Need for Alertness to Neuropsychiatric Manifestations of Inorganic Mercury Poisoning

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INORGANIC MERCURY as a cause of a characteristic psychiatric syndrome is sometimes not recognized by diagnosticians.

The recent opportunity to examine some hospital laboratory employees who had been exposed to inorganic mercury from working with the Van Slyke blood gas apparatus has impressed upon us the likelihood that cases of this occupational intoxication may be overlooked when a diagnostician is concluding that a patient's symptoms are due to neurosis or functional psychosis. Several of these people had been told by a physician that it was "just nerves."

Nine individuals, ranked in order of number of typical symptoms and signs, showed a significant positive rank order correlation with their ranking in mgm of Hg per liter of urine.

CASE STUDY

A 28 year old young woman complained of marked irritability and other symptoms of emotional tension of two year's duration. She had also had painful headaches, often accompanied by nausea and feelings of faintness and "shakiness." She was feeling very fatigued, weak, and lacking in appetite when she got home from work, and she was "snapping" at her small son and quarrelling with her husband.

She had consulted her family internist about a year previously, who found no physical abnormalities and told her that her symptoms were due to "nervousness." He prescribed a minor tranquilizer, which seemed to allay her shakiness somewhat, but she continued to become more irritable and depressed, with bursts of temper and with fainting and gross muscular jerking on two occasions. A physician on the staff of the hospital where she worked advised her to undertake transcendental meditation.

When she was interviewed by one of the authors it was ascertained that her past history indicated no predisposition to neurosis or depression and that the only symptom of "nervous tension" previous to the last two years had been some crampy diarrhea in response to some foods. This had increased recently with watery rather than mucous stools. She talked with considerable pressure of speech, with some circumstantiality and emotional lability, bursting into tears at times. Her affect was mostly anxious, but there was some depressive "hanging on" at the end of the interview. In addition to the symptoms mentioned in the first paragraph, questioning elicited the fact that she had become increasingly withdrawn from social activities and had felt most uncomfortable when with strangers. She also felt that some of her friends had turned against her. She had a repetitive disturbing dream of "electric fire around the frames of the windows" in her bedroom.

Testing of her immediate memory retention evidenced no impairment over a two to three minute span. She showed a definite intention tremor on finger to nose testing and on reaching for a cigarette.

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Fleeting coarse muscular jerking was also observed in one arm. Inspection of the mouth suggested some gingivitis.

Industrial hygiene inspection of the laboratory in which she worked had found gross contamination with mercury dust and inadequate ventilation. The air exit was through a refrigerator in which the technicians kept their lunch bags. The urine mercury level just before removal from exposure was 0.142 mg per liter. Three weeks later at the time of neuropsychiatric examination it was at 0.056 mg per liter. Two months later it was 0.026 mg per liter.

NINE CASES WITH VARIOUS MERCURY LEVELS

We had the opportunity to interview and examine eight women and one man who had been working in four different hospital laboratories in two cities. The symptoms and signs and urine mercury levels for these nine individuals are presented in Table 1. The neuropsychiatric features listed in the table are the ones which have been described in the standard literature about this long-recognized

Table 1. Neuropsychiatric Features With Inorganic Mercury (Hg)

Demographics									
Case Number	#1	#2	#3	#4	#5	#6	#7	#8	#9
Age	22	33	24	23	28	28	27	25	28
Sex	F	F	F	F	F	F	F	M	F
Marital Status	S	M	M	M	M	M	S	M	S
Specific Symptoms									
Erethism									
Irritability	0	+	0	+	+	+	+	+	0
Excitability	0	+	0	0	+	0	0	0	0
Temper	0	+	0	0	+	0	0	0	0
Quarreling	0	+	0	0	+	0	0	0	0
Xenophobia									
Shyness	0	+	0	+	+	0	0	0	0
Sensitivity	0	0	0	0	+	0	+	0	0
Somatic Symptoms									
Fatigue	0	0	0	+	+	0	+	0	0
Weakness	0	0	0	0	+	0	+	0	0
Headaches	0	+	0	0	+	+	+	+	0
Dizziness	0	0	0	0	+	0	0	0	0
Miscellaneous Symptoms									
Indecision	0	0	0	0	0	0	0	0	0
Insomnia	0	0	0	+	0	0	0	0	0
Nightmares	0	+	0	+	+	0	0	0	0
Anxiety	+	0	0	+	+	0	+	0	0
Tension	0	+	0	+	+	0	+	0	+
Depression	0	+	0	+	+	0	+	0	0
Projection	0	0	0	0	+	0	0	0	0
Hallucinations	0	0	0	0	0	0	0	0	0
Forgetfulness	0	+	+	+	+	+	0	0	0
Signs									
Clinically Tested Memory Retention Defect	0	0	0	0	0	0	0	0	0
Fine Intention Tremor	0	+	0	+	+	+	0	0	0
Coarse Muscle Jerking	0	0	0	0	+	0	0	0	0
Urinary Mercury Levels									
Milligrams of Hg/Liter	0.012	0.020	0.004	0.060	0.056	0.054	0.008	0.002	0.004

