

HEMLOCK



“Death of Socrates”, oil on canvas, 1787, Jacques Louis David, Metropolitan Museum of Art, New York City.

I will try to tell you everything from the beginning.

On the previous days I and the others had always been in the habit of visiting Socrates. We used to meet at daybreak in the court where the trial took place, for it was near the prison; and every day we used to wait about, talking with each other, until the prison opened, for it was not opened early; and when it was opened, we went in to Socrates and passed most of the day with him. On that day we came together earlier; for the day before, when we left the prison in the evening we heard that the ship had arrived from Delos. So we agreed to come to the usual place as early in the morning as possible. And we came, and the jailer who usually answered the door came out and told us to wait and not to go in until he told us. “For”, he said, “the eleven are releasing Socrates from his

fetters and giving directions how he is to die today". So after a little delay he came and told us to go in. We went in then and found Socrates just released from his fetters and Xanthippe - you know her - with his little son in her arms, sitting beside him. Now when Xanthippe saw us, she cried out and said the kind of things that women always do say: "Oh Socrates, this is the last time now that your friends will speak to you or you to them". And Socrates glanced at Crito and said, "Crito, let somebody take her home". And some of Crito's people took her away wailing and beating her breast...

Crito said, "I think Socrates, the Sun is still upon the mountains and has not yet set; and I know that others have taken the poison very late, after the order had come to them, and in the meantime have eaten and drunk and some of them enjoyed the society of those whom they loved. Do not hurry for there is still time".

And Socrates said, "Crito, those whom you mention are right in doing as they do, for they think they gain by it; and I shall be right in not doing as they do; for I think I shall gain nothing by taking the poison a little later. I should only make myself ridiculous in my own eyes if I clung to life and spared it, when there is not more profit in it. "Come", he said, "do as I ask and do not refuse".

Thereupon Crito nodded to the boy who was standing near. The boy went out and stayed a long time, then came back with the man who was to administer the poison, which he brought with him in a cup ready for use. And when Socrates saw him, he said, "Well, my good man, you know about these things; what must I do?" "Nothing", he replied, "except drink the poison and walk about until your legs feels heavy; then lie down, and the poison will take effect of itself".

At the same time he held out the cup to Socrates. He took it, and very gently, Echecrates, without trembling or changing colour or expression, but looking at the man with wide open eyes, as was his custom, said, "What do you say about pouring a libation to some deity from this cup. May I, or not?...we prepare only as much as we think is enough". "I understand", said Socrates, "but I may and must pray to the gods that my departure hence be a fortunate one; so I offer this prayer, and it may be granted". With these words he raised the cup to his lips and very cheerfully and quietly drained it. Up to that time most of us had been able to restrain our tears fairly well, but when we watched him drinking and saw that he had drunk the poison, we could do so no longer, but in spite of myself my tears rolled down in floods, so that I wrapped my face in my cloak and wept for myself; for it was not for him that I wept, but for my own misfortune in being deprived of such a friend. Crito had got up and gone away even before I did, because he could not restrain his tears. But Apollodorus, who had been weeping all the time before, then wailed aloud in his grief and made us all break down, except Socrates himself. But he said, "What conduct is this, you strange men! I sent the women away chiefly for this very reason, that they might not behave in this absurd way; for I have heard that it is best to die in silence. Keep quiet and be brave". Then we were ashamed and controlled our tears. He walked about and, when he said his legs were heavy, lay down on his back, for such was the advice of the attendant. The man who had administered the poison laid his hands on him and after a while examined his feet and legs, then pinched his foot hard and asked if he felt it. He said "No"; then after that, his thighs; and passing upward in this way he showed us that he was growing cold and rigid. And again he touched him and

said that when it reached his heart, he would be gone. The chill had now reached the region about the groin, and uncovering his face, which had been covered, he said - and these were his last words - "Crito, we owe an offering to Aesculapius. Pay it and do not neglect it". "That", said Crito, "shall be done; but do you have anything else to say?". To this question he made no reply, but after a little while he moved; the attendant uncovered him; his eyes were fixed. And Crito when he saw it, closed his mouth and eyes.

Such was the end, Echecrates, of our friend, who was, as we may say, of all those of his time whom we have known, the best and wisest and most righteous man.

