

# Transdermal Spirit (Methanol) Poisoning: A Case Report

Hatice Dogan,<sup>1\*</sup> Banu Yilmaz Karakus,<sup>1</sup> Kubra Serefoglu Cabuk,<sup>2</sup> Ozlem Uzun,<sup>1</sup> Huseyin Yenice,<sup>1</sup> and

Aysun Orucoglu<sup>1</sup>

<sup>1</sup>Department of Emergency Medicine, Bagcilar Research and Training Hospital, Istanbul, Turkey

<sup>2</sup>Department of Ophthalmology, Bagcilar Research and Training Hospital, Istanbul, Turkey

\*Corresponding author: Hatice Dogan, Department of Emergency Medicine, Bagcilar Research and Training Hospital, Istanbul, Turkey. Tel: +90-2124404000, Fax: +90-2124404242, E-mail: haticetopcu2000@yahoo.com

Received 2014 September 23; Revised 2014 December 09; Accepted 2015 March 20.

## Abstract

**Introduction:** Methanol is a highly toxic substance and methanol poisoning results in severe health situations. Methanol poisoning occurs when it is consumed by various methods such as orally, by inhalation, and transdermally. Transdermal poisoning is rarely seen and causes severe health complications.

**Case Presentation:** A 59-year-old male patient was admitted to the emergency room due to blurred vision and knee pain. He had wrapped alcohol soaked cotton around his knees because of pain, and left it for 10 hours at night. On physical examination the knees only exhibited redness. Upon funduscopic examination, signs of poisoning were not seen, but a high anion gap metabolic acidosis was shown by arterial blood gas analysis. Hemodialysis was performed for severe acidosis and the patient was admitted to the ICU. The patient was treated and discharged from the ICU without sequelae.

**Conclusions:** Methanol poisoning presents to the emergency department in our country with many different situations and with varying histories. In different parts of the world, transdermal intoxication cases may be more prevalent and they may be overlooked, therefore, we aimed to present this case.

**Keywords:** Alcoholic Intoxication, Transdermal Absorption, Methanol

## 1. Introduction

Methyl alcohol is a toxic substance, which is used as a raw material in industrial production of a wide range of end products including dye, wax, and ice solvents (1). It is a poisonous substance obtained by distillation of wood flour and is found in many commercial products such as solvents and cleaning fluids. Methanol intoxication causes concern as it may cause serious metabolic damage and death. Inside the body, alcohol is metabolized into formaldehyde and formic acid by dehydrogenase enzymes. While methanol itself is not a type of toxin, the metabolites are toxic and may cause metabolic acidosis, brain injury, blindness, cardiovascular instability, and death (2, 3). Toxication ensues most frequently via the oral route, but may also result from the industrial inhalation route, and although rare, via the transdermal route (4).

Our aim in this case presentation is to show that methanol intoxication may occur not only after oral intake but also by the transdermal route.

## 2. Case Presentation

A 59-year-old man presented to the emergency department with cloudy vision and difficulty of movement. It was

learned that the previous night, before sleeping, the patient had wrapped a cotton pad impregnated with spirit around his knees and covered his knees with stretch film to end his pain. The patient had remained for over ten hours with the cotton pad and stretch film wrapped around his knees. Anamnesis from the patient was that he had had knee pain for over ten years and that he was not treated with any medical or surgical treatments. He had no comorbid chronic diseases. His father had hypertension, and coronary artery disease was in his family history. The patient's Glasgow coma scale (GCS) score was 15. Vital findings revealed arterial tension of 130/85 mmHg, heart rate of 86/bpm, respiration rate of 18/min, temperature of 36.8°C, and oxygen saturation of 98%. The only note on physical examination was redness on the knees. The biochemical parameters of the patient are shown in Table 1. Because of a high anion gap, metabolic acidosis was considered, caused by methanol. Regarding a differential diagnosis, diabetic ketoacidosis, ethanol intoxication, salicylic acid intoxication, lactic acidosis, and uremia were considered. All of these diagnoses were ruled out according to the drug and ethanol abuse anamnesis, kidney function tests, and blood glucose levels. Brain tomography and MRI were performed to rule out an intracranial event, and results were normal with no radiological pathological findings such as brain

edema or atrophy, infarctions, or hemorrhages of the putamen. On ophthalmic examination there were light perception and light reflex in both eyes. The patient had no signs or symptoms of intoxication in fundoscopic examination. Macula was normal, there was not cavity or pale of the optic nerve. The visual field examination was normal.  $\text{HCO}_3$  replacement treatment was started. The blood methanol level could not be studied, and antidotal treatment could not be given, so the patient was put on hemodialysis. After three hours of hemodialysis, arterial blood gas analysis was improved. Anion gap and acidosis were normalized. Then, the patient was admitted to the intensive care unit (ICU) for observation. Two days later, the patient was discharged to home with a healthy status. One week later, the patient returned for neurological and ophthalmic examinations that revealed no pathology. He had healthy vision and movement.

