DIFFERENTIAL DIAGNOSIS BETWEEN PHOSPHOORGANIC PESTICIDE AND COPPER SULPHATE INTOXICATION – A FORENSIC CASE REPORT

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ABSTRACT

Introduction: Phosphorus compounds and copper sulphate form part of many pesticide formulations, making them widely available for mass usage. They are responsible for a large number of poisonings around the world, and the majority of fatal outcomes are accidents or suicides. The general physical characteristics of these substances in some cases create differential diagnostic problems in the forensic practice. Based on these facts of utmost importance is a full toxicological analysis with additional, non-routine testing to determine the exact cause of death. **Materials and methods:** Full forensic autopsy of the body; Full chemical analysis and specific testing. **Case presentation:** We present a case of a 72-year-old woman found dead in her home with bluish stains around her mouth and traces of vomit with the same color on her clothes and bed. When performing the internal examination of the body and opening the stomach, a sharp, irritating smell of garlic and gasoline was present. **Discussion:** On the basis of the examination of the corpse and the fact that blue-stone intoxications are more common, it was firstly suggested that the intoxication had that particular origin. However the abovementioned smell was not characteristic for such poisoning. The classic toxicology analysis was negative for copper sulfate, therefore an in-depth additional testing was performed and it showed the presence of the phosphoorganic compound dimethoate. **Conclusion:** It is necessary to carry out a full range of studies and to know the physicochemical properties of the substances and their effects on the body not only for accurate forensic diagnosis, but also in the clinical practice, in the cases of intoxications.

Keywords: *intoxication, phosphorus compounds, dimethoat, copper sulphate*

INTRODUCTION:

Phosphorus compounds and copper sulphate are widely used pesticides in agriculture, mainly as insecticides, acaricides and nematicides. Their mass distribution and affordability makes them comfortable for use by a large number of people and makes them responsible for the high worldwide mortality rate as a result of acute poisoning, especially in the developing countries. The majority of the fatal outcomes are suicides or accidental poisoning with the substance, more often from children.

The Phosphorus compound Dimethoate and Copper Sulphate have similar physical manifestations that create differential diagnostic problems in forensic practice based only on the external examination of the corpse, a problem for the clinical practice as well - the need for a rapid and adequate reaction after the patient's intake to the hospital and setting the most accurate diagnosis, based on the collected information from the taken history and the appearance of the patient, with the purpose of proper treatment and saving a human life. For this to be possible, it is necessary for the doctors to have knowledge of the nature, physical and chemical properties of the different substances, their toxic effects on the organism, and the necessary set of specific tests to prove them in the body. The leading link in the mechanism of the toxic action of Phosphorus compounds is the inhibition of cholinesterase,

enzyme that degrades the mediator of nerve impulses to choline and acetic acid. As a result, acetylcholine accumulates in the body - endogenous acetylcholine poisoning. /1/
Signs and symptoms of poisoning with phosphorus compounds can be divided into three main categories:
Muscarinic effects – blurred vision, miosis, excess lacrimation, hypersalivation, nausea and vomiting, abdominal pain, diarrhea, bradycardia, bronchospasm, bronchorrhea, cough.
Nicotinic effects – muscle fasciculations, cramping, weakness, diaphragmatic failure, Autonomic nicotinic effects include hypertension, tachycardia, mydriasis and pallor.
Central nervous system effects – anxiety, emotional lability, confusion, ataxia, tremors, seizures, coma. /2,5,8/

Dimethoate is an organic compound of the family of phosphorus compounds with the formula C5H12NO3PS2.

Figure 1 Dimethoate

It is a pesticide widely used as insecticide and acaricide. Dimethoate is a white crystalline solid, with a camphor-like odor. / 10,12 /. In our country it is distributed in the form of light to dark blue colored liquid with names Bi-58, Danadim Progress 400 EC, Roger L 40 and B-58 Top containing dimethoate 400 g / l. /figure 1/
A huge amount of cases have been reported in the world during the years with that type of poisoning with the following general clinical manifestations – profound hypotension with peripheral vasodilatation and bradycardia, and in over 40% of patients dying after dimethoate intoxication, systolic blood pressure of less than 80 mmHg. Cardiac arrest occurs within 2 to 30 hours of taking the substance. The following macroscopic findings were found in cases of intoxication with dimethoate - foam around the mouth, specific, acute smell of "garlic" or "gasoline" at the opening of the corpse and especially from stomach contents, smudging of the lining of the esophagus and stomach with greyish or bluish matter. / 4, 6, 13). The morphological finding is not very characteristic and is like intoxications with other phosphorus compounds - there is a rapidly occurring corpse stiffening, acute swelling of the lungs and brain, bleeding in the lining of the esophagus and the stomach. / 1 /

Copper sulphate, known as "blue stone," occurs naturally in the form of blue crystals containing five molecules of water [CuSO4. 5H2O] - Figure 2.