occupational disease[1-6] and in some recent reviews.[7-9] We have not listed other physical symptoms which may be present with more severe organic mercury poisoning* where the diagnosis is less likely to be missed by the internist.

The neuropsychiatric characteristics include the symptoms of "erethism": irritability; excitability; outbursts of temper; and quarreling with close associates. These symptoms have been noted for centuries to be presented by workers exposed to mercury (e.g. mad as a hatter). The features also include a somewhat unique avoidance of strangers, because of shyness and sensitivity. There are also somatic symptoms with headaches and fatigue being most prominent which the individuals will discuss more readily than they will discuss symptoms which the patients feel make them "peculiar." In addition there are miscellaneous symptoms of anxiety and tension, and defenses against anxiety, such as depression, projection, and sometimes even hallucinations.

These patients may complain of forgetfulness, and with severe inorganic mercury poisoning (as with organic mercury) there may be clinically detectable impairment of recent memory. In our experience, including the application of the Wechsler Memory Scale to some of these subjects (and the clinical examination of other patients by the first named author more than 20 years ago[4]) this is a defect in registration, from distractibility and lack of concentration,[10] rather than failure of short-term retention. Hence organic brain impairment may not be picked up by testing over a two to three minute span, as is done with Cameron's counting test (Ross, p 37[4]).

The typical neurological signs of mercurialism are fine intention tremor and a course jerking of some muscles (especially of the face or arms).

For all nine subjects we noted the presence or absence of all the symptoms and signs listed in Table 1. These are tabulated as + or 0. We also noted that some of the individuals gave us histories of having had more of the symptoms during several months prior to our examinations, and that all of them had had very few of the symptoms during the years prior to the possible exposure.

Degrees of Accumulation of Mercury

Table 1 also shows the urine mercury levels in milligrams per liter obtained around the time of neuropsychiatric examinations.*

Since urine mercury measurements are notoriously variable, and we did not have many urine samples for each individual, we decided to use the rank ordering of levels as evidence for the probable degree of accumulation of mercury in each subject as compared to other individuals.

Severity of Neuropsychiatric Manifestations

As evidence for the severity of the features of psychiatric interest in each subject, as compared to the other individuals, we totalled the recent symptoms and signs listed in the table for each of the nine persons and then rank-ordered the sub-

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jects according to these totals. We broke ties between numbers of recent symptoms and signs by comparing the numbers of symptoms which had been present during several months prior to our examinations. (Some of the subjects had been removed from exposure, or had reduced exposure, prior to our studies.)

Comparison of Mercury Levels with Symptoms and Signs

The ranking of subjects from mercury levels and the ranking of subjects from number of neuropsychiatric features yielded a statistically significant rank-order correlation (rho = 0.73, $p < .05$).

CONCLUSIONS

A simple count of the number of neuropsychiatric symptoms and signs which have been described in the literature for workers with inorganic mercury showed a significant correlation for our subjects with their urinary mercury levels even though the highest of these levels was not as high as has been reported for severe mercury intoxication.[7]

The presence of several of these symptoms and signs should alert the diagnostician to the need to take a careful occupational history and to obtain laboratory measurements of mercury in the urine or hair before coming to a final diagnosis which might be a low grade inorganic mercury intoxication. Medical and dental laboratories should not be overlooked as a possible source of risk.

If the laboratory findings are positive, there is a further public health responsibility to see that an industrial hygiene inspection of the working environment is arranged for the protection of other employees.

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