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Suicidal Poisoning by Ingestion of Taxus Baccata Leaves: A Case Report with Review of the Literature

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Abstract

Taxus baccata is one of the most poisonous trees in the world. It contains taxanes and toxic alkaloids: the most dangerous one is the taxine. It is a fairly common plant in our environment and could be extremely dangerous; however, yew poisoning is quite rare. Cases may occur by voluntary or accidental ingestion. Therefore, the rapid orientation and diagnosis of suspected episode are important, in order to treat it quickly.

There are no specific clinical or analytical alterations in this intoxication and it is very difficult to determine in each case the evolution of the episode. Patients who ingest a lethal dose frequently die due to cardiac arrest, in spite of resuscitation efforts. At present, no specific therapy exists. Therapeutic procedures reported in the literature are only referred to in published case reports, so there is insufficient evidence to recommend any treatment in yew poisoning.

In our case report, we describe poisoning by ingestion of Taxus baccata leaves in a suicide attempt, its clinical evolution and its management and we do a brief review of the literature about yew poisoning.

Keywords: 3,5-dimethoxyphenol; Cardiotoxicity; Poisoning; Taxine; Taxus baccata; Yew

List of abbreviations: ECG: Electrocardiogram; GC/MS: Gas chromatography/mass spectrometry

Introduction

Taxus baccata (Common yew, English yew, or European yew), native to western, central and southern Europe, is one of the most poisonous trees in the world. It contains taxanes (from which antineoplastic drugs, such as paclitaxel, are obtained) and toxic alkaloids. The most dangerous one is the taxine, a dose-dependent sodium and calcium channel antagonist.

It is a fairly common plant in our environment and could be extremely dangerous; however, yew poisoning is quite rare. The whole tree is toxic, except for the aril of its berries. Cases may occur by voluntary or accidental ingestion. Therefore, the rapid orientation and diagnosis of suspected episode are important, in order to treat it quickly.

Case Presentation

48-year-old man was transferred by ambulance to the emergency department of the hospital, with no symptoms, 2 hours after autolytic attempt by abundant yew leaves ingestion. He was aware of the arrival of the ambulance and he said that he was cutting yew leaves and ingesting them, although he could not specify the exact amount. The physical examination was normal and the analysis only presented respiratory alkalosis, mild leukocytosis ($13.75*10^3$/μL (3.8-10)) and increased lactate (4.66 mmol/L (<2)).

While in emergency room stay he suffered from abrupt reduced consciousness and ventricular fibrillation that had required electrical cardioversion, 200 joules twice. Subsequently, he presented aberrated rhythm with wide QRS and ventricular tachycardia. Amiodarone (IV 300 mg) was administered and orotracheal intubation and mechanic ventilation were performed. Therefore, he entered the intensive care unit. The results of a second analysis were leukocytosis ($20.96*10^3$/μL (3.8-10)) and increased lactate

2.89 mmol/L (<2), high-sensitivity troponin T (19.3 ng/L (0-14)) and creatine kinase (237 U/L (0-189)). Rest of the analysis were normal (Figure 1).

Parameters (Units)	Results						Reference values
	18 March 17:45	18 March 19:35	18 March 21:25	19 March 8:15	20 March 8:15	21 March 8:25	
Bilirubin (mg/dL)	-	1.19	-	1.67	1.71	1.29	[0-1.1]
Creatinine (mg/dL)	0.98	0.95	1.02	1.01	0.70	0.67	[0.70-1.20]
Glucose (mg/dL)	109	186	263	124	117	94	[70-110]
Total proteins (g/dL)	7.32	5.90	5.93	5.91	-	-	[6.6-8.7]
Chlorine (mEq/L)	96	98	97	103	104	107	[93-110]
Sodium (mEq/L)	137	136	138	140	135	142	[135-145]
Potasium (mEq/L)	3.77	3.68	3.72	4.62	3.99	3.83	[3.3-5.1]
Calcium (mg/dL)	10.1	8.1	8.7	8.5	-	-	[8.6-10.2]
Lactate (mg/dL)	4.66	2.89	2.78	1.55	1.67	-	[<2]
High-sensitivity troponin T (ng/L)	-	19.3	110	99.9	-	-	[0-14]
NT-proBNP (pg/mL)	-	96	217	1222	-	-	[0-300]
Creatine kinase (U/L)	-	237	427	-	-	-	[0-189]
C-reactive protein (mg/L)	-	1.9	-	24.6	96.7	56.4	[0-5]
Procalcitonin (ng/mL)	-	-	-	0.83	0.56	0.36	[<0.5]
pH	7.63	7.36	7.36	7.47	7.43	-	[7.35-7.45]
pO_2 (mmHg)	112	193	380	188	102	-	[83-108]
pCO_2 (mmHg)	15	32	37	32	36	-	[35-48]
Bicarbonate (mmol/L)	15.8	18.1	20.9	23.3	23.9	-	[21-28]
O_2 saturation (%)	98.8	99.7	100.2	99.8	98.8	-	[95-99]
Red blood cells ($*10^6/\mu L$)	5.170	4.830	5.150	5.080	4.110	4.140	[4.3-5.6]
Hemoglobin (g/dL)	15.5	14.7	15.8	15.4	12.7	12.5	[13-17]
White blood cells ($*10^3/\mu L$)	13.75	20.96	26.06	19.33	13.84	10.54	[3.8-10]
Platelets ($*10^3/\mu L$)	235	204	229	216	160	133	[140-400]
Prothrombin time (%)	-	86	-	83	75	90	[70-140]
APTT (sec)	-	26.4	-	29.6	33.8	31.4	[24-36]

