Development of Neurologic Symptoms in a 26-Year-Old Woman Following Recovery From Methanol Intoxication*

Andrew P. Fontenot, MD; and Victoria S. Pelak, MD

A 26-year-old woman with no significant medical history presented with visual changes and altered mental status 36 h after the ingestion of methanol. On the evening of the ingestion, she reported blurred vision followed by the development of nausea and vomiting. On the following morning, family members noted a worsening mental status and persistent blurred vision, prompting presentation to the emergency department.

Physical Examination

Vital signs were as follows: temperature, 35°C; pulse, 135 beats/min; respirations, 30 breaths/min; and BP, 160/70 mmHg. Generally, she appeared to be critically ill. Head, eyes, ears, nose, and throat examination revealed round, equal pupils that were sluggishly reactive and 6 mm in diameter. Her lungs were clear to auscultation. Cardiac examination revealed tachycardia without murmurs, gallops, or rubs. Abdominal examination revealed hypoactive bowel sounds without distension. Her extremities showed no cyanosis, clubbing, or edema. Neurologic examination revealed an intact gag reflex, withdrawal from painful stimuli, and 2+ deep tendon reflexes with downgoing toes.

Laboratory Findings

Laboratory findings were as follows: WBC count, 30,800/µL; hemoglobin, 18.3 g/dL; hematocrit, 54%; sodium, 135 mEq/dL; potassium, 5.5 mEq/dL; chloride, 103 mEq/dL; bicarbonate, <5 mEq/dL; BUN, 21 mg/dL; creatinine, 1.3 mg/dL; anion gap, >25; osmolar gap, 146; methanol, 86 mg/dL; aspirin, negative; acetaminophen, negative; ethylene glycol, negative; isopropyl alcohol, negative; and arterial pH 6.79. Chest radiography showed no infiltrates. ECG showed sinus tachycardia without ischemic changes.

Hospital Course

Endotracheal intubation was performed for airway protection. An initial head CT scan showed mild cerebral edema (Fig 1, left, A). Treatment included hemodialysis and ethanol infusion with correction of the acidosis and resolution of the anion gap over the next 18 h. Following extubation, she continued to complain of blurred vision. Her visual acuity was 20/60 bilaterally, and a fundoscopic examination showed bilateral disk swelling and hyperemia. Impairment of recent memory, mild anemia, moderate impaired attention, disinhibited behavior, and lower-extremity tremors were also present. Her cognitive function progressively improved; however, the lower-extremity tremors remained. Repeat head CT scan was obtained 48 h after presentation (Fig 1, right, B).

What is the most likely diagnosis?

*From the Departments of Medicine (Dr. Fontenot) and Neurology (Dr. Pelak), University of Colorado Health Sciences Center, Denver, CO.

Manuscript received November 29, 2001; revision accepted February 12, 2002.

Correspondence to: Andrew P. Fontenot, MD, Department of Medicine, University of Colorado Health Sciences Center (B164), 4200 East Ninth Ave, Denver, CO 80262; e-mail: andrew.fontenot@uchsc.edu
Figure 1. Left, A: CT scan at the level of the basal ganglia obtained at hospital admission showing mild cerebral edema. Right, B: CT scan at the same level obtained 48 h following hospital admission showing hypodensities in the putamen (arrow) and the peripheral white matter (arrowhead).
Diagnosis: Putaminal necrosis following methanol intoxication

The CT scan in Figure 1, right, B was obtained 48 h following hospital admission and shows hypodensities in the putamen (arrow) and the peripheral white matter (arrowhead) consistent with necrosis compared with the initial CT scan (Fig 1, left, A). Methanol poisoning results from the ingestion of methanol-contaminated whiskey and commercially available solvent, such as antifreeze, paint remover, and windshield washer fluid. Ingestion of methanol results in the development of nausea, vomiting, abdominal pain, visual disturbances, and mental status changes after a 12- to 24-h latent period. Metabolic derangements including a severe anion gap metabolic acidosis are commonly present, and permanent neurologic sequelae due to optic neuropathy and putaminal necrosis characterize severe ingestions.

