

## Case Report

# Nitromethane-containing fuel toxicity causing falsely elevated serum creatinine

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## Introduction

Nitromethane (CH<sub>3</sub>NO<sub>2</sub>) ingestion is not known to cause significant morbidity or mortality. Nitromethane is a common component of model airplane fuel or rocket fuel along with methanol. It has been reported that nitromethane exposure can cause false elevation of the serum creatinine level when using the common Jaffe reaction method of analysis [1,2]; however this is not clinically well known. The standard assay for the measurement of creatinine is based on the Jaffe reaction, in which alkaline sodium picrate reacts with creatinine to form an orange-red color. There are many substances known to interfere with the Jaffe assay, the most important being acetoacetate, cephalosporins, bilirubin, ascorbic acid pyruvate and dopamine.

## Case report

A 38-year-old woman with a history of substance abuse presented to the emergency department of an outside hospital. She had consumed an unknown quantity of synthetic model engine fuel that contained methyl alcohol and nitromethane. Her initial vital signs included a heart rate of 97 beats per minute, respiratory rate of 16 breaths per min, blood pressure 130/90 mmHg and oxygen saturation of 100% on a non-rebreather mask. The patient's clinical condition deteriorated and she became obtunded in the emergency department, requiring intubation and mechanical ventilation. Her initial laboratory data included a methanol level of 102 mg/dl, ethanol level <10, salicylate level <1.0, acetaminophen level <10, ethylene glycol level and isopropanol level were undetectable, anion gap 12, blood

urea nitrogen (BUN) 6 mg/dl, creatinine 0.6 mg/dl and serum osmolality 275 mOsm/kg. Arterial blood gas results: pH 7.314, pCO<sub>2</sub> 42, pO<sub>2</sub> 202, SaO<sub>2</sub> 95%, HCO<sub>3</sub> 20.8. Urine drug screening was positive for cannabinoids and benzodiazepines. Due to the elevated methanol level, the patient was treated with fomepizole at the outside hospital. She was not given any charcoal and was transferred to our hospital for further care. Laboratory data on presentation to our hospital revealed a BUN of 7 mg/dl, creatinine of 14.1 mg/dl, an anion gap of 16 and osmolar gap of 44. Patient was dialysed due to clinical deterioration and an elevated methanol level. Post-dialysis creatinine dropped to 6.9 mg/dl and returned to 1.6 mg/dl by hospital Day 7 without any further dialysis treatments.

Nitromethane is used commonly as a fuel additive along with methanol for race cars, boats and model engines. Acute ingestion of nitromethane is not known to cause significant morbidity, but it is a topical irritant. Nitromethane is highly lipid-soluble, which may account for the relatively long elimination over several days. Isolated nitromethane exposure requires only supportive care with no specific therapy. None of the common laboratory tests or toxicology screens can detect nitromethane. Nitromethane interferes with the routinely used Jaffe reaction in the measurement of serum creatinine. These assays involve the interaction of creatinine with alkaline picrate and subsequent monitoring of changes in absorbance between 500 nm and 530 nm. Nitromethane contains a reactive methyl group, which reacts with alkaline picrate to produce a chromophore with a pattern of absorbance across the spectrum that closely resembles the creatinine–picrate complex, creating a falsely elevated creatinine level. Known potential sources of interference with the Jaffe reaction include ascorbic acid, acetone, bilirubin, ketoacids and drugs such as cephalosporins and dopamine. These substances generally produce mild elevations and may double the apparent creatinine. Enzymatic assay of creatinine, while not as widely used as the Jaffe reaction, renders accurate measurement of creatinine in the presence of nitromethane. We should caution that enzyme-based creatinine assays are not free from drug-related interference. We note that our patient's initial creatinine was 0.6 mg/dl and increased to 14.1 mg/dl in a few hours,

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which might be due to absorption of nitromethane in the blood.

Nitromethane is a component of fuels for race cars and model aircraft. Although nitromethane produces dramatic elevations in creatinine concentrations using the Jaffe reaction, these elevations are due to assay interference and do not indicate renal dysfunction. Falsely elevated measurement of serum creatinine in patients with methanol and nitromethane co-ingestion is significant. The false measurement can lead to unnecessary treatment interventions such as sedation, insertion of central venous catheter, administration of unnecessary medication and even dialysis. Some of these treatment modalities could have serious consequences. Management of the methanol intoxication takes precedence over concerns about the nitromethane in the combined methanol–nitromethane exposure. Nitromethane ingestion needs to be considered for patients with elevated creatinine and toxic ingestion.

*Conflict of interest statement.* None declared.

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