Figure 2 Copper sulfate

It is mainly used for agricultural purposes as a pesticide, as well as in the leather and dyeing industry. It has a metallic taste. The cases of cooper sulphate intoxications are not rare, most of which are suicidal or accidental poisoning of a children. / 9, 11 / The clinical manifestations are burning sensation in the oral cavity, esophagus and stomach, hypersalivation, nausea, metallic taste and profuse vomiting, which begins within 15 minutes after taking - up to 10 times one after another and has a characteristic bluish-greenish color, accompanied by abdominal pain, diarrhea, sometimes bloody. Hematemesis and melaena are often seen in cases of "blue stone" poisoning. Hypotension, tachycardia and hypovolaemia are observed within a few hours after intake. Late complications include severe kidney failure, jaundice, gastritis, haemorrhage, necrosis of the mucosa of the stomach and small intestin sometimes with perforation. The autopsy finding is characterized by cyanosis of the lips and limbs. Blue-greenish spotting on the mucose of the esophagus and stomach, with superficial or deep necrosis. The blood has a characteristic brownish chocolate-like color. / 1,7,13 /

MATERIALS AND METHODS:

Full forensic autopsy of the body; Full chemical analysis and specific testing.

CASE PRESENTATION: In the clinic of Forensic Medicine and Deontology, Sofia a 72-year old woman was brought. She was found dead in her home, with bluish stains around her mouth and traces of vomite with the same color on her clothes and bed. Close to her, during the crime scene investigation was found a basin filled with blue-colored liquid. In the external examination of the corpse, during the forensic autopsy, we found a bluish-colored substance around the mouth, mixed with foam - Figure 3

Figure 3 bluish-colored substance around the mouth, mixed with foam.

In the internal examination of the corpse we found stains of the mucous of the oral cavity, gullet, throat, esophagus, trachea and bronchus with the above-described bluish matter and

superficial ulceration and epithelial lesion - necrosis were detected in the esophagus – Figure 4. The stomach was full with 500ml bluish liquid, with a severe irritating and smell resembling to gasoline or garlic, its mucous relief is smooth, easily sliding, grayish-blue colored – Figure 5. The primary part of the small intestine is filled with the same bluish matter as found in the stomach.

Figure 4 Esophagus

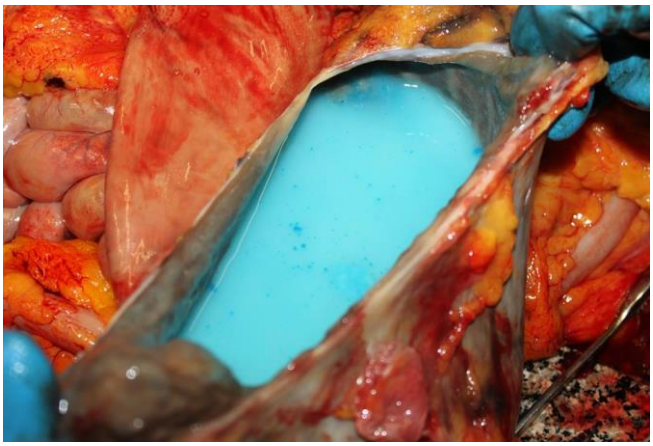

Figure 5 bluish-colored substance in the stomach

Additional samples were taken - samples of blood and urine, stomach and contents, small intestine and contents, liver and kidney, and in the chemical analysis of the samples tested, the presence of the phosphororganic compound dimethoate in the following amounts - in a blood sample - 82, 20 mg%; In a urine sample - 8.32 mg%; In the gastric contents - 1691.63 mg%; In a sample of the stomach, the small intestine - 1660,70mg%; In the liver and the kidney samples 0.11 mg%.
Death is due to acute poisoning with dimethoate, resulting in severe circulatory and metabolic disorders in the central nervous system, resulting in severe brain swelling with paralysis of the centers of the respiratory and the cardiovascular systems.

DISCUSSION:
In both forensic and clinical practice, doctors see a number of diseases or intoxications that have similar external morphological manifestations, and often during the first examination of the patient, a misdiagnosis can occur, which can lead to difficulties in the treatment and to delay the recovery period or to carry out unnecessary further research. In the case presented above, after the initial examination of the corpse and due to the fact that the "blue stone" intoxications are more common in the forensic practice, it was firstly suggested that the intoxication had that particular origin. After analysis of blood, urine, internal organs and stomach samples, the presence of the phosphoorganic compound dimethoate was determined.

CONCLUSION:
It is necessary to carry out a full range of studies and to know the physicochemical properties of the substances and their effects on the body not only for accurate forensic diagnosis, but also in the clinical practice, in the cases of intoxications for adequate reaction.

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