Figure 1: Analysis results

Since admission, he had tendency to bradycardia (less than 50 beats/min) alternating with wide QRS tachycardia (up to 110 beats/min). Nasogastric tube was placed and activated charcoal and Mg sulfate (IV 1 g) were administered. Treatment with vasopressor support with norepinephrine and inotropic support with dopamine was also initiated, and calcium gluconate (IV 200 mg) was given for the purpose of myocardial membrane stabilization. He had some episodes of pulseless ventricular tachycardia that required several attempts of electrical cardioversion, reversing the episodes to chaotic rhythms with wide QRS and tendency to bradycardia. Therefore, an external pacemaker was placed to recover the cardiac frequency and the blood pressure.

Doctors called toxicology department that refered there is no antidote for this poisoning and recommended continuing with activated charcoal, forcing diuresis without alkalizing the urine and treating with vasoactive support. After 24 hours, he achieved progressive clinical and hemodynamic stabilization. The ECG, after this stabilization, showed signs compatible with Brugada Syndrome type I in V1-V2. Apparently, yew toxin interacts in the same sites (sodium channels) as in people who genetically have this syndrome. With Glasgow 15, the extubation proceeded without problems and the pacemaker was removed, after confirming by echocardiogram that he had no cardiac abnormalities. In analysis, leukocytes and cardiac enzymes were altered with good evolution. Given the normalization of the ECG and the absence of arrhythmic events in the next 72 hours, the episode was interpreted as secondary to the toxin of yew, so it was not considered convenient to adopt other measures. He fully recovered in a week.

The final diagnosis was confirmed by the detection of 3,5-dimethoxyphenol, by GC/MS. Samples (EDTA blood and heparin plasma) were analyzed by the Spanish National Institute of Toxicology and Forensic Sciences, 7 months after their obtention and preservation at 2-8 ºC. 3,5-dimethoxyphenol was detected in both samples.

Discussion

Yew (Taxus spp.) is a coniferous tree of the Taxaceae family, typical of mountainous areas with cool and humid environments. It contains taxanes and toxic alkaloids (such as taxine). There are many species and one of them is Taxus baccata [1].

Taxus baccata is a species of the genus Taxus, one of the most toxic trees in the world. It grows slowly, reaching a longevity up to 5000 years. They rarely form forests, being commonly found as isolated individuals. It is a conifer with a persistent leaf that can reach 20 meters high, although usually they don´t exceed the size of a small tree. The trunk is usually thick and short and can reach 4 meters in diameter. Its crown is pyramidal, very dense and dark, with abundant branches and it projects a very dense shade. The leaves, thin and dark green colour, are grouped in spiral on the branch (Figures 2 and 3).

The yew tree has been known since antiquity for its toxicity. It was a sacred tree for the Celts. In ancient times, it was a desired species, particularly for its high quality wood, and was studied both for its medicinal and poisonous properties. It was known as the "tree of death" by the Greeks and Romans and among the ancient Galician, Asturian, Cantabrian and Vasconian populations of the Iberian Peninsula the practice of suicide with yew poison was widespread. It was part of some of their rituals, probably due to the extraordinary longevity of the plant, which makes it seem immortal. For this reason, in many parts of Europe, individual ancient yew trees are considered monuments of nature and, therefore, they are protected and conserved.

Figure 2: Taxus baccata in Gaztelu, Gipuzkoa (Basque Country)

Figure 3: Taxus baccata in Arimekorta, Bizkaia (Basque Country)

Currently, yew (Taxus baccata) poisoning is very rare, being of extreme gravity or fatal if it happens. The tree contains a toxic substance called taxine that is dangerous and deadly. It is a mixture of alkaloids that generate gastrointestinal irritation and cardiotoxic effects [2], since it antagonize the sodium and calcium channels in the myocyte causing heart paralysis at high doses. The lethal dose has been estimated at 50-100 grams of leaves, and the twigs and fallen leaves of the tree are as toxic as the fresh plant. Death can occur due to acute cardiotoxicity, although in most cases symptoms usually appear over the course of several hours and even days after exposure [3]. However, as toxins are absorbed quickly, in some cases death occurs by cardiotoxicity so early that no symptoms are manifested.

