

CASE REPORT

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Carbofuran Poisoning of Pregnant Woman and Fetus Per Ingestion

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ABSTRACT: A case of carbamate pesticide poisoning of a pregnant woman by carbofuran ingestion is presented. The mother recovered from the poisoning in the hospital but necrosis of the fetus was found. Toxicological findings of the liver, brain, and kidney of the fetus revealed carbofuran in concentrations comparable with the mother's blood. Our findings in the case contribute to the research on permeation of the placental barrier by chemical substances.

KEYWORDS: pathology and biology, poisoning, carbamate pesticides, carbofuran, fetal necrosis, placental barrier

In recent years carbamate pesticides have gained a measure of popularity because of their pest specificity and relatively low mammalian toxicity.

Since 1977 to 1978, ten carbamate pesticides have been introduced to the Polish market, five of which are of first class toxicity, four of which are harmful substances, and one of which is practically harmless [1].

Carbamates are used in mixture or alone. Some of these carbamate pesticides are noncholinesterase inhibitors, others are toxic because they inhibit cholinesterase activity in plasma. Cholinesterase inhibitor carbamates differ from organophosphorus insecticides since the inhibition they produce is generally more rapidly reversible.

Carbamates are not stored in the body so the symptoms of poisoning can subside in a short time. Toxic activity of carbamates can be enhanced by the presence of xenobiotics in a body [2].

The treatment of patients with carbamate poisoning is very similar to that for organophosphorus poisoning for which the main antidote is atropine. Methods of extracorporeal

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elimination of the absorbed poison in addition to the conventional methods of treatment are of particular interest in these cases.

One of the carbamates from this group of pesticides used widely in agriculture is carbofuran/2,3-dihydro-2,2-dimethyl-7-benzofuranyl methyl carbamate of first class toxicity, available as an active substance in the pesticide preparation Furadan G.

Carbofuran can be converted to the main metabolites carbofuran-3-keto and carbofuran-3-hydroxide.

During the past few years there were several cases of poisoning by carbofuran ingestion in our Cracov district, two of which were fatal.

One case involved an 18-weeks pregnant woman who, after being administered some carbofuran, recovered but her fetus died. This case offered a unique opportunity to investigate fully the level of carbofuran in the fetus's body.

Numerous methods for the determination of carbamates have been reported in the literature—thin-layer chromatography, high pressure liquid chromatography, and gas chromatography [3–6]. Gas chromatography is often the method of choice in quantitative determination of carbofuran in biological autopsy tissues.

Case History

A 17-year-old woman, 18 weeks pregnant, took carbofuran to commit suicide.

Two hours after the ingestion of the poison the patient was referred to the local hospital. On admission the patient was unconscious with the symptoms of pulmonary edema. During hospitalization an intensive symptomatic treatment was instituted, and carbon gastric lavage with water was performed.

After 19 h the patient was transferred to the Toxicological Clinic.

Acetylcholinesterase (AChE) activity was 1700 IU (normal 3500 to 8000, IU), serum cholinesterase (SChE) activity was 15 (normal 25 to 55 IU). The patient was given oxygen therapy, fluid infusion/physiological salt solution, glucose and multielectrolytic fluid solution, atropine drip in doses of 10 to 15 mg in a 24-h period, and antibiotics.

Gynecological examination carried out on the second day showed the uterine fundus extended to the umbilicus. Fetal pulse was not audible. Ultrasonography determined that the fetus demonstrated longitudinal pelvic presentation. Neither fetal movement nor heart tones were audible. On the seventh day the patient was transferred to the Institute of Gynaecology and Obstetrics because of still pregnancy.

No complications were revealed when the patient had toxicological checkups.

The delivered fetus was transferred to the Institute of Forensic Medicine. Postmortem investigation revealed a macerated, intrauterine-dead female fetus, of the age four to five lunar months, body length 29 cm, weight 250 g, with no congenital defects.

During autopsy some samples were taken for toxicological examination.

Materials and Methods

The blood of the mother was sampled 9 h after the poison was ingested, and the kidney, brain, and liver of the fetus were analyzed nine days after the poisoning. Biological samples were extracted with methylene chloride in pH 7 medium. The dry extracts were resolved in acetone and investigated by means of gas chromatography on a Chrom-5 gas chromatograph (Laboratorni Pristroje, Praha) equipped with a wide-bore glass capillary column SPB-1, Supelco, inside diameter (id) 0.75 mm, length 30 m, film thickness 2.0 μm , and alkali flame ionization detector. One microlitre of the extract was injected into the column.

