CASE REPORT

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Death Caused by Ingestion of Endosulfan

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ABSTRACT: This paper reports the autopsy and toxicological findings of a death caused by ingestion of endosulfan dispersed in a colorless liquid containing about 55% of xylene (w/v). For isolation of endosulfan, the biological material was homogenized and the drug was isolated by extraction with ether. Quantitative determinations were carried out by gas chromatography. The following concentrations of endosulfan were found:

Blood	30 mg/L
Gastric contents	0.5 g in the total 50 mL
Liver	20 mg/kg
Kidney	2.0 mg/kg
Brain	0.3 mg/kg

Xylene (solvent) was detected only in stomach contents (0.4 g in the total 50 mL).

KEYWORDS: toxicology, endosulfan, death, chromatographic analysis, analysis, endosulfan and xylene in postmortem material

Endosulfan,[2] or thiodan or malix (1,4,5,6,7,7-hexachloro-5-norbornene-2,3-dimethanolcyclic sulfite $C_9H_6Cl_6O_3S$, PM 407), a cyclic sulfurous acid ester [*1,2*], is registered in Italy for use as an insecticide [*3,4*].

The mean lethal dose (LD_{50}) (rats, oral) is 0.1 to 0.5 g/kg [*1,5*].

The commercial product (brown crystals) is a mixture of α-isomer (m.p. 108 to 110°C) and β-isomer (m.p. 208 to 210°C) [*1*].

It is practically insoluble in water and soluble in most organic solvents.

Since a literature search revealed few toxicological reports of fatal ingestion of endosulfan, the findings reported in the following case may be of value to pathologists and toxicologists.

Case Report

The deceased, a 55-year-old female, was found dead at 7:50 a.m. in her bed by her husband. She had a malignant melanoma for 2 years. Found on the shelf near the bed was an

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[2]Common name recommended by the International Organization for Standardization.

empty bottle (100 mL) labelled Thiodan 35® which was purchased a week before (active ingredient: endosulfan 35 g dispersed in 100 mL of solvent (55% xylene), surfactant (calcium alkylsulfonate 5%) and stabilizer (epichlorohydrin 1%)[3]). A suicide note was found. Based upon what her husband said and on the thanatological conditions, it is possible to presume a time interval between ingestion of insecticide and death of about 1 h.

Autopsy

Postmortem examination was performed about one day after death on the obese female who was 160 cm tall and 75 kg in weight. The surface of the body revealed no signs of trauma. On the third finger of the right hand were present the results of a surgical excision of a malignant melanoma. There were abundant hypostatic dark violet stains.

Pathology findings were edema of the lungs and polyvisceral stasis, several kidney infarcts, cerebral pulmonary, pancreatic and omental metastases of malignant melanoma, cholecystectomy, old hysterectomy, and aortosclerosis.

Stomach contents consisted of about 50 mL of a gray liquid, which was also present in the first part of the duodenal tract. Histological examination revealed chronic stasis of the liver with steatosis, fragmentatio cordis, and modest widespread myocardiosclerosis. No other pathological findings were observed.

Toxicological Analysis

Endosulfan: Extraction

The endosulfan in the stomach contents (20 mL), blood (20 mL), liver (20 g), kidney (20 g), and brain (20 g) was extracted twice by mixing 20 g of homogenized samples with 20 mL of ether, pH 5 with hydrochloric acid 2*N*.

The combined ether extracts were dried over anhydrous sodium sulfate, the suspensions filtered, concentrated under vacuum to a few millilitres, and evaporated to dryness. The residue was dissolved in methanol and the methanol solutions were serially diluted to a suitable concentration with methanol for the subsequent gas chromatography.

Endosulfan: Gas Chromatography

Estimation of the concentrations of endosulfan was carried out by comparison of peak heights obtained from the samples with those obtained from standard solution of Endosulfan (5 $\mu g/\mu L$, $\alpha:\beta = 3:1$, Dr.S.u.I. Ehrenstorfer D.-8900 Augsburg) using a DANI 6800 gas chromatograph equipped with a flame photometric detector and with a 2 by 0.2-cm glass column packed with 3% SE 30 on Chromosorb 100-120 mesh.

The injection port, column, and detector were operated at 300, 220, and 300°C, respectively. The flow rate of the nitrogen carrier gas was 50 mL/min. It has been determined that the two isomers of endosulfan can be detected unchanged.

The retention indices are 2085 for the α-isomer and 2175 for the β-isomer, respectively, according to Report II of the DFG-Commission for Clinical Toxicological Analysis (DFG).

[3]Xylene is a mobile, flammable liquid practically insoluble in water, and is used as solvent for the production of benzoic, isophthalic, and teraphthalic acids and phthalic anhydride. Xylene can have toxic effects on the living organism. The minimum oral lethal dose in rats is 4 g/kg [6]. The commercial product is a mixture of the three isomers *o*-, *m*-, and *p*-xylene with the *m*- predominating.

Xylene: Gas Chromatography

Xylene content was measured only in sample of stomach contents.

Determination of low concentrations of xylene (micrograms of hydrocarbons in several millilitres of distillate from tissue) is very difficult because the sensitivity of flame photometric detector is often not sufficient for the low concentrations of body fluids. For the contents of stomach or intestinal tract of persons who have ingested aromatic hydrocarbons, gas chromatographic analysis is adequate enough [*7,8*].

A DANI 6800 gas chromatograph fitted with a hydrogen flame detector kit and a 1-mV Shimadzu recorder were used to obtain the chromatograms. The conditions were: column temperature programmed from 60 to 150°C (20°C/min); injection temperature 270°C; detector temperature 270°C; nitrogen input 5 mL/10 s; column SE 30 5%, 1.5 m by 0.20 cm on Chromosorb W 100, 100-120 mesh.

Results and Discussion

The results of the toxicological analysis of body tissues and fluids are presented in Table 1.

There was no evidence of the presence of other metabolites (for example, thiodandiol in urine). However, in acute poisoning cases, it is important to quantify the unprocessed substances because the high dose and the short survival time often result in a lack of metabolism. Thus, to identify and quantify the unprocessed compound, more research must be done than just studying the metabolites.

In three cases of fatal ingestion of endosulfan, Coutselinis et al. [*9,10*] reported only low concentrations (less than 0.8%) in the blood, liver, kidney, and brain.

Data relating to stomach and gastrointestinal contents and adipose tissue were not presented. It is impossible therefore to compare those results directly with these of the present case because no information was available as to the amount of endosulfan ingested. Autopsy revealed a lack of gross anatomical and histological abnormalities attributed to endosulfan. In the opinion of the pathologist, death was too quick for any observable effects to occur in the organs. The acute kidney infarcts and liver degeneration are ascribed to liver pathology (vasculopathy, chronic hepatic stasis).

Conclusion

The high concentration of endosulfan in the body was deemed lethal even if the cause of the death might have been attributed to either the pathology of the subject (malignant melanoma) or the toxicity of the solvent ingested (xylene).

TABLE 1—*Endosulfan and xylene concentrations.*

Specimen	Concentrations
ENDOSULFAN	
Blood	30 mg/L
Stomach contents	0.5 g in the total 50 mL
Liver	20 mg/kg
Kidney	2.0 mg/kg
Brain	0.3 mg/kg
XYLENE	
Stomach contents	0.4 g in the total 50 mL

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