

## Central Venous Oxygen Saturation Does Not Correlate with Serum Lactate in Patients with Cardiogenic Shock after Cardiac Surgery

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**Introduction:** Mixed venous (SvO<sub>2</sub>) and central venous (CvO<sub>2</sub>) oxygen saturation are increasingly relied upon as indicators of the adequacy of global oxygen delivery in critically ill patients. Monitoring CvO<sub>2</sub> can be done continuously, and access to central venous blood is usually straightforward in most patients cared for in an ICU. An early manifestation of an imbalance in oxygen supply-demand in critically ill patients is a rise in serum lactate concentrations. Lactate levels have also been demonstrated to correlate well with the adequacy of resuscitation and outcome in patients with trauma and shock. We hypothesized a possible reliable inverse correlation between CvO<sub>2</sub> and lactate levels in patients with cardiogenic shock after cardiac surgery.

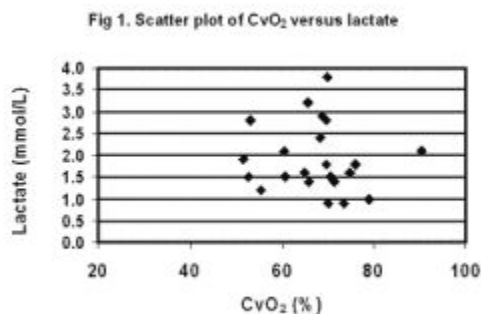
**Methods:** After obtaining IRB approval, we enrolled 16 ICU patients who had undergone cardiac surgery. All patients had indwelling internal jugular access and preserved renal and hepatic function. Blood gases were drawn from the internal jugular line, and the CvO<sub>2</sub> saturation, pvO<sub>2</sub>, and lactate levels in central venous blood were measured using the ABL 700 analyzer (Radiometer America Inc., Westlake, OH). Statistical analysis included Pearson correlation and construction of a scatter plot.

**Results:** We obtained 22 pairs of CvO<sub>2</sub>/lactate measurements from 16 patients. 5 patients had more than one measurement obtained. The average lactate level in mmol/L was  $1.913636 \pm 0.778457$  (range 0.9 to 3.8); the average CvO<sub>2</sub> % was  $67.40909 \pm 9.248213$  (range 51.6 to 90.5); the average pvO<sub>2</sub> in mmHg was  $37.29091 \pm 7.448356$  (range 27.4 to 62.6). The correlation coefficient for CvO<sub>2</sub>/lactate was -0.06881; the correlation coefficient for pvO<sub>2</sub>/lactate was -0.11964. **Discussion:** Correlation was poor between the central venous saturation and lactate levels in this population of patients. Our results suggest that measurements of CvO<sub>2</sub> cannot substitute for measurement of serum lactate to assess the adequacy of oxygen delivery in critically ill patients after cardiac surgery. There are a variety of possible explanations for our results. Lactate levels may not have risen because of a combination of ongoing bleeding and efforts at resuscitation. Patients with baseline low cardiac output syndromes may have tissues that have adapted to conditions of low oxygen delivery. Adaptation may lower the threshold for transformation to anaerobic metabolism and generation of lactate.

**References:** 1. Rivers E. NEJM 2001; 345:1368-77. 2. Ladakis C. Respiration 2001; 68:279-85. 3. Squara P. Intensive Care Med 2004; 30:2170-79. 4. Husain F. Am J Surg 2003; 185:485-91.

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### Figure 1



### Figure 2

Fig 2. Scatter plot of  $pvO_2$  versus lactate

