AN APPARENT CASE OF PESTICIDE POISONING

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CASES of poisoning from the organophosphate pesticides have been reported in many scientific journals. Usually, these poisonings have resulted from ignoring instructions or from accidents involving aircraft or farm machinery used to apply the pesticides.

This paper deals with a unique case of possible organophosphate poisoning involving the private water supply of a person undergoing renal dialysis. Had it not been for the physical condition of the patient in this incident, the presence of the organophosphate pesticide in the water supply probably would not have been detected.

In March 1969 a sanitarian from central Idaho requested that the State health laboratory perform a complete chemical and biochemical analysis, including a check for possible pesticide contamination, of a water sample submitted to him by a farm family. The request was prompted by the illness of a farmer who had a severe reaction after becoming dependent on the use of a renal dialysis machine.

Chronology of Events

The patient, a 45-year-old white farmer, was referred to the Spokane, Wash., Inland Empire Artificial Kidney Center in April 1968 for treatment of chronic uremia. He gave a history of polycystic renal disease which was discovered in 1963. The patient had no disabling symptoms from his renal disorder until January 1968, when he had an episode of gross hematuria accompanied by hypertension.

During the ensuing 3 months the patient had increasing symptoms of renal failure, with his blood urea nitrogen rising to 120 milligrams per 100 cubic centimeters. In April his renal function was so impaired that he was given hemodialysis therapy. After being trained to use the dialysis equipment at home, he was discharged from the hospital in June 1968. Throughout the summer and early fall of 1968, he remained in good condition, was able to do his farmwork, and had no trouble with his dialysis.

Late in fall 1968, after a period of heavy rainfall, he experienced episodes of chills and fever which seemed related to the dialysis. He also began to have periods of hypotension immediately after beginning dialysis. These episodes were palliated by infusion of saline solution. Occasionally the hypotension was so severe that the patient became unconscious.

In early March 1969 the patient was readmitted to the hospital for evaluation of the attacks. At this time, he also had gram-negative septicemia, resulting in persistent pain and hematuria. A bilateral nephrectomy was performed in hope of eliminating the source of infection which was considered to be causing most of the problems. The patient left the hospital in good health and afebrile.

After he returned home, the patient again began having hypotension while receiving dialysis therapy. The most severe instance resulted in the patient also experiencing arrhythmia, alternating chills and fever, nausea, vomiting, and convulsions within minutes after dialysis began. When dialysis was discontinued, the patient rapidly became normal. He was again connected to the machine, and he immediately experienced even more severe symptoms resulting in near total collapse.

In view of the circumstances, the local sani-

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tarian suspected a contaminated water supply. At his suggestion, the patient was moved to a nearby motel which had water supplied by the city. Dialysis was again begun, and the patient had no ill effects.

The sanitarian found that the water source on the patient's farm consisted of a hand-dug well about 25 feet deep. A drainage ditch ran within 30 feet of the well, and its location made the well subject to possible contamination from the barnyard, an adjacent pond, runoff from surrounding fields, and a nearby sewage line. A chlorinator was installed as a temporary measure while testing was completed, and discussions about a new water supply were started.

Analysis

Tests of the water supply revealed no large quantity of heavy metals. Zinc at 1 part per million was found, but this amount is not considered uncommon when galvanized pipe is used. The water was not exceptionally hard, having only 5.8 grains or 100 parts per million calcium carbonate. The pH was normal at 7.4. From this analysis we concluded that the chemical elements were not causing the patient's toxic reaction.

The water was then tested for the presence of enteric bacilli, as an index of contamination from human feces. The water was found positive for *Escherichia coli* with 17.2 coliforms per cubic centimeter. This level is sufficiently high to warrant judging the water unfit for human consumption, but it does not approach the extremes of severe contamination (*1*).

Testing for pesticides was then started. Using the procedures recommended by the U.S. Food and Drug Administration (*2*), a sample of the water was extracted. Analysis by means of a Micro–Tek 220 gas chromatograph (*A*) equipped with a tritium foil electron-capture detector, revealed no unusual or abnormal amounts of organochlorine pesticides.