Plato, 399 B.C.E

If we imagine to list the dozen or so who have had the profoundest influence on the history of human affairs, the world's first "philosopher" Socrates would surely rank highly. His greatest message to us echoes powerfully down through the countless centuries since his death, "the unexamined life is not worth living and ethical value is the only thing that matters". During his life time he did not record a single word - or if he did they are now lost. Everything we know of his existence comes to us via his companions but especially from his most famous pupil, Plato, in the form of his "Socratic Dialogues". His most important contribution to Western thought was his method of enquiry, or "elenchus" in Greek, which he principally applied to the examination of key moral concerns of Good and Justice. Problems would be solved by breaking them down into a series of questions, the answers to which gradually distill the final solution. This is analogous to the modern scientific method we use today, where the hypothesis is the first stage of enquiry into truth. Needless to say Socrates' "rational questioning of everything" did not endear him to the authorities of the Athenian state, especially when he had repeatedly made them look foolish and had gathered a very large following in so doing. The state, brought charges of "corrupting the young" and "neglecting the gods" against him, and condemned him to death. He was offered the option of suicide by hemlock, an option many condemned chose to take, considering the alternative forms of execution that then existed.

Socrates' two greatest followers would shape the Western scientific mindset, that exists to this day. Plato would be the father of humanism, truth through deep and critical contemplation. Aristotle would be the father of science, truth through empiric observation and the scientific method. All this would be lost for close on a millennium, tenuously kept alive by the Islamic world, during the long Dark Ages of the West that followed the collapse of the Western Roman Empire. But the West would reemerge from the darkness in spectacular fashion, in the form of the two most astonishing cultural developments in history. In the Arts Plato would inspire the Renaissance. In the sciences Aristotle would inspire the Enlightenment. Both Plato and Aristotle were themselves inspired by one man - their beloved teacher, Socrates.

HEMLOCK

Introduction

Conium maculatum, the **hemlock plant**, contains one of the most poisonous toxins known in the plant kingdom.

It has been used as a means for poisoning and suicide since at least the Fourth century B.C.E.

Death is usually by respiratory paralysis.

There is no specific antidote to hemlock, and treatment is decontamination and supportive.

Prognosis is good with early and appropriate supportive care.

Terminology:

The Hemlock plant has many misleading common names, including; Carrot fern, Poison parsley, Winter fern, so the correct botanic identification is crucial.

Poison hemlock has been responsible for many human fatalities because of the resemblance of the seed to Anise, the leaves to parsley or carrot, and the roots to parsnips

Hemlock most commonly refers to *Conium maculatum* (poison hemlock) but can refer also to *Cicuta species* (water hemlock), which are related and also significantly toxic, but contain different toxic components.

Although many symptoms overlap, differentiation is important; in severe poisoning *Conium maculatum* causes **respiratory paralysis**, whereas *Cicuta species* plants result in profound seizure activity.

Habitat

Conium maculatum was originally native to Europe and Western Asia.

It has been introduced to America, North Africa, Australia, and New Zealand.

History

Hemlock has been used as a means for poisoning and suicide since at least the Third century B.C.

In ancient Greece it was used as a means of execution. Those condemned to death were given the option is voluntarily drinking a highly concentrated brew of the plant - most accepted in the light of alternative means of execution them practiced by the state.

The most famous person condemned to death by this means was Socrates.

Extracts of this species were used “medicinally” in the past (as were many other highly poisonous plants - such as strychnine) as both a sedative and an antispasmodic. However, because of the plants extreme toxicity, medicinal use was abandoned (in the West) by the early 20th century

Botany



Conium maculatum, (Poison Hemlock)

Conium maculatum is a member of the Umbelliferae family of plants.

It is a tall herbaceous plant of moist hedgerows, river banks and waste grounds. It is found throughout the UK and Ireland, but is absent from large parts of Scotland.

It grows up to 3 meters in height.

Leaves are finely divided and very **fern like**.

Stems are smooth and hollow with purple spots/blotches.

Flowers are small and white on thin stalks arising from the same point at the top of each stem and grouped together in 10-20 to form a flat topped inflorescence (or umbel).

Fruit consist of a pair of flattened, greyish-brown seeds, with five prominent wavy longitudinal ridges, which are about 3 mm long when ripe

Hemlock is said to have an unpleasant mousy odour, more noticeable when its leaves or flowers are crushed.

Different parts of the plant have (tragically) been confused with other plants:

- Its fruits with aniseed
- Its leaves with parsley and wild carrots
- Its roots with parsnip.

Pharmacokinetics

Absorption

Systemic symptoms can occur after ingestion of fresh hemlock plant material.

Although the active alkaloids are oily volatile liquids, deaths have been reported after drinking liquid from boiling hemlock leaves.

Nicotine-like alkaloids are generally well absorbed across all routes of exposure.

Skin contact may cause a burning sensation, numbness or dermatitis. Systemic toxicity is possible from dermal contact.²

Distribution:

Coniine crosses the placenta and the blood brain barrier

It is also distributed in breast milk.

