Motor Dysfunction as a Permanent Complication of Methanol Ingestion

Presentation of a Case With a Beneficial Response to Levodopa Treatment

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In a suicidal attempt by a 13-year-old white girl, methanol produced classical immediate symptoms and permanent damage to the central nervous system characterized by severe bilateral optic atrophy, rigidity, spasticity, and hypokinesia. Administration of levodopa has resulted in significant functional relief of the rigidity in this patient. It is suggested that this is the first case report in English describing permanent neurologic sequelae other than optic atrophy as a result of methanol ingestion. The physiologic basis is unknown. Further clinical-pathologic correlation should be easily elucidated through rerevaluation and longitudinal follow-up of other patients having ingested methanol.

Key Words—Methanol ingestion; adolescent suicide attempt; levodopa treatment; Parkinson's syndrome; movement disorder; motor dysfunction.

This brief report details the case history of a young girl who developed rigidity, akinesia, tremor, and pyramidal tract signs following ingestion of methanol in a suicidal attempt. Permanent motor dysfunction due to methanol intoxication has not been previously reported in the English literature. Marked improvement in the motor disorder (rigidity) accompanied treatment with levodopa.

Report of a Case

The patient, a 13-year, 10-month-old, depressed, white girl attempted suicide on the afternoon of June 11, 1969, by ingesting between 90 and 240 ml of a commercial windshield washer antifreeze (Wizard). This solution contained 90% methanol, 39.24% potassium phosphate, 0.25% wetting agent, and 0.25% green and yellow dye, but no heavy metals. Immediately following ingestion the patient vomited. The hours later the family noted that she was unsteady, had slurred speech, but no other symptoms. She was taken to the Children's Mercy Hospital in Kansas City, Mo. that evening (nine hours after ingestion) where she was described as mildly drowsy, but alert; oriented; At that time her vital signs were: temperature, 98°F (36.7°C); blood pressure, 140/90 mm Hg; pulse rate, 80 beats per minute; respirations, 18 to 22 per minute; findings from her general physical examination were normal. During the initial eight hours in the hospital, she slept intermittently, took fluids orally, and conversed appropriately with the nurses attending her.

The following morning laboratory data showed that results of a urinalysis were nor-

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Fig. 1.—Rigidity and pain impaired passive extension of elbow and abduction of arm.

The hematocrit reading was 42%; white blood cell count, 23,000 with 90% polymorphonuclear leukocytes; sodium, 140 mEq/liter; potassium, 11 mEq/liter; chloride, 104 mEq/liter; carbon dioxide content, 25 mEq/liter; glucose, 147 mg/100 cc; calcium, 8.9 mEq/liter; and phosphate, 16 mEq/liter. At this time she was more lethargic but her vital signs were unchanged from admission with the exception of her respiration which was described as deep and somewhat irregular, varying from 18 to 30 per minute. Blood gases (arterial-capillary) confirmed the impression of a severe metabolic acidosis (pH = 7.107, arterial carbon dioxide pressure [PaCO₂] = 15.8 mm Hg). The patient was then transferred to an intensive care unit (ICU) where she was observed continuously with vital sign checks every 15 minutes, and blood gas determinations every two to four hours, and electrolyte counts at four- to six-hour intervals until recovery from the acute illness was complete. She was treated with intravenously administered fluids, including bicarbonate and ethanol. During the first 12 hours in the ICU, she was lethargic with acidic respirations, but at no time did her blood pressure drop below 125/75 mm Hg or other vital signs change significantly. All electrolytes and results of blood chemistry studies remained normal except for the arterial pH and blood gases. The acidity was corrected, and 20 hours after transfer to the ICU her arterial pH was 7.36 PaCO₂ = 40.0 mm Hg, and carbon dioxide content 19.9 mEq/liter. Although initially sleepy and sometimes stuporous, she was always easily arousable and had normal pupillary responses. She was never cyanotic, had no difficulty handling oral secretions, and did not require vasopressor drugs, oxygen, intubation, or tracheotomy. By 36 hours after admission to the hospital, she was fully alert and following commands. Vital signs, arterial blood gases, and electrolytes were all normal. A blood methanol level obtained approximately 24 hours after ingestion and after ethanol infusion was 5 mg/100 cc.

