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PESTICIDES POISONING – CASE REPORT

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Extensive use of pesticides for agricultural and non agricultural purposes lead to an increassed number of accidental poisonings with these compounds. For physicians, it remains a constant concern in determining the type of pesticide that cause poisoning. The treatment is different, depending on compound and it is very important to know which pesticide was involved. This article presents a case report with diazinon poisoning and another with one pyrethroid poisoning compound. It is not enough to know that the patient has been exposed to insecticide. The clinical diagnosis refers to clinical symptoms, that are common for most pesticides, organophosphorus or other type. The analytical diagnosis is the most important to establish the compound and to drive the treatment. It is used the gas chromatography method, coupled with mass spectrometry. The aim of this study was to test if laboratory determination of compound is essential for driving the treatment in pesticides poisoning. In conclusion, if there is any suspicion of pesticide exposure, the physician must collect samples for toxicological investigation.

Key words: pesticide, diazinon, pyrethroid, gas chromatography, mass spectrometry.

INTRODUCTION

Organic phosphorus compounds are cholinesterase inhibiting pesticides that are widely used in industrial, agricultural and domestic surroundings. Their main toxic effect is to inactivate irreversible the esterases in the central nervous system. As a result, acethilcholinesterase accumulates in the synaptic cleft, causing overstimulation of the cholinergic receptors and consequently impended neurotransmision[1-5]. The risk of extended pesticides usage are related to the acute and chronic toxicity of these compounds. Acute poisoning is most unintentional, but sometimes these compounds are used for suicidal reasons. Chronic toxicity can be the consequence of occupational exposure or continual consumption of contaminated food and drinking water.

Many studies shown that pesticides can cause adverse human health effects due to their ability to accumulate in environmental media (air, water, soil) and food products[6-8]. Also, we must consider the occupational exposure and there are more and more studies about monitoring the exposure of farmers and other professional pesticides handlers[5].

To obtain an indication of the overall exposure by the different routes-of-entry, one can rely on the measurement of the chemical or its metabolites in biological matrices, such as blood and urine[9, 10]. The measurement of urinary biomarkers of organophosphorus (OP) exposure is of special interest, being non-invasive and highly sensitive[11-14]. The laboratory methods used to assess OP compounds are based on gas chromatography (CG), coupled with mass spectrometry (MS), (CG-MS). Many currently used methods, described in the scientific literature, focus on the determination of certain pesticides and their metabolites[15-18]. Over the past few years, CG methods, which identify a mutch greater number of markers belonging to more classes of compounds and require smaller amounts of urine, have been developed[19, 20].

For clinicians it is very important to know what pesticide caused the poisoning, because the treatment is different from case to case[21, 22]. The treatment follows the symptoms in the first stage,

but can be wrong if we do not know for sure the compound. We present in this article two cases of poisoning with pesticides, one with organophosphorus compound and one with pyrethroid compound. The determination of the pesticides was made using GC-MS method.

The aim of this study was to show that, although there are two cases of pesticide poisoning, treatment was guided by determining the compound in laboratory.

CASE REPORT 1

A 50-year-old woman was brought by her husband to the emergency department, after voluntary drinking of a insecticide, probably organophosphorus compound, 3 hours earlier. The pacient was awake, confused and diaphoretic. We had no evidence that the liquid was spilled out from her stomach. Her initial vital signs were: blood pressure = 160/90 mmHg, heart rate 100 beats/min, respiratory rate = 24–26 breaths/minute, oxygen saturation = 96% in room air, normal temperature. Physical examination showed midsized pupils, minimal crackles in all lung fields, vomiting and diarrhea. She had at initial examination no respiratory distress. We placed a cardiac monitor, an intravenous line and we administered oxygen by face mask 4 to 6 l/min. We inserted a nasogastric tube in her stomach and lavage of the stomach was performed**.** It was administered 2 mg of atropine and the pacient was transferred to ICU for next treatment. In the ICU, we collected blood samples for determining the plasmacholinesterase and for the toxicology laboratory. In the next 2 hours the oxygen saturation began to fall, she was copious vomiting. Her heart rate was increased to 130 beats/min. We took a chest radiograph that showed pulmonary edema. Although we have not the toxicology results, we administered more atropine and we started administration of pralidoxme 1 g iv and after 500 mg/hour continuous infusion. Despite therapy, the oxygenation continued to fall to 86–84% and she began coughing up pink-tinged, frothy sputum. Atropine was given 2 mg every 10 minutes and another bolus of 1 g of pralidoxime was administered. We chose to intubate the pacient and to sedate her. Fresh frozen plasma was administered. After 24 hours the chest radiograph dramatically improved. The pacient was kept sedated with midazolam and intubated for another 24 hours. The plasmacholinesterase was initial severe inhibited at 150 u/l. The reference level at this laboratory was for female between 3500 and 12000 u/l. The toxicology result, performed by gas-chromatographic method was the organophosphorus compound diazinon (Figure 1).

