Delayed bilateral blindness after methanol poisoning

Ceguera bilateral tardía secundaria a intoxicación por metanol

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Methanol is a solvent present in numerous cleaning products, antifreeze solutions, paints, and varnishes, as well as in adulterated alcoholic beverages. Following exposure, potentially severe clinical presentations may occur, including metabolic acidosis, various neurological abnormalities with characteristic visual or extrapyramidal symptoms, and even death.[1] Although the most frequent and lethal route of exposure is ingestion, accidental intoxications via inhalation or dermal contact are also possible, although uncommon due to the recommended protective measures for its use.[2]

We report the case of a 50-year-old woman with a past medical history of depressive disorder and occasional alcohol consumption who presented to the emergency department with a 4-day history of bilateral blindnenn. Seven days earlier, she had been painting the walls of her home using a Universal Solvent (methanol, toluene, and methyl acetate) in an enclosed, unventilated space, and without protective equipment. She had been evaluated in the emergency department 48 hours after exposure for nausea, vomiting, and diarrhea, though she did not report toxic exposure at that time, and was diagnosed with acute gastroenteritis. Subsequently, she developed visual disturbances—photopsias, decreased visual acuity with "shadowy vision," followed by bilateral blindness—which prompted her return to the emergency department.

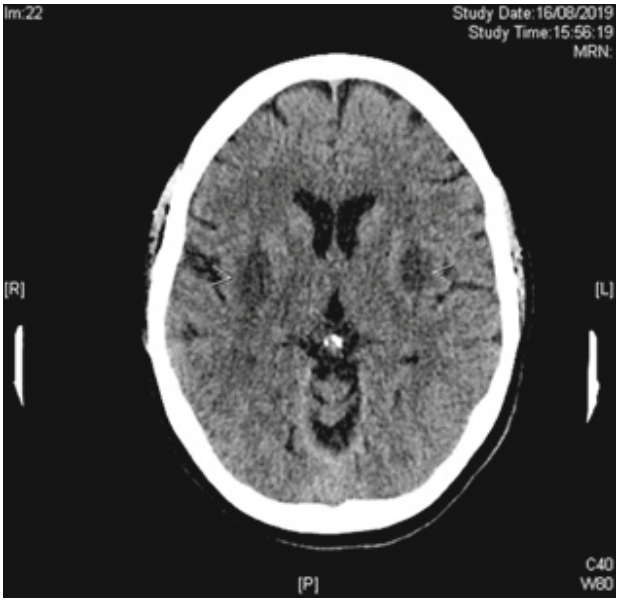

Figure 1. Cranial CT: bilateral putaminal hypodensity.

On arrival, she presented with bilateral blindness, absent corneal reflex, and mildly reactive bilateral mydriasis. She was hemodynamically stable (blood pressure 120/80 mmHg, heart rate 60 bpm, respiratory rate 14 breaths/min, baseline oxygen saturation 95%), somnolent, bradypsychic, and dysarthric. Cranial CT revealed severe bilateral hypodensity of the putamen without abnormal contrast enhancement, findings suggestive of methanol intoxication (Figure 1). Ophthalmologic evaluation demonstrated visual loss, absent corneal reflex, bilateral nonreactive mydriasis, and funduscopic evidence of papilledema and bilateral retinitis (Figure 2).

Venous blood gas analysis ruled out metabolic acidosis (pH 7.39, CO_2 41 mmHg, HCO_3^- 24 mmol/L). Given the diagnostic suspicion of methanol intoxication, ethanol therapy[3] was initiated with a loading dose of 1 mg/kg over one hour, followed by continuous infusion at 6 mg/hour to maintain serum ethanol levels of 100–200 mg/dL during the first 3 days. Because of the bilateral presentation and the low likelihood of an underlying infectious cause (HIV serology negative; nontreponemal syphilis test negative), corticosteroid therapy with methylprednisolone 100 mg/24 h was started 24 hours later. Subsequent improvement in visual acuity was observed, with decreased papilledema on funduscopic examination; visual acuity fluctuated, likely related to supratentorial