**Table 1.** The biochemical parameters of the patient

Parameter	Value
pH	7.10
$\text{PO}_2$ , mmHg	42
$\text{PCO}_2$ , mmHg	32
$\text{HCO}_3$ , mmol/L	9.5
BE, mmol/L	-18.2
Osmolarity	286.2
Lactate, mg/dl	1.7
Urea, mg/dl	21.4
Creatinine, mg/dl	0.8
Blood glucose, mg/dl	110
Chlorine, mmol/L	108
Calcium, mg/dl	9.64
NA, mmol/L	139
K, mmol/L	4.8

### 3. Discussion

In Turkey, methanol is allowed as an universal spirit content in stove fuel, paint, and adhesive cleaners in shoe-making. In daily life, many people continue to deal with pain by self-medicating with alcohol, but this case shows how Turkish people use spirits transdermally, not orally, for pain because of religious beliefs. There are no references to epidemiologic studies about transdermal spirit use for medical purposes. Due to its ability to depress the central nervous system (CNS), methanol slows down

the brain and nervous system and does deliver a certain amount of pain relief. It also has muscle relaxing and sedating properties. Methanol is used in the production of many materials in industry and is a common laboratory solvent. About 40% of methanol is converted to formaldehyde and from there into other products (5).

Local, regional, and national traditions against poisoning by the need to cut us how to get out. All cases in the literature regarding transdermal methyl alcohol poisoning have been reported from Turkey.

Methanol poisoning is classically characterized by central nervous system depression, metabolic acidosis, and visual changes. However multiple other organ systems are also affected. The severity of poisoning correlates more with the level of acidosis than the methanol levels (2).

Poisoning typically induces nausea, vomiting, abdominal pain, and mild central nervous system depression. If it progresses, uncompensated metabolic acidosis develops and visual function becomes impaired, ranging from blurred vision and altered visual fields to complete blindness (6). In this case, only cloudy vision and difficulty of movement was seen, which was the result of slow metabolism of transdermal intoxication of methanol. The patient had no signs or symptoms of intoxication in fundoscopy. Iscan et al. reported a case of bilateral total optic atrophy due to transdermal methanol intoxication. In that case, the patient was wrapped with methylated spirit-soaked materials for 6 - 7 hours, and after two days came to the hospital with nausea, vomiting, and unconsciousness (7). Onder et al. reported acute blindness and putaminal necrosis in methanol intoxication (8). Transdermal methanol absorption is slow, so before the beginning of the patient's lethal symptoms, he was taken to the ED so any visual complication was seen. We think that end-organ damage has been caused because of delayed discovery and late treatment of patients.

Laboratory tests for a patient with suspected methanol poisoning should include an arterial blood gas analysis, a chemistry panel (sodium, potassium, chloride, bicarbonate, glucose, blood urea nitrogen, creatinine, calcium, and magnesium levels), serum osmolarity, creatine kinase level, and ethanol level. The diagnosis of methanol poisoning should be considered in a patient with an unexplained acidosis. It is important to understand that acidosis will not present immediately after exposure. In many hospital and clinical laboratories, methanol level test results are not available in a timely manner to assist with initial medical decision making. In such circumstances, the osmolar gap may be used as a surrogate marker for toxic alcohol levels (2). We calculated osmolar gap (26.9) and identified a high osmolar gap with severe metabolic acidosis in our patient, so we planned hemodialysis for treatment. Serum

levels of methyl alcohol could not be measured in this patient because the measuring centers are closed on weekends.

