

Transdermal Methyl Alcohol Intoxication Cause of Pain Relief

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ABSTRACT

A 60-year old female patient was found comatose at home and taken to the hospital's Emergency Department by her relatives. It was learnt that she wrapped her knees with spirit-impregnated cotton pad for pain for one week. On physical examination, only a colour change of purple violet on her knees was noted. Metabolic acidosis with increased anion gap was detected by arterial blood analysis. The patient underwent haemodialysis. She was discharged from the hospital with no complaints, alert and rational following five days of follow-up treatment, with the diagnosis of methyl alcohol poisoning.

Keywords: Haemodialysis, intoxication, methanol, transdermal

Intoxicación Transdérmica con Alcohol Metílico Tratando de Aliviar un Dolor

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RESUMEN

Una paciente de 60 años de edad fue hallada en estado comatoso en su casa, y trasladada por sus familiares al departamento de emergencias del hospital. Se supo que la paciente había sentido dolor en sus rodillas, y las cubrió con almohadillas de algodón impregnadas de metanol por espacio de una semana. Al realizarse el examen físico, sólo se observó un cambio de color violeta púrpura en sus rodillas. El análisis de sangre arterial reveló acidosis metabólica con hiato iónico elevado. A la paciente se le practicó una hemodiálisis. Fue dada de alta del hospital sin dolencias, consciente, y en su sano juicio, luego de cinco días de seguimiento de su tratamiento, tras de haber sido diagnosticada con envenamiento por alcohol metílico.

Palabras claves: Hemodiálisis, intoxicación, metanol, transdérmica

West Indian Med J 2013; 62 (1): 84

INTRODUCTION

Methyl alcohol 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 is of concern as it may cause serious metabolic damage and death. In the body, alcohol is metabolized into formaldehyde and formic acid by dehydrogenase enzymes. While methanol itself is not toxic, the metabolites are toxic and may cause metabolic acidosis, brain injury, blindness, cardiovascular instability and death (1, 2).

Intoxication frequently occurs following oral intake, but absorption is also possible from the lungs and skin. Following

intake, it reaches high levels in the kidneys, liver and gastrointestinal system, and is also found in high levels in vitreous humour and optic nerve. Metabolites cause cerebral infarct and optic atrophy (3). Production of formaldehyde in the retina gives rise to optic papillitis and retinal oedema; blindness may develop in serious cases (4).

This case highlights that methanol intoxication may occur not only after oral intake, but also by the transdermal route and early diagnosis and treatment are important.

CASE REPORT

A 60-year old female was found in a comatose state at home and taken to the hospital emergency room with impaired consciousness. Anamnesis from her relatives revealed that she only had osteoarthritis and used painkillers irregularly. It was learnt that she had wrapped cotton pad impregnated with spirit around her knees during the previous week, usually at nights for about two hours duration because of severe pain. On physical examination, the patient was confused, Glasgow Scale

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was E2/M5/V3, no characteristic sign on inspection was determined except for a colour change of purple violet on both knees (Figure). She had hypotension (100/55 mmHg), heart



Figure: A colour change of purple violet was noted on the patient's knees after wrapping them in alcohol-soaked cotton.

rate was 122/minute, tachypnoea at 28 breaths/minute and deep breathing. Complete blood count, renal and liver function tests were normal. Electrocardiography showed sinus tachycardia, chest X-ray and cranial tomography were normal. Arterial blood analysis on four litres per minute of oxygen showed pH: 7.18, PO₂: 112 mmHg, PCO₂: 26 mmHg, HCO₃: 11.9 mmol/L, anion gap: 14.3 mmol/L. Metabolic acidosis with increased anion gap was determined and it was thought that the spirit was absorbed by the skin causing methanol intoxication. Forty per cent ethyl alcohol was infused enterally by nasogastric catheter with 0.2 ml/kg/hour infusion after the loading dose of 1.8 ml/kg. The patient received haemodialysis for three hours. During the dialysis, 40% of ethyl alcohol infusion was continued. After treatment, the following results were obtained: pH: 7.36, PO₂: 98.9 mmHg, PCO₂: 34.4 mmHg, anion gap: 8.1. The analysis of the spirit revealed that it contained 150 times more methyl alcohol content compared to ethyl alcohol, and serum levels of methyl alcohol were abnormal (Table). The