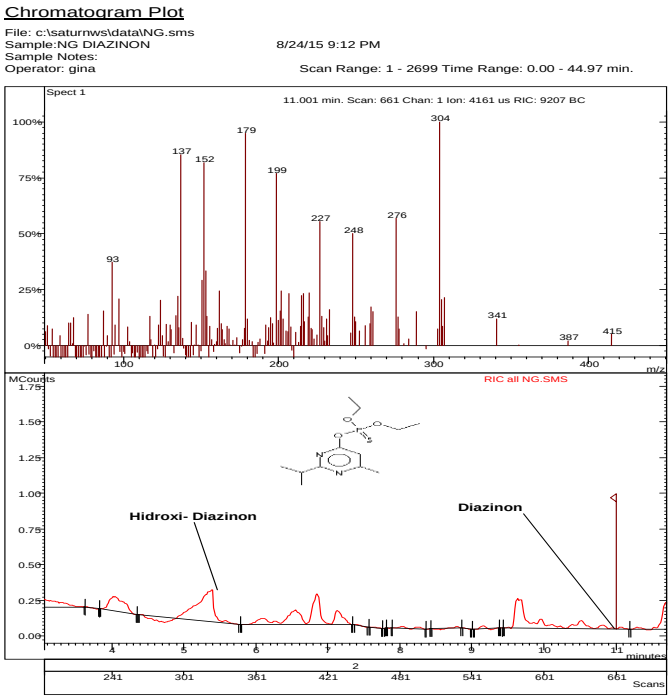

Fig. 1. Total ions chromatogram and mass spectrum for diazinon, for urine sample.

On day 2 we stopped sedation and we extubated the patient. The pralidoxime infusion was maintained at 500 mg/hour for another 2 days. Also the patient was administered fresh frozen plasma every day and the level of plasmacholinesterase was determined every two days. The treatment included volume and electrolytic rebalancing, gastric protection, antiemetics and diuretic. The outcomes was favorable and the patient was discharged to psychiatric facility on hospital day 7.

CASE REPORT 2

A young boy, 19 years old, was brought by rescue crew to emergency department. He was found by his mother, home, unconscious, with a bottle that smelled of insecticide beside him. The patient was in serious condition, comatose, with miotics pupils, with slow photomotor reflexes, with muscle fasciculations, cyanotic extremities, inefficient breathing and bronchial pulmonary crackles in both fields, oxygen saturation = 67%, blood pressure = 80/60 mmHg, heart rate = 44/min., diarrhea. In the emergency department, we decided to intubate him. The oxygen saturation increased. We placed an intravenous line and atropine was given, 2 mg. We placed also a nasogastric tube and lavage of the stomach was performed. We collected blood and urine samples for toxicology laboratory. The patient was taken to radiology department for chest radiograph and head CT. The chest radiograph showed pulmonary edema and the CT was normal. The patient was placed in ICU for treatment. The clinicians had suspected poisoning with organophosphorus compound. The plasmacholinesterase was severe inhibited, 100 u/l, (normal 4000–12500 u/l), the toxicology determination of compound using G-C method was not available in the first hours after admission.

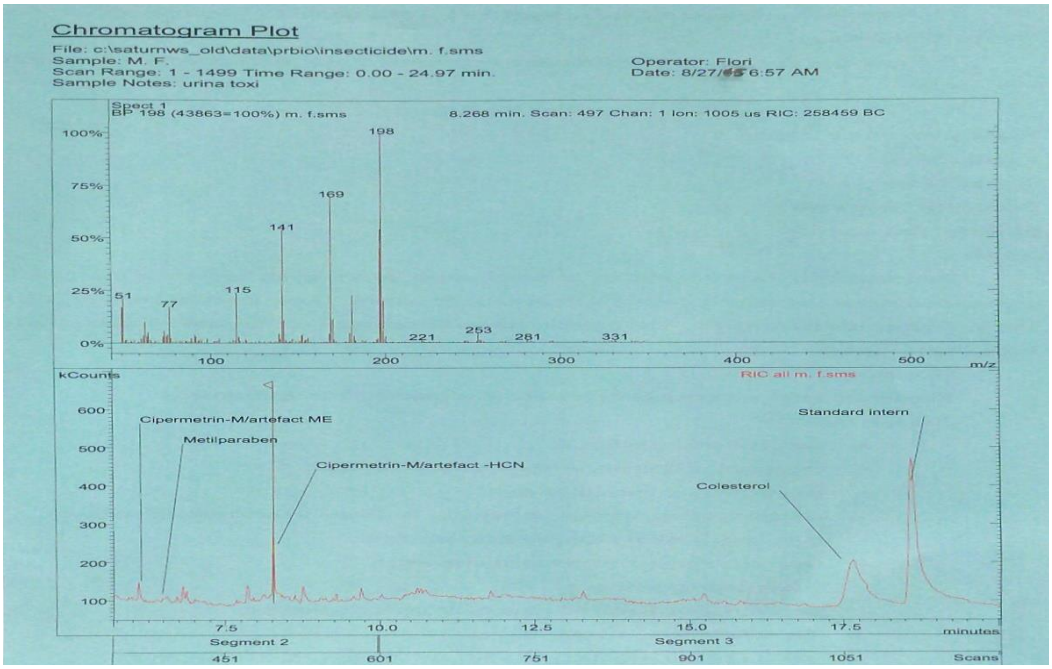

Fig. 2. Total ions chromatogram and mass spectrum for cipermetrin metabolite, for urine sample.

