Clinical Medicine

Seizures and Death on a White River Float Trip

Report of Water Hemlock Poisoning

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White river rafting is becoming a major summer recreational activity throughout the United States. Many people who are ill prepared physically or emotionally to survive will find themselves isolated and in extremely dangerous situations without access to medical help. In addition to the physical dangers of drowning, there are dangers that exist in the concept of "living off the land" and foraging for food. Cicuta douglasii *is found in all of our western states, is extremely toxic and can easily be confused with wild parsnip or carrot. Physicians and poison control centers need to be aware of the common poisonous plants in their area and be prepared to treat cases of poisoning from these plants.*

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White river rafting is becoming a major recreational activity because of the large number of scenic rivers in the United States. A rough estimate of the number of people in Idaho involved in float trips annually would be in the range of 25,000 to 30,000. The Middle Fork of the Salmon River alone had about 8,000 people on it during 1980. Out of a total of 670 separate launches on this river, 373 of these were private launches in which no outfitter was present (Ken Olsen, Mackay Bar Idaho's Wilderness Company, oral communication, June 1984).

It is not a common practice for outfitters to allow consumption of any wild foliage while on the river with the exception of some berries, such as huckleberries and currant berries. However, since the publication of books by Euell Gibbons* that extolled the concepts of "returning to nature" and equating all things natural with being "good," many people are experimenting with living off the land and eating "edible" plants. *Cicuta douglasii,* the Western water hemlock plant, has roots that look like parsnip roots and have a parsnip or celerylike odor, thus tempting people to make the fatal mistake of eating them.[1] Unfortunately, there is a thin line between edible and poisonous plants, and when a mistake is made while on a rafting trip, the victims are usually far from any medical help and oftentimes inaccessible except by riverboat or helicopter.

In late April 1984, six out of eight men on a float trip on the Owyhee River in eastern Oregon were poisoned after eating what was thought to be wild parsnip. Four of the men each took from one to four small bites of the root (rhizome) while the other two men ate at least one of the rhizomes. About 45 minutes after eating the root, one person (case 1) had a grand mal seizure that the other men assumed was an epileptic seizure. When a second person (case 2) had a grand mal seizure about 15 minutes later, the remaining members of the party began to suspect that the roots they had eaten were poisonous. One of the four men who ate only a small amount of the root, a senior medical student at The University of Oregon Health Sciences Center, attempted to maintain the airways to protect the seizing patients; despite his efforts, however, the second man suffered cardiopulmonary arrest and could not be resuscitated.

The following case reports from the Southwest Idaho Poison Control Center at St Alphonsus Medical Center in Boise are presented to draw attention to a deadly poisoning that could occur in any of our western states.

Reports of Cases

Case 1

The patient, a 27-year-old man, was admitted to St Alphonsus Regional Medical Center in late April 1984, seven hours after ingesting a large rhizome of the water hemlock plant, *C douglasii (Cicuta vagans).* Seizure activity with generalized tonic-clonic movements had developed about 45 minutes after he ate the rhizome. The seizures lasted about two

**Stalking the Wild Asparagus* (1962), *Stalking the Healthful Herbs* (1966) and *Beachcomber's Handbook* (1967), all published by D. McKay Company, New York.

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minutes each and occurred at 1345, 1415, 1440, 1517 and 1656 hours (Table 1). The patient had partial airway obstruction with cyanosis, bradycardia and decreased pulse pressure during the seizures; he did not suffer a respiratory arrest at any time. After the last seizure at 1656, the patient was quite lethargic but was arousable.

He was evacuated by helicopter to St Alphonsus where he had a workup and was treated. On examination he was lethargic but arousable and oriented to person and place but not to time. Blood pressure was 172/92 mm of mercury, the pulse rate 80 beats per minute and respirations 20 per minute. The skin was not cyanotic and showed no evidence of trauma.

TABLE 1.—*Seizure Sequence in Two Men Who Ingested Water Hemlock Rhizomes (Ingestion Occurred About 1300 hr)*

	Time	
Seizure Episode	*Case 1*	*Case 2*
1	1345	1400
2	1415	?
3	1440	1441
4	1517	1450*
5	. . .	1500*
6	1656	1535†

*A dreamlike state with low-volume yelling of nonintelligible sounds occurred between seizures 4 and 5.
†Cardiopulmonary arrest following seizure 6.

