A patient with serum creatinine of 61 mg/dl

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ABSTRACT

Spurious elevation of serum creatinine by Jaffe assay is known to occur due to a variety of substances. This results in subjecting the patient to invasive and complicated procedures such as dialysis. We report a rare case of false elevation of this renal parameter following exposure to an organic solvent.

Key words: False elevation, Jaffe assay, nitromethane, serum creatinine

Introduction

Many substances are known to interfere with the most common method used to estimate serum creatinine, i.e., Jaffe assay. Nitromethane, which is a popular solvent in organic industry, is known to cause a similar effect.[1,2] We report one such rare case with spurious elevation in serum creatinine secondary to chemical exposure at workplace.

Case Report

A 25-year-old male presented with complaints of dizziness and three episodes of generalized seizures. He had these symptoms after returning home from a full day's work at an organic factory. There was no history of swelling of feet or face and breathlessness, fever, nausea, vomiting, or diarrhea. There was no oliguria, dysuria, pyuria, hematuria, or graveluria. No history was suggestive of any connective tissue disorder. There was no preceding painkiller or native medicine intake.

On examination, the patient was irritable with blood pressure of 131/86 mm Hg with no evidence of edema or pallor. Biochemical analysis revealed elevated serum creatinine of 61 mg/dl, serum urea of 7 mg/dl, and random blood sugar of 141 mg/dl with normal serum electrolytes. Hemogram was suggestive of raised total leukocyte count at 18000/mcl with predominance of neutrophils, normal hemoglobin, and platelet count. Liver function tests were normal. Serum bicarbonate level was 24.5 mmol/l. Viral markers were negative. Urine examination was suggestive of traces of protein, nil glucose, with 2–4 pus cells and no red blood cells. Due to the discrepancy in laboratory reports with normal blood urea and raised serum creatinine, a portion of blood sample collected at night was preserved in standard conditions for further analysis. In view of raised serum creatinine and history of seizures, uremic encephalopathy was suspected, and the patient was started on hemodialysis via femoral catheter access. He was given parenteral anticonvulsants for seizures. Ultrasonogram of the abdomen revealed bilateral normal-sized kidneys with normal echotexture. Roentgenogram of chest was normal. Plain computed tomography of brain was normal. Blood and urine cultures were sterile. Serum creatine phosphokinase and lactate dehydrogenase levels were normal at 213 IU/L and 140 IU/L, respectively. His urine output was maintained at 1–1.5 L/day throughout the hospital stay.

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Enquiry of patient's relatives and his employers at the factory for possible toxin exposure revealed usage of nitromethane gas at the workstation of the patient Preserved blood sample was sent for estimation of serum cystatin-C and enzymatic estimation of serum creatinine on the second day of admission. The values were 0.69 mg/L (0.60 to 1.03 mg/L) and 0.9 mg/dl (0.6 to 1.4 mg/dl), respectively. After two hemodialysis sessions, on the 4th day of admission, patient's blood sample was resent for serum creatinine estimation by Jaffe's assay and enzymatic method. Levels were 7.8 mg/dl by Jaffe assay and 0.7 mg/dl by enzymatic method. This confirmed our suspicion of false-positive elevation in serum creatinine. Nitromethane levels could not be estimated in serum due to nonavailability of gas chromatography technique.

Serum creatinine level on the 7th day of admission by Jaffe's technique was 0.8 mg/dl. He was discharged in a stable condition on antiepileptics at the advice of neurologist. Review after 2 weeks in OPD revealed a stable patient with serum creatinine of 0.9 mg/dl with no complaints. He was weaned off antiepileptics at 4 weeks of discharge.

Discussion

Several compounds can cause a false-positive reaction with Jaffe assay. They include acetoacetate, cephalosporin, bilirubin, ascorbic acid, pyruvate, and dopamine. Discrepancy of reports in the form of raised serum creatinine with normal blood urea should raise suspicion of a possible laboratory error.

Conditions associated with isolated raise in serum creatinine include those with decreased creatinine secretion, interference with the serum assay, or enhanced creatinine production.[3] Drugs such as cimetidine, trimethoprim, and fibric acid derivatives competitively inhibit creatinine secretion and raise serum creatinine concentration, despite having no effect on glomerular filtration rate. Higher muscle mass, ingestion of cooked meat, and conditions associated with rhabdomyolysis, for example, hypothyroidism cause an increased generation of creatinine, thus raising the blood level.

Nitromethane is an organic compound with the chemical formula CH_3NO_2. It is a popular solvent in organic and electroanalytical chemistry. It interferes with colorimetric assay for the estimation of serum creatinine, i.e., Jaffe reaction. 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 [Figure 1], creating a falsely elevated creatinine level.[4] Studies show that 1 mmol/l of nitromethane causes a 7.1 mg/dl rise in serum creatinine. Enzymatic assay of creatinine, while not as widely used as the Jaffe reaction, renders accurate measurement of creatinine in the presence of nitromethane. Extensive literature search could not reveal any information regarding the dialysability of this chemical.

In our case, the patient was exposed to fumes of nitromethane at the organic factory while cleaning the boiler. This led to central nervous system toxicity of this chemical in the form of seizures, which were later controlled with antiepileptics. The false rise in serum creatinine due to absorption of toxin into blood resulted in unnecessary intervention in the form of central line cannulation and hemodialysis.[5]

Conclusion

Nitromethane is commonly used as a solvent in a variety of industrial applications. Its interference with Jaffe assay leads to a false elevation in serum creatinine and does not indicate renal dysfunction. The concept of false elevations in renal parameters needs to be considered in cases where the clinical features and/or other parameters do not correlate with renal dysfunction. Normal blood urea level, if present, is a soft clue to falsely elevated serum creatinine. This is probably the first case of its kind reported from our country.

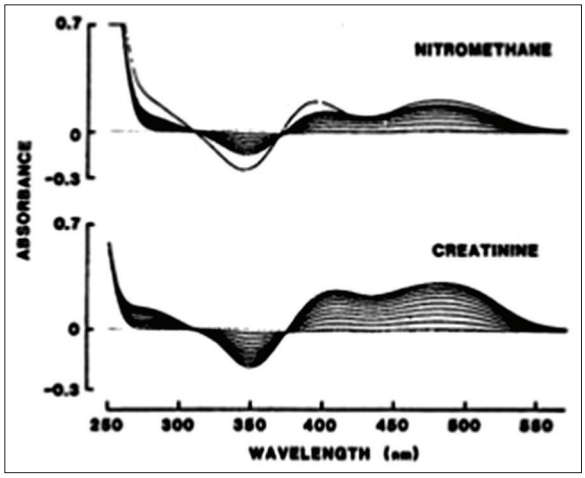

Figure 1: Similar absorbance spectrum of nitromethane and creatinine in Jaffe assay

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Conflicts of interest
There are no conflicts of interest.

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