



Lactate Based Resuscitation

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Up2Date

What is lactate? Lactate is produced from Pyruvate by the enzyme lactate Dehydrogenase, present in the body during REVERSIBLE reactions. It is an indirect measure of oxygen debt in the tissues, and gives the provider an idea about the level of shock the patient is experiencing.

Ready for Krebs cycle? In the presence of sufficient oxygen, pyruvate (produced from aerobic glycolysis) is converted to acetylco-enzyme A; this enters the Krebs cycle and produces ATP. (Adenosine Tri-Phosphate: Energy for the cells. In ideal situations, 38 moles of ATP are produced.)

IN THE ABSENCE OF SUFFICIENT OXYGENATION, PYRUVATE IS CONVERTED TO LACTATE this lactate enters the Krebs cycle and produces only 2 moles of ATP.

What does an elevated Lactate mean? The greater the level of lactate present in the body, the greater the chance of mortality. Anything over a 2 is considered elevated. Broder and Weil report that only 11% of patients will survive with a lactate greater than 4 in the presence of circulatory shock. Patient survival is roughly 100% if lactate is less than 2 within 24 hours of initial injury. Patient survival is 78% if lactate is less than 2 with 48 hours. This is of course dependent on other injuries that may or may not be treatable.

Talking shock:

- Shock is peripheral circulatory failure- resulting from a discrepancy in the size of the vascular bed and the volume of intravascular fluid.
- Inadequate tissue perfusion: Oxygen delivery is too low to meet oxygen demands which causes anaerobic metabolism which leads to tissue acidosis and oxygen debt.
- Vital sign changes happen- traditionally the patient is considered “resuscitated” when vital signs improve. This is an indicator of COMPENSATED shock (the patient is able to “compensate” for the lack of blood flow, however this is self limiting. Once the body is no longer able to compensate for the lack of oxygen or flow, they will decompensate).

- **Compensated shock exists when evidence of ongoing inadequate tissue perfusion is present, DESPITE normalization of Blood pressure, Urine output and Heart rate. *Inadequate tissue perfusion can only be discovered by the production of lactate, or base deficit levels.***

Hallmark of compensated shock is mal-distribution of blood flow and tissue oxygenation. The heart and the brain take the majority of the O₂, depriving other organs of oxygen.

What do we do?? We need to trend the lactates, request (when possible) that the sending facility order a lactate so that a comparison can be made at the destination facility. Consider resuscitation with fluid and consider blood products. Fluid cannot carry oxygen; we need resuscitation with oxygen carrying capacities.

Trend the lactates so that we can see if our patients are improving or decompensating.

Remember that vital signs are simply one piece of the puzzle. Is the patient a responder, a transient responder or a non-responder. Assess the entire picture, which may require a lactate or base deficit.