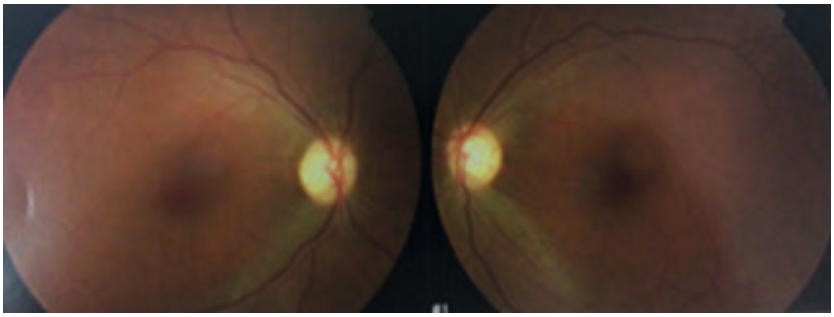

Figure 2. Fundus photography: bilateral retinitis.

involvement. The brain MRI performed 3 days after admission showed marked T2/FLAIR hyperintensities in the posterior aspect of both putamina and the bilateral insular subcapsular region, with corresponding diffusion hyperintensity and small gradient-echo hypointensities suggestive of minimal petechial components,[4] along with subtle contrast enhancement in these areas. Mild flattening and moderate signal increase of both optic discs were also noted. Overall, these findings were consistent with methanol toxicity (Figure 3).[5] After improvement in visual acuity, the patient was discharged after 15 days of hospitalization. At follow-up 2 weeks after discharge, she again presented with bilateral blindness and "shadow vision"; visual acuity was 1 in the left eye and 0.2 in the right eye. Funduscopic examination showed features of retinitis pigmentosa. The patient failed to attend further scheduled visits or follow-up MRI.

Blood and urine samples obtained upon arrival to the emergency department were sent to the Canary Islands Delegation of the National Institute of Toxicology and Forensic Sciences (Canary Islands, Spain). Using gas chromatography with flame ionization detection, methanol levels in blood and urine tested negative. However, formic acid levels were elevated: 10.6 mg/dL in blood (normal ≤ 5 mg/dL) and 47.6 mg/dL in urine (normal 12–17 mg/dL). Toluene levels were undetectable, although its metabolites (benzyl alcohol 0.89 mg/dL and benzoic acid 0.20 mg/dL) were detected in serum; they were undetectable in urine, and hippuric acid was undetectable in both (Table 1).

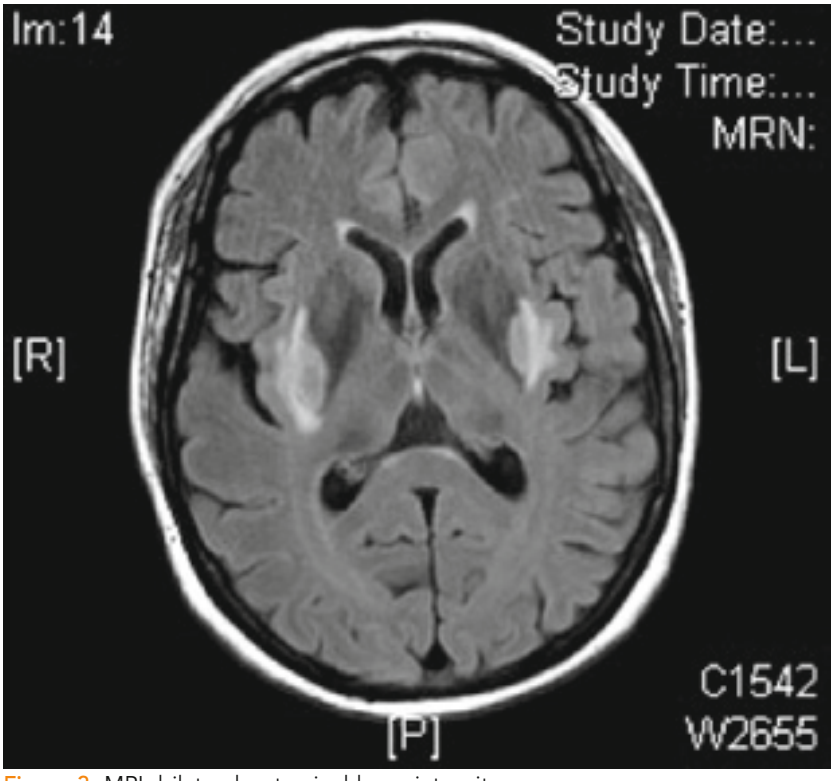

Figure 3. MRI: bilateral putaminal hyperintensity.