With the exception of the patient's lethargy, the physical examination showed no abnormalities.

After lavage of his stomach was done, he was given 60 grams of activated charcoal. An intravenous line was established for fluid replacement of lactated Ringer's solution and for venous access in case of the need for diazepam (Valium) for seizure control. During the patient's stay in the Emergency Department and hospital, no seizures were noted.

Laboratory studies on admission gave the following values: serum glucose, 199 mg per dl; creatinine, 1.8 mg per dl; uric acid, 15.6 mg per dl, and lactic dehydrogenase, 301 units. Serum electrolyte values were within normal range. Leukocytes numbered 17,400 per μl and the hemoglobin was recorded at 16.4 grams per dl.

A urinalysis showed 2+ occult blood with 0 to 2 leukocytes per high-power field and 0 to 2 erythrocytes per high-power field. A urine drug screen was negative.

An electroencephalogram that was done two days after ingestion of the water hemlock was diffusely abnormal. It showed synchronous and symmetrical bilateral theta activity of the type that might be seen with toxic metabolic conditions or increased intracranial pressure.

The patient was observed in hospital for two days, during which time he had no seizures and gradually became more arousable. Following dismissal from the hospital he continued to be amnestic for the seizure period and he had short

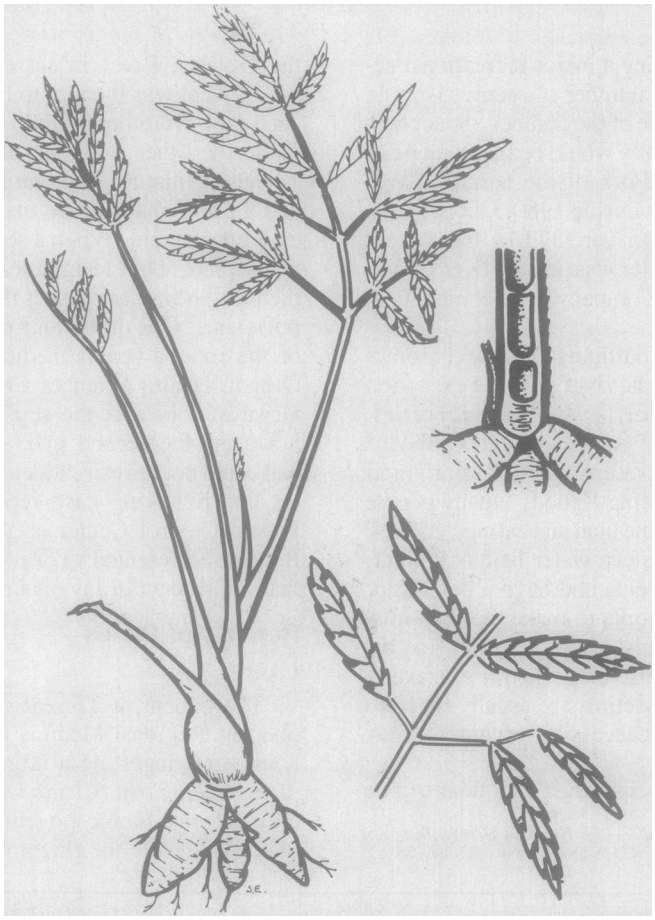

Figure 1.—*Cicuta douglasii.* The young water hemlock plant is cut lengthwise through the stem base. The central main vein runs the length of the leaflet.

periods of difficulty finding the words he wanted. He also complained of short periods in which his mind was a little fuzzy.

Case 2

This 22-year-old man ingested two large rhizomes of the water hemlock plant, *C douglasii.* About one hour after eating the rhizomes, he had severe seizure activity with generalized tonic-clonic movements. As noted in Table 1, he had six seizures between 1400 and 1535 hours before he suffered a cardiopulmonary arrest. After the cardiac arrest, cardiopulmonary resuscitation was done; however, the patient did not respond to the basic life support and died without regaining a pulse or blood pressure.

