Falsely elevated salicylate concentration in a patient with hypertriglyceridemia

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ABSTRACT
Because salicylism is a clinical diagnosis, the serum concentration should be interpreted in conjunction with the clinical presentation. A 26-year-old man presented to the Emergency Department with abdominal pain and had extremely elevated serum triglycerides (>7000 mg/dL). Ethanol, acetaminophen, and salicylate concentrations were checked because of concern of self-injurious behavior, which returned at 13.1 mg/dL, undetectable, and >100 mg/dL, respectively. His basic metabolic panel revealed a bicarbonate of 23 mEq/L and an anion gap of 11. An arterial blood gas showed a pH 7.39 and a PCO2 of 36.6 mmHg. On physical examination, he was awake and alert, and had a respiratory rate of 12–14/min. The possible effect of hyperlipidemia to falsely elevate the salicylate concentration was recognized. He was treated for severe hypertriglyceridemia and as his triglyceride level dropped, his repeat salicylate concentration was <1 mg/dL. Since different sized lipoproteins contribute variably to serum sample turbidity they have the potential to interfere with the absorption of light thereby producing erroneous laboratory results. Clinicians need to be aware of the implications of severe hyperlipidemia and interference to prevent clinical errors based on false positive laboratory results.

Background
Because salicylate toxicity is a clinical diagnosis, the serum concentration should be interpreted in conjunction with the clinical presentation. Colorimetric techniques used to measure salicylates create a potential for interference. Here, we report an artificially high, potentially life-threatening salicylate concentration resulting from hypertriglyceridemia.

Case
A 26-year-old man presented to the emergency department with diffuse lower abdominal pain. The patient had been drinking alcohol the night prior to admission, and the admitting diagnosis of alcoholic pancreatitis was supported by an elevated lipase concentration of 226 U/L. On history, the patient denied any tinnitus, headache, confusion, or shortness of breath. The patient’s vital signs were: BP, 140/80 mm Hg; HR, 110/min; RR, 12/min; Temp 99.8 °F. He was lying on the stretcher, conversant and comfortable appearing; he was neither tachypneic nor hyperpneic. His abdominal examination revealed a benign abdomen, which was soft, with no epigastic tenderness and only very mild right lower quadrant pain. Laboratory testing showed a sodium of 122 mEq/L; potassium, 3.8 mEq/L; chloride, 90 mEq/L; bicarbonate of 21 mEq/L; Blood Urea Nitrogen (BUN) 10 mg/dL; creatinine 0.7 mg/dL; glucose 103 mg/dL with an anion gap of 11 mEq/L. Arterial blood gas showed pH 7.39, PCO2 of 36.6 mmHg, and PO2 120 mmHg. He had a serum triglyceride concentration of 7650 mg/dL and serum cholesterol of 1160 mg/dL. Ethanol and salicylate concentrations measured due to concern of self-injurious behavior were reported as 13.1 and >100 mg/dL (therapeutic 15–30 mg/dL), respectively. The salicylate was measured by the colorimetric methodology on a Siemens machine. While formal toxicology and nephrology consultations were pending, serum and urinary alkalization with intravenous NaHCO3, and multiple dose activated charcoal commenced for presumed salicylate poisoning, and upon initial telephone consultation, hemodialysis was recommended. On bedside consultation, however, the patient was awake, alert, and breathing comfortably at a respiratory rate of 12–14/min. He had no complaints at the time of examination. There was no tinnitus. Furthermore, the patient denied having used any salicylate containing products.

The absence of clear symptoms or other laboratory findings attributable to salicylate toxicity led to
recognition of the possible effect of hyperlipidemia falsely elevating the salicylate concentration. We discontinued the sodium bicarbonate infusion and withheld dialysis and multiple dose charcoal. Hewas treated with an insulin infusion for severe hypertriglyceridemia. As his triglyceride concentration dropped, his repeat salicylate concentration fell below the limit of detection.

Discussion

A salicylate concentration of >100 mg/dL should produce signs and symptoms of severe salicylism [1]. Yet, the patient had no nausea, vomiting, tinnitus, tachypnea, hyperpnea, or acidosis; and his blood gas showed a normal pH, and PCO₂, with an unremarkable anion gap. Thus, the reported salicylate concentration was inconsistent with the benign nature of the patient’s examination, which alerted the physicians to consider laboratory interference.

Salicylates can be measured in the serum utilizing many different analytical methods. The commonly used Trinder method combines ferric ions with salicylate to form a purple color [2]. The Trinder test is a colorimetric method, and many substances, including phenolic or aliphatic metabolites, can show reactions similar to salicylate [3]. Fluorescence polarization immunoassay is also available and uses a polyclonal antibody [4]. Additionally, an enzymatic method, which utilizes salicylate hydroxylase, is specific for salicylate and shows no interference [5]. In this case, the salicylate measurement by a colorimetric method reported an erroneously high concentration.

In the case of elevated triglycerides, etiologies for the resulting analytical errors include electrolyte exclusion, partitioning, and light scattering [6]. Different sized lipid molecules contribute variably to serum sample turbidity. There is well-established variability in laboratory results measured on lipemic samples [7]. The most common mechanism of erroneous laboratory results is likely related to the ability of lipoprotein particles to absorb light. The amount of absorbed light is inversely proportional to the wavelength and decreases from 300 to 700 nm [7].

In one previous report of hyperlipidemia leading to a falsely elevated salicylate concentration, the patient’s triglyceride concentration was 6390 mg/dL and his serum salicylate concentration was reported to be 77 mg/dL, and was later found to be an error [8].

Patients who present with severely elevated triglyceride concentrations are rare. Intravenous lipid emulsion therapy, however, is being used more frequently in the management of poisoned patients. The data for its use are controversial. An important consideration following its use is that these patients develop lipemic samples. In fact, lipid emulsion is occasionally used experimentally to conduct interference studies [7]. In a review of the effect of lipid emulsion therapy on laboratory values, many of the routine labs were found to be inaccurate [9].

Conclusion

Most diagnoses depend on clinical signs and symptoms with support by laboratory testing. When clinical judgment is entirely inconsistent with the laboratory values, laboratory error from interference may be the cause. Clinicians need to be aware of this interference to prevent clinical errors based upon false positive laboratory results. Although prompt treatment of acute life-threatening salicylism should often include hemodialysis, the time required to initiate dialysis can be an opportunity to review whether salicylate poisoning is the correct diagnosis.

Disclosure statement

No potential conflict of interest was reported by the authors.

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