Helium was used as a carrier gas with a flow rate 10 mL/min. The temperature program in the range of 100 to 250°C was applied.

Quantitative determination of carbofuran in the examined material was carried out using biological standards of calibration. Blank blood, kidney, liver, and brain samples were spiked with carbofuran in concentrations of 1, 2, and 5 $\mu\text{g/g}$ and the curve of calibration was used for calculations of carbofuran concentration in tissues.

Results and Discussion

The results of toxicological analysis are given in Table 1. Figure 1 shows a chromatogram of the extract from the mother's blood (a) and the extract from the fetus's liver (b).

The case presented in this paper, quite unique in clinical practice, presents the most valuable research opportunity.

TABLE 1—Carbofuran concentration in the examined biological samples.

Material	Concentration of Carbofuran in Tissues, $\mu\text{g/g}$	Recovery Mean \pm SD
Blood of mother	2.6	27 ± 6 $N = 6$
Kidney of fetus	1.4	24 ± 10 $N = 6$
Liver of fetus	2.5	30 ± 7 $N = 6$
Brain of fetus	0.3	22 ± 10 $N = 6$

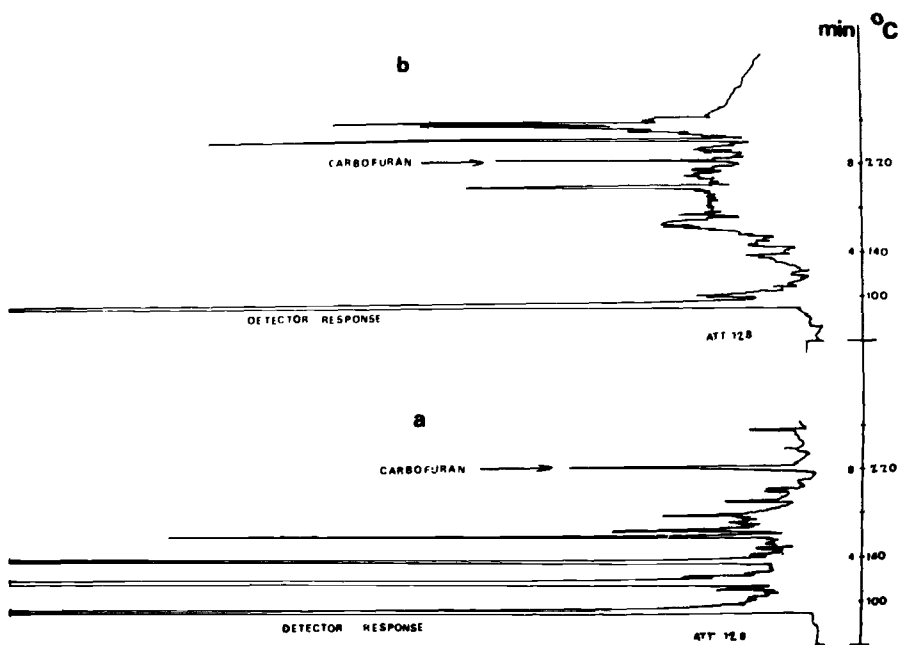


FIG. 1—Chromatogram of the extract from mother's blood (a) and the extract from fetus's liver (b).

The toxicological findings revealed (Table 1) that the level of poison in the blood of the poisoned mother was comparable to that in the fetus. The highest level of poison was found in the liver of the fetus. Carbofuran evidently passed through the placental barrier in sufficient concentrations to cause the fetus's death.

The concentration of carbofuran in the mother's blood (2.6 $\mu\text{g/g}$) was almost the same as that in another case of carbofuran poisoning of a woman treated in the Toxicological Clinic using hemoperfusion, 2.8 $\mu\text{g/g}$ before and 0.7 $\mu\text{g/g}$ after hemoperfusion [7]. Cases of carbamate poisoning have been rarely reported in the literature. So far, toxic concentrations of carbamate pesticides in biological samples have not been well documented.

More complete data and research are needed concerning carbamate poisoning for a complete understanding of this complex toxicological problem.

Conclusion

The results of our research in the case reported in this paper make a contribution to research findings concerning permeation of the placental barrier by chemical substances.

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