Analysis was then conducted for organophosphates, and we used a Melpar flame photometric detector (*B*) in conjunction with the gas chromatograph. This technique indicated the presence of Thimet (phorate, diethyl methyl phosphorodithioate), a potent organophosphate systemic insecticide at a concentration of 16 parts per billion. A second water sample was obtained and analyzed in the same manner. As before, Thimet was found. The second sample, however, had a Thimet content of only 1 part per billion.

Blood samples from the patient and his family were then tested for Thimet, and all were found positive. The patient's daughter had the highest blood level of Thimet, which was 2,300 parts per billion. Despite the presence of Thimet in all members of the family, none but the patient displayed any detectable clinical or physical symptoms. (The patient had a blood Thimet concentration of only 111 parts per billion.)

Since an organophosphate was now suspected, serum and red blood cell cholinesterase activity of the patient and his family was monitored. Analyses were by pH stat method, using analytical techniques modified after those of Michel (*3*). All cholinesterase activities were found to be within normal ranges. The patient, however, had a lower level of plasma cholinesterase than that of his family.

Discussion and Conclusions

Although Thimet was detected in both the water supply and the blood of the patient and his family, this was not conclusive proof that the patient's adverse reactions to dialysis were due to the insecticide. This ambiguity was further influenced by the patient's gram-negative septicemia, the bacillus-contaminated water supply, and the apparent absence of cholinesterase inhibition in the blood samples. The parasympathomimetic effects expected from Thimet poisoning seemed to be borne out by his dialysis-induced symptoms (for example, hypotension, vomiting, nausea, convulsions, chills, and fever), but some of these symptoms might also have been due to concomitant septicemia.

Despite the tainted water source, renal dialysis would not allow bacteria or viruses to enter the patient's circulatory system from the dialysate, so the level of biological contamination should have theoretically posed little problem. Failure of other members of his family to display symptoms, despite the concentration of Thimet in their blood, is perhaps most easily explained by the physical condition of the patient.

An investigation was undertaken to deter-

mine the possible source of Thimet contamination. Pesticide dealers in the area and farmers who might have used Thimet were contacted. No record of Thimet having been sold in the area was found, and all persons questioned denied using this pesticide.

It was possible, however, that a field had been sprayed or that pesticide spillage had occurred. Then, because of the topography of the land, rain and runoff washing into the drain ditch could have contaminated the well. Evidently, this type of contamination did occur, and it might be assumed that the contamination was of a sufficiently heavy concentration to have persisted.

A new deep well was drilled under the direction of the sanitarian, and it has provided a safe source of water that has presented no further problems to the patient. Testing of the new water supply has consistently shown no detectable contamination of any sort. The patient has thus far recovered sufficiently to resume farming.

Summary

During the fall of 1968 a well apparently was polluted with Thimet from an unknown source, and four members of a household were exposed to contamination. This contamination probably would not have been noticed if the physical condition of the father who was receiving renal dialysis treatment had not been adversely affected.

The family's private water supply was found to contain *Escherichia coli* which was first considered to be the source of the father's difficulty. Chlorination of the water supply did not prevent a subsequent attack, and further testing of the water supply revealed the presence of Thimet (phorate, diethyl methyl phosphorodithioate). Although the source of the Thimet contamination could not be found, we assumed that Thimet apparently was the cause of the acute illnesses that the father experienced. A new, deep well providing a safe source of water eliminated further acute illness associated with the father's dialysis.

REFERENCES

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(*2*) U.S. Food and Drug Administration: Pesticide analytical manual. Vol. 1. Methods which detect multiple residues. Sec. 200. Washington, D.C. Revised January 1968.

(*3*) Michel, H. O.: An electrometric method for the determination of red blood cell and plasma cholinesterase activity. J Lab Clin Med 34: 1564–1568, November 1949.

EQUIPMENT REFERENCES

(*A*) Micro-Tek, Baton Rouge La.

(*B*) Melpar, Falls Church, Va.

Tearsheet Requests

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