CLINICAL VIGNETTE

A Case of Medication-induced Lactic Acidosis

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Case Presentation

An 86-year-old male with gastritis, COPD, hypertension, and prior gastric ulcer presented to the ED with 1 hour of shortness of breath and mild lower sternal pain. On initial exam in the ED, he was in distress and dyspneic, with poor air movement, wheezes, and rales. He required 10L supplemental oxygen via facemask to maintain O2 saturation in mid 90s. He was tachycardic to 100s, without fever, with normal blood pressure. Initial labs were unremarkable, and portable CXR only showed mild right basal atelectasis without a focal consolidation concerning for pneumonia. Fifty-five minutes after presentation to ED, patient received 125 mg IV methylprednisolone, 500 mcg nebulized ipratropium, and 15 mg nebulized albuterol with resolution of his SOB and supplemental oxygen requirement.

Patient was placed under medical observation for presumed COPD exacerbation, trending of cardiac enzyme to rule out acute MI, monitoring of respiratory status, and ongoing scheduled albuterol/ipratropium nebulizer treatments. In patients meeting SIRS criteria (in this case tachycardia and tachypnea), our institutional practice is to check lactate initially and repeat within 3 hours later if 18 mg/dL or greater. This patient's initial lactate 34 minutes after presentation was 17 mg/dL and rose to 21 mg/dL, 19 minutes later. Although he appeared well on exam and reported resolution of both dyspnea and chest pain, another lactate was checked along with repeat troponin 7 hours after initial labs, revealing undetectable troponin and rising lactate of 56 mg/dL.

He was re-examined with new finding of mild-moderate upper abdominal distension (after eating food brought by family) but no pain or dyspnea. Per patient and family, he had long history of dyspepsia and slow gastric transit with frequent bloating after eating. With incongruent exam and lab findings, another set of labs was checked 2 hours later (9 hours after initial labs) revealing lactate of 81, anion gap of 23, bicarbonate of 18, glucose of 211, and normal hepatic function panel. Given abdominal distension, CT A/P showed no acute intra-abdominal findings. As symptomatically he had improved, medication effect was suspected, and inhaled albuterol stopped. Lactate subsequently decreased to 79 two hrs later, 45 later that evening, and normalized at 15 the following morning. He was discharged on short course of steroids, tiotropium, and ipratropium inhaler as needed for COPD exacerbation.

Discussion

Biochemical energy is converted and stored for use in human cells by producing ATP (adenosine triphosphate). When the third phosphate group of ATP is cleaved, energy is released which drives cellular processes. Under ordinary conditions, ATP production is an aerobic, or oxygen-requiring, process that occurs in mitochondria within the cell called aerobic respiration.[1] In the absence of adequate oxygen levels, however, cells cannot utilize this pathway to produce ATP and will transition to an anaerobic (or non-oxygen requiring) process termed fermentation. Anaerobic fermentation is highly inefficient yielding only 2 molecules of ATP per glucose molecule as opposed to 36 molecules of ATP per glucose molecule with aerobic respiration[1]. Fermentation produces lactic acid as an end waste-product leading to a rise in blood levels of lactate (note that some fermentation occurs normally in human cells including red blood cells which lack mitochondria, yielding a low level of lactate in the peripheral blood).

The lactate created by the alternative anaerobic pathway is clinically useful as a marker of poor oxygen delivery/end organ ischemia such as occurs in sepsis, severe heart failure, viscous organ rupture, etc.[2] Elevated blood lactate is most commonly associated with end organ hypoperfusion-termed type A lactic acidosis. However, elevated lactate can also occur without signs of tissue hypoperfusion – termed type B lactic acidosis.[2] In this setting, adequate oxygen is delivered to the cell, but altered cellular metabolism leads to inadequate utilization of oxygen or impaired lactate breakdown, resulting in an elevated lactate level. This can occur in many states including liver failure, DKA, alcoholism, malignancy, or as suspected in this patient, as a medication side effect.[3] Although uncommon, several medications have been implicated including beta agonists such as albuterol.[4] Albuterol-induced lactic acidosis most commonly occurs in the setting of acute asthma exacerbations and can be misleading to the provider (as here) as albuterol will increase air movement, but may also paradoxically increase lactate and acidosis.

Conclusion

Lactate is a very useful marker of end organ dysfunction due to hypoxia – type A lactate acidosis – and should prompt a rapid and thorough evaluation.[3] However in the appropriate clinical context with no obvious sign of end organ hypoperfusion, type B lactic acidosis should be considered and other causes of

elevated lactate evaluated including potential inciting medications such as albuterol as suspected here.

REFERENCES

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