Improvement was sustained, and on the fifth hospital day she was transferred to a regular ward. At that time bilateral optic neuritis with visual acuity of 20/200 ODL was documented. She was discharged on the 16th hospital day. Four weeks after the ingestion and following discharge from the hospital, the patient noted progressive tightness in her neck and limb muscles, tremulousness, deterioration in handwriting, and difficulty walking. Neurological examination at the original hospital six weeks after ingestion revealed a broad-based, unsteady, steppng, propulsive gait. There was tension of the head and hands and poverty of spontaneous movement.

During the following six months, both rigidity and spasticity increased and extension of the left arm became severely limited and painful. The patient’s depression persisted with fre-
demonstrated a low voltage fast tracing with serum aeroalbumin. The cerebrospinal fluid was colorless, acephalous, and under normal alkaline phosphate's, serum protein with were normal as were blood ro

de strength was good, and there was no atrophy. Positive grasp response in first right foot; the right planter response was clearly extensor and

during the school vacation period with prompt worsening of her condition to the pretreatment lev.

The patient's depression was treated with amitriptyline (Elavil), 150 mg/day for three weeks and then imipramine hydrochloride (Tofranil), 75 mg/day and amitriptyline, 50 mg at bedtime. The depression improved over the following four to six weeks, but attempts at decreasing dosage resulted in return of the depressive symptomatology.

**Comment**

Methanol has been an important industrial solvent for the past 100 years. During the 19th century, a few reports of adverse effects following methyl alcohol ingestion stimulated a spirited controversy as to whether the abnormalities were due to methanol or a contaminant. In 1923, Reif presented unequivocal evidence that pure methanol could cause serious toxicity and death. Ree published a historical review of this controversy in his classical paper on methanol poisoning in 1946.

The most extensive and well-studied experience in the United States occurred in 1951.

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332 cases of methanol intoxication were treated over a five-day period in Atlanta. Bennett et al. studied both the acute and long-term effects of methanol in these patients. Their report has become the definitive statement regarding methanol poisoning in this city. Optic atrophy with associated visual field defects has been described as a late effect of methanol intoxication with the CNS depression acute methanol intoxication with the CNS depression acute methanol intoxication. During the acute phase, but no sequelae described "diffuse congestion and edema" in the postmortem findings of three cases. These findings were subsequently confirmed many times. In a review by Bennett et al. of the Atlanta epidemic, they reported autopsy findings in 17 patients dying of acute methanol intoxication with the CNS abnormalities limited to "cerebral edema with meningeal and subarachnoid hemorrhage."

In 1965, Erlanson et al. reported the cases of four patients who had undergone a neuropathologic study. Three died several days after ingesting methanol despite vigorous therapy including vasopressor drugs and positive pressure respiratory support. In all the brain showed edema and diffuse grayish-red discoloration with large hemorrhages in the basal ganglia (especially putamen) and upper brain stem. The fourth patient, a 41-year-old woman, had particular interest for she recovered from the acute intoxication without any significant anoxia and at no time required respiratory support or vasopressor drugs. She was apparently normal at the time of discharge and lost to follow-up until 11/2 weeks later when she died of bronchopneumonia. Postmortem examination revealed multiple silt-shaped cysts restricted to the lateral parts of both putamina with gliosis formation noted microscopically. According to Erlanson et al., similar postmortem findings were described by Orthner who considers them typical of methanol poisoning. Thus, although the motor abnormalities found in our patient represent a unique clinical sequelae of methanol intoxication, a possible neuropathologic substrate for such findings has been documented previously.

Interestingly, methanol intoxication in children is extremely rare, with no patient less than 19 years of age documented, although Bennett et al. state the age range of

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patients in the Atlanta epidemic was 10 to 78 years. This, no doubt, reflects the usual reason for methanol ingestion as a substitute alcoholic beverage.

The beneficial effects to our patient of levodopa were gratifying. Substantial clinical improvement without adverse side effects has been maintained over seven months. The basis for this improvement, as in classic Parkinson’s disease, is currently unknown, but attributed to effects on the dopaminergic neurons of the basal ganglia.

Knowledge of the potential dangers of methanol is increased by the observations noted in this report. Hereofore, only blindness has been recognized as a long-term effect of this poison. Careful reevaluation of patients known to have survived the acute stage of methanol intoxication, with or without visual sequelae, may bring to light further evidence of this toxin’s damaging effects on the brain.

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Nonproprietary and Trade Names of Drug

Levodopa—Larodopa.

References