

Case Report

Heart Failure and Hypothermia in an Infant: Pseudocyanide Syndrome?

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Purpose. Mixed or central venous oxygen saturation has not been described during concurrent heart failure and hypothermia in children, both of which may be associated with hyperlactatemia. This report of an infant with heart failure and hypothermia is significant for increased inferior vena cava (IVC) oxygen saturation and hyperlactatemia. *Case Report.* A 36-day-old female was fussy for a day and then developed respiratory distress. In the Pediatric ER, she was tachycardic (260 beats/minute) and hypothermic (32.4 degrees C) with prolonged capillary refill and faint distal pulses. Adenosine was given twice via an intraosseous line for supraventricular tachycardia, with conversion to sinus rhythm. Blood drawn from an IVC catheter was significant for uncorrected (for temperature) oxygen saturation of 94% and lactate 18 mmol/L; corrected and uncorrected IVC oxygen saturation early during rewarming were >90%. During rewarming, declines in uncorrected IVC oxygen saturation and lactate correlated. Hypothermia and hyperlactatemia resolved after 10 and 12 hours. *Conclusions.* Concurrent heart failure and hypothermia in an infant were associated with increased IVC oxygen saturation and hyperlactatemia, similar to lab findings associated with a mitochondrial toxin such as cyanide. Improvement of heart failure and hypothermia were associated with resolution of these lab abnormalities, thus helping to rule out mitochondrial toxins. Additional reports may help better define a pseudocyanide syndrome in this setting.

1. Introduction

Mixed or central venous oxygen saturation (SO_2) is decreased with heart failure and increased with hypothermia; though normal limits for mixed or central venous SO_2 require interpretation within a clinical context, levels below 70% and above 90% are concerns [1]. Hyperlactatemia is common to both heart failure and hypothermia. With concurrent heart failure and hypothermia in children, hyperlactatemia is increased in proportion to heart failure severity [2], but mixed or central venous SO_2 data are lacking. This report of an infant with heart failure and hypothermia is notable for increased inferior vena cava (IVC) SO_2 and hyperlactatemia, similar to the findings associated with a mitochondrial toxin, such as cyanide.

2. Case Report

The Columbia University Medical Center IRB (AAAR0802) exempted this retrospective case report from review.

A 36-day-old female was fussy for a day and then developed respiratory distress. She was born at term, and a New York State newborn screen was negative. In the Pediatric ER, she was tachycardic (260 beats/minute) and hypothermic (32.4 degrees C) with prolonged capillary refill and faint distal pulses. She was placed on continuous positive airway pressure via nasal prongs. Adenosine was given twice via an intraosseous line for supraventricular tachycardia with conversion to sinus rhythm. She was then intubated for worsening respiratory distress and placed on an FiO_2 of 1.0. An echocardiogram was notable for decreased biventricular systolic function and left to right shunting through a patent foramen ovale. A dobutamine infusion was started. Arterial cannulation was unsuccessful; transcutaneous pulse SO_2 was consistently 100% during rewarming. Results from the first blood gas (all blood gas results were reported uncorrected for temperature) drawn from a catheter placed in the IVC (by Seldinger technique; sutured in place after advancing to its full length overlying the L3 vertebral body; Figure 1) were pH 7.01, PCO_2 33 mm Hg, PO_2 101 mm Hg, SO_2 94%,

TABLE 1: Temperature, uncorrected and corrected (for temperature) IVC PO₂, uncorrected IVC SO₂, and IVC lactate in infant with heart failure and mild hypothermia.

Time (minutes)	Temperature (degrees Centigrade)	Uncorrected PO ₂ (mm Hg)	Corrected PO ₂ (mm Hg)	Uncorrected SO ₂ (%)	Lactate (mmol/L)
0	33.4*	101	83	94	18
63	33.6*	100	84	97	18
74	33.7*	174	134	99	17.2
87	33.9*	71	58	94	15.6
106	33.9	59	48	89	13.6
133	34.4	60	50	87	11.9
177	35.3*	49	44	83	10.3

*Interpolated temperatures.

As cardiopulmonary bypass replaces cardiac function, it is possible that heart failure with mild hypothermia in an infant would be associated with more severe hyperlactatemia and an increased IVC SO₂, as noted in this infant. In any case, the trend in lab results from the IVC catheter was consistent during rewarming following cardioversion and suggests that these findings represent an actual association.

Limitations to this report include those related to retrospective case reports generally. Some laboratory data—including arterial blood gas results as well other metabolic testing—were not available due to limited vascular access during acute illness. The FiO₂ was maintained at 1.0 during the first 3 hours of rewarming while the infant's clinical condition stabilized, and this could have contributed to an increased IVC SO₂; however, this effect was not dramatic, as the IVC SO₂ fell to 83% before the FiO₂ was weaned. In any case, pediatric intensivists may benefit from knowing that the SO₂ from a femoral vascular catheter may be as high as 99% in certain clinical conditions, even when the catheter is not arterial. As the IVC catheter was advanced to its full length and sutured in place overlying the L3 vertebral body, proximal catheter migration was not possible, such that the left to right shunt across the patent foramen ovale did not contribute to an increased IVC SO₂.

4. Conclusion

This report offers anecdotal evidence that IVC SO₂ may not always be low in infants with heart failure, while lactic acidosis may be profound in the presence of mild hypothermia: concurrent heart failure and mild hypothermia were likely responsible for the lab abnormalities in this infant, which to some extent mimic the lab abnormalities associated with a mitochondrial toxin such as cyanide. Further study of a pseudocyanide syndrome associated with concurrent heart failure and mild hypothermia in infants may be helpful.

Disclosure

This study was presented in abstract form at the 2017 American Thoracic Society's Annual meeting [15].

Conflicts of Interest

The author has no conflicts of interest relevant to this article to disclose.

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