

# Lactate FAQ

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## **Why do these guys keep talking about lactate? Leave me alone with the damn lactate already.**

An elevated lactate is associated with increased mortality.<sup>1-7</sup> If the lactate is cleared it is associated with better outcome.<sup>8-12</sup> Lactate is the best means to screen for occult severe sepsis (occult sepsis is when the patient's blood pressure and mental status are good, but the patient is still at high risk of death.)<sup>9</sup> In the River's Trial, almost 1/5 of the patients with severe sepsis had a completely normal blood pressure (MAP > 100).<sup>9,13</sup> Almost 1/2 of the patients didn't have a SBP < 90 when their lactate was discovered to be high.<sup>9</sup>

## **Ahh, so an elevated lactate is a sign of anaerobic metabolism. Tissue oxygen delivery goes down so lactate goes up; makes total sense...right?**

Unfortunately, it is not that simple.<sup>14,15</sup> Most of the cases of elevated lactate are probably occurring with good global oxygen delivery. Even the theory of regional hypoxia is probably not the explanation. More likely, the adrenergic state and the cytokine storm changes glucose metabolism, lactate metabolism, and lactate use. The heart and the brain can actually take up lactate and use it for energy, so lactate generation is probably an adaptive response to stress situations. Much of the lactate may be from the lung in sepsis and acute lung injury.<sup>16-18</sup>

## **What is the unit of measurement? Oh, and what is this d-lactate stuff I've heard about? And how does lactic acid fit in with all of this?**

Lactate should be measured in mmol/L; this is what we mean when we are discussing a threshold of 4. If your lab measures in mg/dl, you can convert to mmol/L by multiplying by 9. If for some reason you wanted to convert mmol/L to mg/dl, multiply by 0.111. When lactate is calculated in mmol/L, it can be subtracted from the anion gap directly.

The lactate we're talking about is L-lactate. The stereoisomer D-lactate is seen in patients with short gut and you need a specialized assay to measure the levels.

Lactate to lactic acid is in a ratio of 3548:1 at pH 7.4. When you hear lactic acid in a clinical setting, you should just consider it to be synonymous with lactate. If you are making cheese, then it is a different story.

## **So I need an arterial stick, right?**

Nope, venous lactate is absolutely fine.<sup>19-21</sup> If you get a value that is wildly discordant with the patient's condition, you can confirm with an arterial lactate, but this happens infrequently. A properly done venous sample that is low will always have a low arterial value. If the venous lactate is wildly discordant

with the patient appearance, I would probably send a properly drawn 2<sup>nd</sup> venous sample rather than doing an arterial stick. If the patient has an arterial line, the arterial lactate can be used interchangeably.

### **Do I need to take off the tourniquet before drawing a venous sample?**

Absolutely not. It would be better if the lactate was one of the first lab tubes drawn and it was not drawn if there was a twenty minute vein hunt prior. In that latter circumstance, it would not be a horrible idea to drop the tourniquet for 20 seconds and then put it back on to grab the lactate sample.

### **I forgot to put the lactate on ice, should I throw away the sample?**

If the sample is going to be sitting for a while, it is probably better to put it on ice, but even if you forget, the result will be unchanged for ~ 15 minutes at room temperature.<sup>22</sup>

### **What is an acceptable turn-around time for lactate results.**

Most hospital labs use a blood gas analyzer for venous and arterial samples. The turn-around time of the actual test is < 1 minute, so it is reasonable to expect a reporting time of < 30 minutes. If the lab can't meet this time, then consideration should be given to POC blood gas analyzers in the ED.

### **Can't I just get an Electrolyte Panel and check the Bicarb or Anion Gap?**

Unfortunately, it doesn't work. This was shown in River's original trial<sup>9</sup> and subsequent studies.<sup>23,24</sup> A normal bicarbonate level or anion gap was observed in 22.2% and 25.0%, respectively, of patients with lactate levels of 4.0 to 6.9 mmol/L.<sup>25</sup>

### **Are there false positives?**

Usually a lactate  $\geq 4$  is associated with badness regardless of whether it is from sepsis or not.<sup>1-7</sup>

However, in patients using beta-agonists, e.g. an acute asthma exacerbation, the lactate may be quite high. If you take the lactate of any patient who has just completed extreme exercise, their lactates will be high. Patients with seizures will also have remarkably high lactates immediately after their ictal period. In all of these cases, the lactate should quickly clear after the inciting situation.

Patients with hepatic failure can have elevated lactate from decreased clearance. They are also prone to sepsis or hypotension, so I am likely to be more rather than less aggressive in these patients.

In terms of badness with elevated lactate other, non-septic possibilities include any shock state, dead bowel or gut, necrotizing fasciitis, and then a multitude of toxicological causes.

### **What if a patient comes in who is sick, but their lactate is 3.8?**

These patients should clearly be admitted, they should be resuscitated, but unless they drop their pressure they should not be included in the data set. When I have these elevations that don't meet the

threshold, we admit them and discuss with the team trending the lactate q 4-6 hours until it is back to normal.

## **We have had patients who were severely septic and their lactates never went over 2, what gives?**

Patients can be hypotensive and sick, requiring pressors with a normal lactate. I've seen this especially in the elderly population.

## **What about the expense?**

Lactate is a cheap test, especially compared to the routine, but often useless cbc.

## **References**

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