The treatment included: atropine 1–2 mg every 10 minutes, fresh frozen plasma 4 units, mucolytic, bronchodilatator, diuretic, volume and electrolytic rebalancing, gastric protection, antibiotic for aspiration pneumonia prevention. In this case, pralidoxime was not used, because the compound could be other than organofosforus insecticide. In the next morning we had the toxicology result; it was cipermetrin, a pyrethroid compound (Figure 2). We continued the treatment with atropine and fresh frozen plasma. Slowly the pacient became aware. On the fourth day he was extubated. The plasmacholinesterase increased in the next days of treatment, to normal range. Antibiotic was continued for tree days after extubation. The laboratory results were normalized after five days fom the admission in ICU. The patient was discharged to psychiatric facility on hospital day 10.

MATERIAL AND METHODS

We collect blood and urine samples from the patients. We had the family consent signed before taking the samples, because one of the patients was unconscious, unable to sign any consent and the other was confused and mentally unstable. The method used for determination of pesticides was the gas- chromatography method coupled with mass-spectrometry[23-25].

GC-MS METHOD

Operational parameters for *GC:* Injector temperature – 300 ^{o}C*;* Interface GC-MS temperature – 260 ^{o}C*;* Carriere gas – He; Column flow 1,2 ml/min*;* GC Column – DB5 MS (30m × 0,25 mm × × 0,254 μm). The GC oven temperature program is shown in Table 1.

Temperature (^{o}C)	Rate (^{o}C/min)	Waiting time (min)
140	0,0	1
250	5,00	17,00

Operational parameters for MS: Manifold temperature – 80 ^{o}C*;* Ion trap temperature – 170 ^{o}C*;* Ionisation current – 10 μA*;* Acceleration voltage – 70 Ev*;* Mass range 50–450.

ANALYTICAL DETERMINATION

Confirmation of the identity of the compound was based on comparing the mass spectrum and the abundance of reference ions of each identified analyte in the sample, with those of standards, using a library of spectra. For spectroscopic identification was used the mass spectra library Pfleger Maurer Weber (PMW), a library specialized for the toxicological compounds and their metabolites. Also there were used other libraries: NIST2000 and Wiley6, both for confirmation of obtained mass spectra using PMW library. The pesticides were extracted from urine using liquid-liquid method, with a synergist mixture of dichlormethane: dichlorethane: chlorophorm 1:1:1 v/v and a phosphate buffer. The quality control of this method was performed by adding an internal standard, midazolam. The extract purification was carried out by centrifugation 10 minutes to 2500 rot./minute and was followed by sample concentration to 100 ^{o}C. The residue was taken up in the mixture of three solvents. In the GC-MS system, was injected 1 μl from the analyte.

DISCUSSION

The two cases presented were similar at first sight. Both patients had similar symptoms, both needed sedation and mechanical ventilation. The treatment included atropine and fresh frozen plasma. We determined daily the plasma cholinesterase. Administration of specific antidote, pralidoxime, was made successfully only in the first case, where toxicology result was an organophosphorus compound. It is well known that only the poisoning with organophosphorus compounds can be treated with antidote like obidoxime or pralidoxime. The other types of pesticides are not well responding to these antidotes. To choose in which case we must give the right antidote, we need to have the toxicological determination.

CONCLUSIONS

Quantification of insecticide metabolites and parent compounds in different biological samples is an established approach for the monitoring of occupational or environmental exposure in humans. Development of analytical toxicology laboratories with a broad base of data is an important step in emergency medicine.

The treatment of patient with acute organophosphate poisoning is an important part in the health care of pesticide toxicity. Any person exposed to an organophosphate insecticide faces the risk of a significant cholinesterase depression, resulting in an acute cholinergic crisis. However, with environmental exposures in the general population, there may be some delay in receiving emergency care, and physicians may not be aware of the exposure to insecticides unless they are informed by the patient or the person accompanying the patient. There are cases when the patient is brought into the emergency room unconscious, or in a comatose state. Therefore, it is critical for physicians to receive a proper history of exposure in order to make a diagnosis and select appropriate treatment[26]. The toxicology lab has a major rol in establishing the type of pesticide compound, using a small sample of urine. Clinical symptoms may be

the same, but the treatment is different and the recovering of the patient depends on that.

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