Discussion

Water hemlock, beaver poison, cowbane, five-finger root, wild carrot, wild parsnip and false parsley are only some of the names commonly applied to several toxic members of the genus *Cicuta,* of the Umbelliferae or carrot family. *Cicuta maculata* is found in eastern North America whereas *C douglasii (C vagans)* is found primarily in the western United States.[2] Because *Cicuta* is a member of the carrot family, the flowers are typically of the umbel type—that is, with compact masses of flower heads. Water hemlock is probably the most poisonous plant that grows in the United States and is known to be extremely toxic to livestock and to humans, with an overall mortality of about 70%.[2] Water hemlock grows in moist ground such as marshes or along rivers or ditches and can easily be confused with wild parsnip, celery, artichokes, sweet potatoes or sweet anise. The root system (Figure 1) consists of a series of large roots (rhizomes) that occur in a bunch attached at a single point to the thickened base of the stem. They look much like a clump of dahlia roots but are smaller. In the spring the roots are the most toxic portion of the plant; as little as one mouthful can kill an adult. Later in the year, the roots are less poisonous, but the leaves and stems contain enough poison to be toxic if ingested.[3]

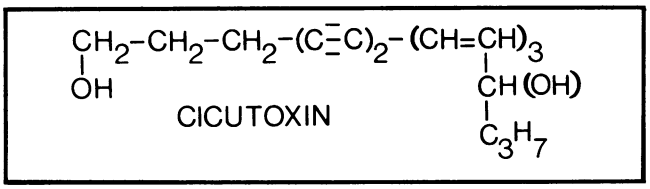

Figure 2.—Cicutoxin structure.

Cicutoxin (Figure 2), the poisonous substance in water hemlock, is a highly unsaturated aliphatic alcohol:

(trans)heptadeca-8:10:12-triene-4:6-diene-1:4 diol

This toxin has a characteristic, dramatic physiologic action that starts 15 to 60 minutes following ingestion.[2]

Poison hemlock, *Conium maculatum,* is a European plant that has been introduced into North America and should not be confused with water hemlock. Poison hemlock and wild carrot both have a long, white, unbranched, turniplike taproot (Figures 3, 4). Poison hemlock was undoubtedly the source of the poison with which Socrates was put to death. It contains several alkaloids that are chemically related to nicotine. Poison hemlock acts by depressing the central nervous system and bringing on paralysis. Death occurs when the muscles of respiration become paralyzed. Figures 3, 4 and 5 show the close resemblance of these plants.

All of the patients who ingested the water hemlock exhibited the early muscarinic and cholinergic symptoms of nausea, abdominal cramping and epigastric distress. In only the two cases reported did the excessive salivation, bronchorrhea, hypotension and seizures that accompany serious poisoning develop. Seizures in both patients started 45 to 60 minutes after ingestion of the water hemlock. The patient in case 2 had five grand mal seizures (Table 1) before suffering cardiopulmonary arrest. During the time between the fourth and fifth seizures, the patient was reported to have a "dream-

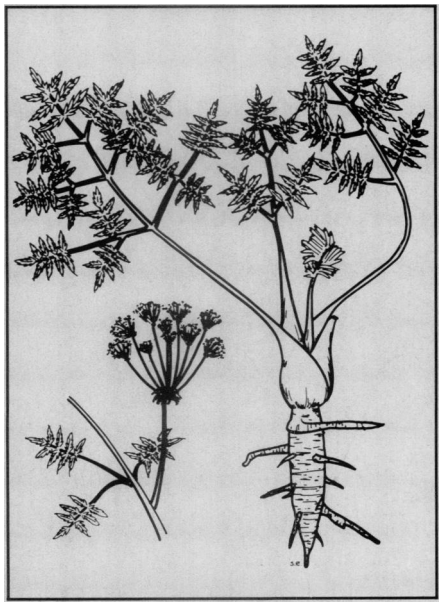

Figure 3.—*Conium maculatum.* A young poison hemlock plant with a long, unbranched taproot.