Table: Alcohol levels in the spirit and patient's plasma

Sample	Ethyl alcohol (g/L)	Methyl alcohol (g/L)
Spirit	3	453
Plasma before dialysis	0.03	3.35
Plasma 1 day after dialysis	0.04	1.56
Plasma 2 days after dialysis	–	1

diagnosis was suggested to be related to methyl alcohol intoxication *via* the transdermal route. The patient was discharged from hospital on the 5th day of treatment in a stable metabolic condition.

DISCUSSION

Methanol is employed 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. In Turkey, methanol is allowed for universal spirit content in stove fuel, paints and adhesive cleaning in shoe-making.

Methanol intoxication is associated with central nervous system symptoms, vision disorders, stomach ache, nausea and vomiting. In these patients, a coma may occur with metabolic acidosis and an anion gap. Visual disorders occur in 50% of patients and include diplopia, blurred vision, reduction in visual acuity, photophobia, reduction of visual space and blindness. Hypotension and bradycardia are late signs and indicate poor prognosis. Clinical results show more correlation with intensity of acidosis than methanol concentration.

For this patient who was unconscious, intracranial pathology and intoxication were considered. On observation, metabolic acidosis and an anion gap were noted. The fact that the patient had no drug use history, urea and creatinine was normal and she was not diabetic excluded salicylate intoxication, uraemic acidosis and diabetic ketoacidosis. The history of the wrapped knees with spirit impregnated cotton for a one-week period led to consideration of methanol intoxication. The final diagnosis was established with abnormal methanol level in the blood and spirit samples.

General treatment approach for methanol intoxication consists of stomach irrigation, administering ethanol, fomepizole and haemodialysis. The American Academy of Clinical Toxicology recommends that ethanol or fomepizole be given to treat methanol intoxication based on the following criteria: plasma methanol concentration > 20 mg/dL or recent history of ingestion of methanol with serum osmolal gap > 10 mOsm/L or strong clinical suspicion of methanol poisoning with at least two of the following: arterial pH < 7.3, serum HCO₃ < 20 mEq/L and osmolal gap > 20 mOsm/L (5).

Ethanol may be administered orally, intravenously or *via* nasogastric tube. Forty per cent ethyl alcohol with 0.2 ml/kg/hour is administered orally from the nasogastric catheter after 1.8 ml/kg loading dose. Fomepizole is the competitive inhibitor of alcohol dehydrogenase, and prevents methanol metabolizing to formic acid, which is the major metabolite of methanol (6, 7). The loading dose of fomepizole is 15 mg/kg. Thereafter, 10 mg/kg is administered four times every 12 hours. Each dose should be administered by intravenous (IV) infusion slowly for 30 minutes. Haemodialysis may be considered in the presence of metabolic acidosis (blood pH 7.25 to 7.30), visual abnormalities, renal failure, or electrolyte imbalance unresponsive to conventional therapy and/or serum methanol concentration of > 50 mg/dL according to the American Academy of Clinical Toxicology guidelines.

We administered ethyl alcohol *via* a nasogastric catheter to the patient, and she received a session of haemodialysis be-

cause she had metabolic acidosis. She did not experience a vision problem. It is considered that administering ethyl alcohol prevents visual pathologies.

CONCLUSIONS

Methyl alcohol intoxication cases are generally encountered in Turkey as a result of drinking counterfeit drinks. However, it should be remembered that intoxication may occur not only by ingestion but *via* skin as well. We think that a high index of suspicion, early diagnosis and treatment are important for reducing the complications.

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