Metabolism:

Nicotine-like alkaloids are metabolized by the liver, and metabolites are renally excreted.

Pathophysiology

Toxins

The hemlock plant contains several toxic alkaloids, but the main toxic constituent is **coniine**. Coniine is extremely toxic.

All parts of the plant are toxic.

Drying is thought to somewhat reduce toxicity, but poisonings have still occurred.

Seeds of hemlock are toxic whether fresh or dried.

The hemlock alkaloids are structurally related to nicotine.

The effects of coniine are essentially similar to those of nicotine, but with more pronounced CNS effects.

Coniine stimulates nicotinic receptors at autonomic ganglia, the CNS, the NMJ, and the adrenal medulla causing a biphasic toxic pattern. There is initial neural and muscular stimulation (with tachycardia and hypertension) then followed by bradycardia, hypotension, coma and respiratory failure.

Coniine also has some non-depolarizing curare-like actions at the neuromuscular junction.

Risk Assessment

An adult lethal dose is 100 to 300 mg of the toxic alkaloids.

Some have become poisoned after ingesting the meat from birds that have ingested hemlock buds or seeds. The birds themselves (quails, robins, skylarks, chaffinches) are *not* susceptible to the hemlock alkaloids.

The toxic content of plants may vary from year to year due to various factors that affect growth such as available moisture and spring temperatures.

Thus, it is difficult to establish a precise association between the severity of symptoms in relation to the ingestion of a specific amount of plant material ingested.¹

All parts, but especially the seeds and flowers, should be regarded as poisonous, even when dried.

In any case, *any* amount of ingestion of hemlock, must be considered potentially lethal.

Clinical Features

The onset of symptoms following ingestion can range from **15 minutes** to **3 hours**.

Clinical features following ingestion are principally nicotinic and include:

1. Initial features include irritation of the mouth with hypersalivation.

Following this:

2. GIT upset
 - Nausea, vomiting and abdominal pain.
3. Adrenergic features:
 - Tachycardia, tremor, sweating, dilated pupils.

Due to stimulation of nicotinic receptors in sympathetic ganglia.

4. Later bradycardia and constricted pupils may be seen
5. Rhabdomyolysis may occur.
6. Renal failure can occur as a result of dehydration, and myoglobinuria.
7. Neurological features:
 - Ataxia, and paraesthesiae
 - Convulsions / Coma
 - Muscle fasciculations followed by an **ascending flaccid paralysis** in the limbs, and eventually leading to respiratory paralysis and death.

Severity assessment:

Severity of poisoning has been classified as follows: ¹

Mild Conium maculatum Toxicity	Moderate Conium maculatum Toxicity	Severe Conium maculatum Toxicity
GIT effects	Severe GIT effects	Bradycardia
Thirst	Salivation/ bronchorrhea	Hypotension
Nausea	Abdominal pain	Seizures
Vomiting	Mydriasis	Ascending Paralysis
Agitation	Muscle weakness	Rhabdomyolysis
	Muscle fasciculations	Renal failure
	Myalgia	Respiratory failure
	Drowsiness	Coma
	Tachycardia/ Tachypnea	
	Pallor/cool periphery	
	Respiratory depression	

Investigations

Blood tests:

1. FBE
2. U&Es/ glucose
3. LFTs
4. Coagulation profile.
5. ABGs/ lactate
6. CK

Coniine blood levels are *not* readily available, however these are not necessary for clinical management.

ECG:

As for any significantly unwell patient.

Management

There is no specific antidote to hemlock poisoning and treatment is entirely supportive.

1. ABC:
 - The mainstay of treatment will be respiratory support, intubation and mechanical ventilation may be required.
 - Atropine is useful to control bradycardia, hypersalivation, bronchorrhea and wheezing.
2. Charcoal:
 - Consider activated charcoal if the patient presents within 1 hour of ingestion, providing the airway can be protected.
 - This can be given via a nasogastric tube in intubated patients.
3. Hypotension:
 - Fluids and inotropes as required
4. Seizures:

- These are treated along conventional lines.
 - Most toxic seizures however are short-lived and often do not require specific intervention.
5. Arrhythmias:
- These are treated according to standard protocols.
6. Renal support:
- Dialysis may be indicated for secondary complications, such as acidosis, hyperkalemia or renal failure, but is not useful for toxin removal alone.

Disposition

Patients should be observed for a minimum of 4 hours following ingestion.



“Conium maculatum”, Chromolithograph from Franz Eugen Köhler’s, “Medizinal Pflanzen in Naturgetreuen”, 1887.

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