The basic principles of treatment for both methanol and ethylene glycol poisoning include initial resuscitation, providing cardiopulmonary support, preventing formation of toxic metabolites, correcting acidosis, and enhancing the clearance of parent compounds and toxic metabolites. Alkalization, folic acid support, oral or intravenous ethanol, fomepizole, and hemodialysis are administered for this purpose (9). Fomepizole, a competitive inhibitor of the alcohol dehydrogenase enzyme, was approved recently as an antidote for methanol intoxication in adults (10). Ethanol increases the inhibitory effects on the alcohol dehydrogenase enzyme. Indications for urgent hemodialysis after methanol or ethylene glycol ingestion (or exposure) are refractory metabolic acidosis pH < 7.25 with anion gap > 30 mEq/L and/or base deficit less than -15, visual abnormalities, renal insufficiency, deteriorating vital signs despite aggressive supportive care, electrolyte abnormalities refractory to conventional therapy, and a serum methanol or ethylene glycol level of > 50 mg/dL (2). Antidotal treatment could not be given to this patient because there were no antidotal drugs in the hospital, so alkalization with HCO<sub>3</sub> was applied.

Methanol poisoning as the result of oral intake is seen more often in patients presenting to the emergency department. However, in our case transdermal absorption resulting in methanol intoxication was seen, highlighting that transdermal absorption leading to methanol poisoning should be kept in mind for patients presenting to the emergency department.

The absence of serum methanol analyses for diagnosis makes the study poor regarding evidence. In addition, the antidote treatment could not be applied as fomepizole and ethanol are not available in the hospital or poison control

center.

## Footnote

**Authors' Contribution** Study concept and design: Hatice Dogan, Banu Yilmaz Karakus; intellectual content: Kubra Serefoglu Cabuk, Ozlem Uzun, Huseyin Yenice, Ay-sun Orucoglu.

## References

1. Gaul HP, Wallace CJ, Auer RN, Fong TC. MR findings in methanol intoxication. *AJNR Am J Neuroradiol*. 1995;**16**(9):1783-6. [PubMed: [8693975](#)].
2. Berk WA, Henderson WV. In: Emergency Medicine; A Comprehensive Study Guide. 7th ed. Tintinalli JE, Kelen GD, Stapczynski JS, editors. New York: McGraw Hill; 2010. p. 1222-30. Alcohols.
3. Wiener SW. In: Goldfrank's Toxicologic Emergencies. 8th ed. Flomenbaum NE, Goldfrank LR, Hoffman RS, Howland MA, Lewin NA, Nelson LS, editors. New York: McGraw Hill; 2006. p. 1146-60. Toxic Alcohols.
4. Soysal D, Yersal Kabayegit O, Yilmaz S, Tatar E, Ozatli T, Yildiz B, et al. Transdermal methanol intoxication: a case report. *Acta Anaesthesiol Scand*. 2007;**51**(6):779-80. doi: [10.1111/j.1399-6576.2007.01332.x](#). [PubMed: [17567277](#)].
5. Sahin S, Solak S, Akyol O, Vatansever S, Ozyuvaci E. Transdermal methyl alcohol intoxication cause of pain relief. *West Indian Med J*. 2013;**62**(1):84-6. [PubMed: [24171334](#)].
6. Barceloux DG, Bond GR, Krenzelok EP, Cooper H, Vale JA. American Academy of Clinical Toxicology practice guidelines on the treatment of methanol poisoning. *J Toxicol Clin Toxicol*. 2002;**40**(4):415-46. [PubMed: [12216995](#)].
7. Iscan Y, Coskun C, Oner V, Turkcu FM, Tas M, Alakus MF. Bilateral total optic atrophy due to transdermal methanol intoxication. *Middle East Afr J Ophthalmol*. 2013;**20**(1):92-4. doi: [10.4103/0974-9233.106406](#). [PubMed: [23580862](#)].
8. Onder F, Ilker S, Kansu T, Tatar T, Kural G. Acute blindness and putaminal necrosis in methanol intoxication. *Int Ophthalmol*. 1998;**22**(2):81-4. [PubMed: [10472766](#)].
9. Sutton TL, Foster RL, Liner SR. Acute methanol ingestion. *Pediatr Emerg Care*. 2002;**18**(5):360-3. [PubMed: [12395008](#)].
10. Unsal A, Basturk T, Sakac T, Ahbap E, Koç Y, Yilmaz M. Epidemic Acute Methanol Intoxication as a Result of Illicit Alcohol Ingestion. *Nephro Urol Mon*. 2012;**4**(1):366-71. doi: [10.5812/kowsar.22517006.1522](#).