Initial symptoms usually show up one hour after the ingestion and are mostly neurological (dizziness, muscle weakness, vertigo) and gastrointestinal (nausea, vomiting, diarrhea, abdominal pain). Later, there might be mydriasis, seizures and lethargy, and finally, after 3 hours there is risk of having cardiovascular alterations (ventricular tachycardia, ventricular fibrillation, bradycardia and cardiac arrest).

There are no specific analytical alterations in this intoxication. Taxine compound analysis is not made in clinical laboratories. In order to confirm the final diagnosis, 3,5-dimethoxyphenol (a taxine metabolite) must be detected, by GC/MS in gastric content, blood, urine or tissues [4-6]. It is a product formed by the breakage of the glucosidic bond of the taxine and it has been proved as a useful biochemical marker in cases of poisoning by any components of the tree. The diagnosis is not possible if the intake of this plant is not suspected [7]. A thorough anamnesis and personal testimony from the patient or the companions are necessary to direct the case as more common pathologies are usually suspected. A differential diagnosis should be made with cardiac or neurological conditions or poisoning by other toxins.

Surprisingly, most nonintentional ingestions are asymptomatic and require minimal, if any, intervention. Intentional suicidal attempts can result in life-threatening cardiac toxicity, which can require aggressive supportive intervention. Most therapeutic interventions that have been utilized in differents cases in the literature have little proven benefit. In the case described, they were guided by some indications of the literature in Spanish that mention that the treatment consists on basic symptomatic measures, support (oxygen therapy and control of vital signs), a quick gastric emptying, by vomit induction or gastric lavage, and the administration of cathartics and activated charcoal. It is also important to control cardiac arrhythmias, which may require temporary pacemaker in severe cases [8]. However, because it is generally unethical to perform controlled clinical trials in clinical toxicology and because of the rarity of yew poisoning, the quality of the evidence for treatment interventions is weak.

Various treatments have been proposed for yew poisoning. In general, gastric lavage, emesis, cathartics, are no more recommended in the management of acute poisoning and with yew massive ingestion, there is a high risk that the traditional management with antiarrhythmic drugs will be ineffective. In almost all the case reports, poisoning with yew tree constituents resulted in effects that were highly resistant to pharmacological intervention. Of the various therapeutic interventions attempted in some cases, such as atropine, lidocaine, amiodarone, sodium bicarbonate, digoxin immune fab, and hemodialysis, none have demonstrated a significant patient improvement. At present, there is insufficient evidence to recommend any of these drugs routinely as a therapeutic intervention in yew poisoning.

The use of extracorporeal support should be reserved for patients not responsive to conventional treatments. Determination of efficacy or alteration of the natural history of a patient's acute exposure with these invasive procedures is lacking. Although it appears to be lifesaving in some cases of severe acute poisoning, it is very difficult to determine how the patient would have fared without it. Extracorporeal support, usually in the form of ECMO (extracorporeal membrane oxygen) therapy, has been used in a number of cases of severe yew poisoning to overcome the asystole phase and the authors concluded that it was a positive intervention in the patient's treatment.

Apart from some cases of autolysis, there have been also cases of accidental poisoning in children that had been playing with the plant [9], in animals that wandered around it [10] and in carpenters that had worked with its wood [11]. Usually, autolytic attempts are life-threatening whilst non-voluntary poisonings have milder symptoms.

The prognosis of yew poisoning depends on the amount of toxic ingested, a successful anamnesis and the rapid establishment of the treatment.

Conclusion

Although yew poisoning is quite rare, it is a common plant in our environment, and it might be extremely dangerous due to its toxic alkaloids. There are no specific clinical or analytical alterations in this intoxication so the differential diagnosis should be made with cardiac or neurological conditions or poisoning by other toxins. A thorough anamnesis and personal testimony from the patient or the companions are necessary to direct the case. And it is very important to start the treatment as soon as possible. Final diagnosis is reached by the detection of the taxine metabolite 3,5-dimethoxyphenol.

In the case described, the patient worsened abruptly, so it was necessary to search information about yew poisoning in the literature to start treatment quickly. Because data on acute severe yew poisoning is sparse, additional data and experience will be necessary with differents treatment and interventions before any recommendations can be made as to their usefulness. Fortunately, in our case, activated charcoal, vasoactive support, electrical cardioversion and an external pacemaker were enough for stabilization and total recovery of the patient.

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