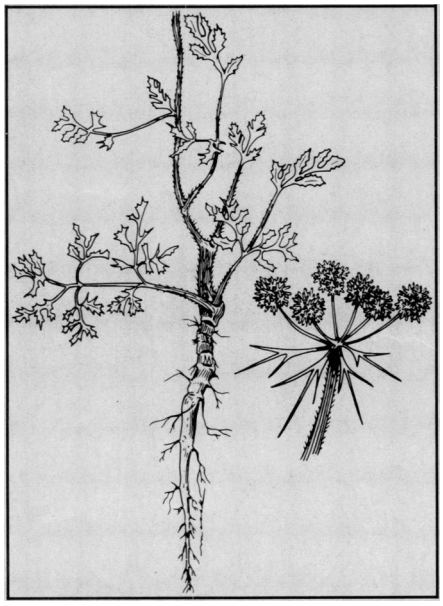

Figure 4.—*Daucus carota.* A young wild carrot plant with a long, unbranched taproot. Note resemblance of taproot to that of poison hemlock.

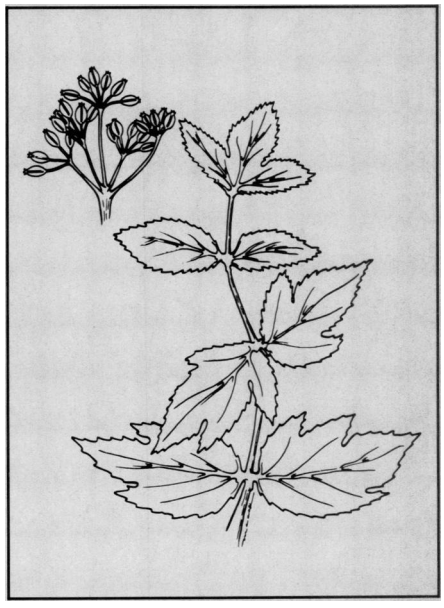

Figure 5.—*Pastinaca sativa.* Wild parsnip leaves and umbel. Note similarity to water hemlock.

like state with low-volume yelling of unintelligible sounds." The patient in case 1 had five grand mal seizures followed by periods of unconsciousness and stupor. It has previously been reported that the convulsions and spastic-tonic movements observed with cicutoxin poisoning are the result of stimulation of the cholinergic-receptor sites in the brain stem (reticular formation) or of the basal ganglia.[4,5] Because of the severe seizure activity, it was difficult to maintain an airway and both patients were reported to have periods of apnea and cyanosis.

The amount of cicutoxin absorbed appears to be a determinant of the severity of symptoms and of survival. The earliest gastrointestinal response may include vomiting and this may be somewhat protective if the undigested root is removed from the stomach. Numerous authors have reported considerable fluid loss as a result of the violent vomiting and sequestering of fluid in the bowel wall. It has been suggested that this fluid loss results in reduced arterial circulating volume and subsequent hypotension.[6] Although reduced circulating blood volume undoubtedly plays a role in the development of hypotension, it has been shown that an intravenous injection of extract from the water hemlock root diluted with alcohol will result in hypotension within 60 seconds.[7] The hypotensive effect that followed the intravenous injection of the water hemlock extract was followed by the onset of unmistakable convulsive electroencephalographic patterns. This suggests that the cicutoxin has a direct cardiovascular effect that contributes to its toxicity.[7,8]

Treatment of cases of water-hemlock ingestion has been well described by many authors and is not unlike the treatment of any poisoning case that is accompanied by airway obstruction and seizures.[9-13] The airway should be maintained using standard methods including endotracheal intubation, if needed and available. Emesis should be initiated unless a patient is comatose, convulsing or has lost the gag reflex. Seizures should be controlled with intravenous administration of diazepam, and hypotension should be treated by restoring the patient's circulating blood volume with an isotonic solution given intravenously.[3-5]

The above treatment protocol can be carried out in an emergency department; however, if confronted with this problem while on a camping or float trip, it is unlikely that there will be any resources available other than one's knowledge and hands. When it was realized that the "wild parsnip" ingestion was responsible for the seizures, all of the men attempted to induce vomiting without success. They had no syrup of ipecac with them and they did not realize that drinking a liquid dish soap will usually induce vomiting. The usual dose is one tablespoon of soap in eight ounces of water.

Conclusion

As more and more people "return to nature," the number of cases of poisoning that occur from foraging for wild foods is likely to increase. While medical treatment is not likely to be available for these patients, educational programs by poison control centers or physicians should result in a reduction in these poisonings.

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