Chapter 115

JEQUIRITY BEAN and ABRIN
(Abrus precatorius L.)

HISTORY

In India, there is a long history of the use of abrin from the jequirity bean plant to poison animals and humans. Administration of small doses of seeds (beans) from Abrus precatorius to protect animals from abrin poisoning is one of the earliest examples of active immunization. The seeds from Abrus precatorius are called gumchi in Hindustani and gunja in Sanskrit. The physical properties (e.g., uniformity, durability) of these seeds were used in Southeast Asia for weighing jewels and gold. An old system of weights called the Ganda system was based on multiples of the weight of four Abrus precatorius seeds. In addition, jequirity beans were used by some African and Madagascar tribes as an ordeal poison, but the delayed toxicity and the development of immunity limited the effectiveness of these seeds as an ordeal poison. In Arab countries, jequirity beans (coq’s eye) were an aphrodisiac. Extracts of these seeds were used to treat chronic eye diseases during the 19th century, particularly trachoma. In India and Sri Lanka during the early 20th century, abrin was used as a homicidal agent by stabbing the victim with a hardened, needle-shaped abrin paste.

BOTANICAL DESCRIPTION

Common Name: Jequirity Bean, Rosary Pea, Buddhist Rosary Bead, Indian Bead, Corral Peas, Paternoster Beans, Lucky Beans, Minnie-Minnies, Seminole Bead, Prayer Bead, Crab’s Eye, Weather Plant, Ojo de Pajaro, Pois Rouge, Tento Muido

Scientific Name: Abrus precatorius L.
Botanical Family: Fabaceae (pea)
Physical Description: Small (1 cm/0.4 in.) alternate compound leaflets develop on a twisting vine that grows up to 20 ft (6 m) in length. The bright scarlet seeds are 3–8 mm (0.1–0.3 in.) long and ovoid with a jet black end. The three color variations of these seeds include a red seed with a black eye (Indian native), a black seed with a white eye, and a white seed with a black eye.

Distribution and Ecology: Abrus precatorius is a vine used as an ornamental plant in tropical regions, such as southern Florida and the Florida Keys. Abrus precatorius also inhabits tropical and subtropical climates in Southeast Asia, India, Hawaii, Virgin Islands, and Puerto Rico.

EXPOSURE

Traditional herbal uses of Abrus precatorius include an anticonvulsant, insecticide, and the treatment of corneal opacities and trachoma by oculists. In the Andaman Islands of India, aborigines eat boiled jequirity beans during extreme famines. The jequirity bean is also a decorative bead in jewelry (e.g., necklace), shoes, and rosaries. Potential uses of abrin as a chemical weapon include aerosolization as a dry powder or liquid droplets and/or the contamination of food and water sources. However, to date there is no documentation of the use of abrin as an aerosolized weapon.
The seeds of the jequirity bean plant (Abrus precatorius) contain four toxic lectins (i.e., abrin compounds) that bind to carbohydrates containing terminal non-reducing galactose residues. The general structure of abrin compounds is similar to ricin with two polypeptide chains (A chain and B chain). The A chain contains 251 residues divided into three folding domains with a molecular weight of approximately 30 kDa. The B chains share the same 256 residues in addition to 12 other amino acids. There are at least three variants of abrin within Abrus precatorius species that differ in toxicity, binding ability, and lag period. The toxic constituents of the jequirity bean are heat-labile and water soluble. A thorough boiling removes these toxic ingredients. The abrin compounds consist of four isolecitins (A to D), which are monovalent compounds with molecular weights ranging from 63,000 to 67,000 Da. However, ricin and abrin are not identical disulfide-linked polypeptide chains. Based on minimal lethal intravenous doses to mice, abrin (0.7 μg/kg) is approximately four times more potent than ricin (2.7 μg/kg).
CLINICAL RESPONSE

The ingestion of jequirity beans frequently involves children, who are attracted to the bright colors of the seeds. These ingestions are usually asymptomatic because the whole bean passes through the gastrointestinal tract without absorption of abrin from the bean. Serious abrin ingestion produces a severe gastroenteritis several hours after consumption, followed by the development of bloody diarrhea. Delayed symptoms do not usually occur during abrin intoxication; however, rare case reports associated the development of cerebral edema, altered sensorium, and seizures 4–6 days after ingesting 7–10 crushed jequirity beans. One of these patients died, but the cause of death was unclear because of the lack of imaging studies or an autopsy. The latter case is typical of fatalities associated with exposure to jequirity beans. These case reports lack sufficient clinical details to determine the cause and mechanism of death. Jequirity beans are highly antigenic and exposure to material in these beans may produce allergic or anaphylactic responses, particularly in atopic patients.

DIAGNOSTIC TESTING

Older analytical techniques include the detection of aqueous extracts of A. precatorius by characteristic ultraviolet absorption on spectrophotometry. Radioimmunoassays have limits of detection near 50–100 pg abrin/mL, and there is little cross-reactivity of abrin with ricin on radioimmunoassay. In animal experiments, sublethal parenteral doses of abrin cause a leukocytosis and mild to moderate elevation of serum hepatic aminotransferases. There are few data on the laboratory abnormalities in humans following the ingestion of jequirity beans.

TREATMENT

The treatment of jequirity bean poisoning is supportive. Decontamination measures are usually unnecessary after the ingestion of whole seeds. The administration of activated charcoal is a therapeutic option for patients, who present to a health care facility within one hour of the ingestion of well-masticated seed, but there are no clinical data to determine the efficacy of decontamination measures including activated charcoal in this clinical setting. There are no commercial antidotes or efficacious methods to enhance the elimination of abrin.

Consequently, there is no commercial source of the antiserum. Careful fluid and electrolyte replacement is the most important aspect of management. In general, supportive care is similar to treatment for ricin (castor bean) poisoning. Asymptomatic children may be observed at home; symptomatic patients should be hospitalized. Gram-negative sepsis from the passage of intestinal bacteria across damaged intestinal mucosa should be considered when a patient with serious abrin ingestion develops fever and hypotension.

References