Table 1. Levels of toxins detected in blood and urine by chromatography

Metabolites	Serum (mg/dL)	Urine (mg/dL)
Methanol	Undetectable	Undetectable
Formic acid	10.6	47.6
Toluene	Undetectable	Undetectable
Benzyl alcohol	0.89	Undetectable
Benzoic acid	0.20	Undetectable
Hippuric acid	Undetectable	Undetectable

According to the most recent report from the U.S. Toxicology Investigators Consortium, among 7,206 cases, 60 (0.6%) involved non-ethanol alcohols, with methanol implicated in 18.3% of cases, following isopropanol and ethylene glycol.[6] In Spain, the 2022 report of the Spanish Toxicovigilance System identified only 2 methanol intoxications among 1,101 recorded cases.[7]

Methanol (CH_3OH) is a water-soluble molecule that readily crosses the blood–brain barrier. Once absorbed, it is metabolized to formaldehyde by alcohol dehydrogenase and subsequently to formic acid by aldehyde dehydrogenase.[8] These metabolites are responsible for the toxicity of methanol. Formic acid inhibits mitochondrial cytochrome-c oxidase, impairing cellular respiration and leading to cellular hypoxia and lactic acidosis. Formic acid is later oxidized to carbon dioxide, which is eliminated via the lungs. It can be detected in urine for 4–10 days after methanol exposure.

Symptoms vary and may appear 1–72 hours after exposure, depending on whether ethanol has been ingested concurrently. Ethanol is the antidote of choice due to its immediate availability; it competitively inhibits alcohol dehydrogenase, preventing the formation of toxic metabolites. Another antidote is 4-methylpyrazole (fomepizole), which remains unavailable in many Spanish hospitals. Initial symptoms may include intoxication-like

sensations, dizziness, or GI complaints; in many cases, the early clinical picture is mild or overlooked. Later, more specific signs may develop, including high-anion-gap lactic metabolic acidosis and, ultimately, death if treatment is not initiated promptly. Neurologic symptoms may include confusion, coma, headache, or vertigo; delayed parkinsonian syndromes have also been described. Visual symptoms range from blurred vision to scotomas, photophobia, nonreactive pupils, or bilateral blindness.

In our case, there was a clear relationship between toxic exposure and symptom onset, beginning with emesis followed by visual disturbances and imaging findings compatible with methanol toxicity.[1] Notably, the markedly elevated formic acid levels in blood and urine nearly 5 days after inhalational and dermal exposure indicate substantial exposure despite the absence of immediate severe symptoms. It is also noteworthy that severe ocular involvement occurred in the absence of metabolic acidosis, possibly explained by the patient's reported alcohol consumption during the exposure period. Similar subacute presentations with visual symptoms but without metabolic acidosis or hemodynamic instability have been reported in occupational exposures.[9]

Severe methanol intoxication after oral ingestion is relatively common, particularly in the context of suicide attempts. However, inhalational and dermal exposure were sufficient to cause bilateral blindness in this patient. Such exposures tend to produce slower-onset, better-tolerated intoxications, delaying presentation to the emergency department. Toxic exposures must always be considered in the differential diagnosis—even in seemingly straightforward clinical scenarios. Maintaining a high degree of diagnostic suspicion is essential to ensure appropriate early management in the emergency department and to anticipate potential complications.

Note of the editors: This is a BOWMAN-generated English translation of the officially indexed Spanish-language article, which should be cited as Rev Esp Urg Emerg. 2023;2:236-238. In this translated version, the editors have supervised the process; however, it cannot be ruled out that some errors resulting from the artificial intelligence translation process may have gone unnoticed.

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