Methanol is rapidly absorbed from the GI tract and is metabolized in the liver by alcohol dehydrogenase to formaldehyde and then by aldehyde dehydrogenase to formic acid, with the majority of toxic effects due to the accumulation of formic acid. Due to the delayed generation of toxic metabolites, a latent period occurs prior to the onset of symptoms and signs of intoxication and the appearance of a profound metabolic acidosis. The mainstay of treatment for methanol intoxication is the administration of ethanol, since ethanol has a 10-fold greater affinity for alcohol dehydrogenase than methanol. Other therapeutic interventions include supportive measures, gastric lavage, correction of acidosis, and occasionally hemodialysis. The indications for hemodialysis include the presence of ocular manifestations, renal involvement, and/or a peak methanol level > 50 mg/dL.

Evidence suggests that survival following methanol ingestion is inversely correlated with the severity of the metabolic acidosis, with a 50% mortality rate in individuals who have a serum bicarbonate level of < 10 mEq/L. There is wide variation in the minimum toxic dose of methanol. This may be related to prior or concomitant ingestion of ethanol, thus decreasing the severity of methanol toxicity. However, alcoholics may be more susceptible to toxicity due to increased alcohol dehydrogenase activity resulting in a more rapid conversion into toxic metabolites.

Putaminal necrosis is a rare but reported complication of severe methanol intoxication. In individuals who survive the initial insult, extrapyramidal symptoms and signs including rigidity, tremors, masked faces, and monotonous speech may develop. These symptoms are usually permanent; however, improvement may occur following levodopa treatment. Recent case reports using CT and MRI have confirmed the unusual location of the pathologic lesion. Discrete regions of necrosis in the white matter have also been identified. Thus, as demonstrated in our case and other case reports, the progression of CT findings from minimal changes to necrosis in the putamen and white matter occurs over a period of 48 to 72 h.

The mechanism responsible for putaminal necrosis remains unknown. It has been postulated that the necrosis results from a decreased blood flow through the basal veins of Rosenthal. However, our patient, as well as others reported in the literature, did not experience hypotension during her course, thus making decreased venous flow less likely. Another possibility is that the necrosis occurs as a direct toxic effect of formic acid with higher concentrations of formic acid accumulating in the putamen compared to other areas of the brain. In addition to its association with methanol ingestion, putaminal necrosis occurs in other disorders such as Wilson disease, Leigh disease, and Kearns-Sayre syndrome. Leigh disease is characterized by a congenital lactic acidosis and symmetrical involvement of the putamen. These findings suggest that the putamen may indeed be more sensitive to an acidic environment than other areas of the brain.

Despite the delay in seeking medical care, our patient survived this critical illness. At follow-up 1 month after discharge, cognitive function had improved, and she had only a mild lower-extremity tremor.

Clinical Pearls

1. Symptoms and signs of methanol intoxication occur after a latent period of 12 to 24 h.
2. The toxic effects of methanol are due to the accumulation of formic acid in the bloodstream.
3. Survival following methanol ingestion is associated with the severity of the metabolic acidosis.
4. Putaminal necrosis is a rare complication of methanol intoxication.
5. Following methanol intoxication, the progression of CT findings from minimal changes to putaminal and white matter necrosis occurs over a period of 48 to 72 h.
6. Head CT scans are useful following methanol intoxication in order to predict long-term neurologic sequelae.

Suggested Readings


Do we have your vitals listed correctly?

Review or refresh your information in the ACCP Member’s Only On-line Membership Directory. The ACCP has done everything possible to ensure that the information in the On-line Directory is correct and up-to-date. However, because of the detail contained in our database, some information may be incomplete or inaccurate. Ensuring the accuracy of your information in this Directory is essential, and we appreciate your assistance in accomplishing this goal.

To review your listing:

1. Log on to: http://www.chestnet.org/mem_directory/
2. Registered users…if prompted, enter your user name and password to proceed to the search screen. New users…Click the link that reads, “New Users sign-up here!” Follow the directions to register as a user. When done, you will see the search screen.
3. Search for your name in the database. If you need help with your search, click the “help” link.
4. Locate your entry and review the information. If corrections or additions need to be made, click the link, “Contact ACCP to update entry,” to send your revisions to ACCP via e-mail. Please make sure that we have an e-mail address listed for you.
5. Should you need to speak to someone, contact ACCP Member Services to update your listing: 800-343-2227 or 847-498-1400.