallucinations can occur.

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The leaves of the Datura plant, when smoked, are hallucinogenic and hypnotic. Ingestion of the seeds may cause a change in mental status that leads to generalized confusion, delirium, and powerful hallucinations that often leave patients in a state of panic and severe anxiety. Small ingestions may cause syncope and severe headaches while larger ingestions of certain species, such as *Datura* stramonium, can be deadly due to toxic effects on the cardiac and respiratory systems. Clinical symptoms of overdose may include blurred vision, clumsiness or unsteadiness, dizziness, confusion, difficulty breathing, tachycardia, arrhythmias, hallucinations, muscle weakness, urinary retention and fever.

The diagnosis of Datura poisoning is generally made clinically, heralded by the typical anticholinergic symptoms of dry mouth, mydriasis, flushing, tachycardia, agitation and hallucinations; the toxins of the plant are not detected on standard toxicology screening assays. However, the presence of tropane belladonna alkaloids in urine samples can be demonstrated by gas chromatography-mass spectrometry.[8]

Treatment

Anticholinergic agents are absorbed through the gastrointestinal tract, so the prevention of absorption by gastric emptying is one of the first steps. Gastric lavage is indicated if the patient reaches the hospital within 1-2 hours. As with general atropine poisoning, repetitive doses of activated charcoal may be indicated. However, due to the slowed gastric motility induced by the anticholinergic agents found in the plant, it may be inadvisable to persist with activated charcoal in multiple doses because of vomiting and abdominal ileus.

To reduce severe anticholinergic symptoms and agitation, intravenous administration of physostigmine can be used.[11] All patients for whom physostigmine is contemplated should have an EKG first. Physostigmine is relatively or absolutely contraindicated in patients with cardiac disturbances.

Physostigmine is an alkaloid and a substrate for acetylcholinesterase that reversibly inactivates it. The result is potentiation of cholinergic activity throughout the body. It is used specifically in the treatment of atropine overdose. It is given in doses of 0.5-2 mg at a rate no faster than 1 mg/minute. It easily penetrates the blood-brain barrier and has a peak effect time of five minutes when given intravenously. It should be administered when toxic symptoms, such as hallucinations or tachycardia and fever are occurring. Physostigmine should be discontinued if excessive symptoms of vomiting, salivation, diarrhea and urination occur. Rapid intravenous administration can cause bradycardia, hypersalivation, and convulsions. In the most severe cases reported, physostigmine has been needed for up to 18 hours with a total dose of up to 25mg.[9]

Patients suffering from Datura poisoning generally require hospitalization due to their agitated behavior and confused mental status. Benzodiazepines are often given as adjunctive therapy for the agitated patient. Supportive care with oxygen, hydration, and symptomatic treatment are administered as needed. Observation of the patient is indicated until the symptoms resolve, usually within 24-36 hours of the ingestion.

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