

Hydroxocobalamin Interference with Carboxyhemoglobin (COHb) Measurements

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Background: Recommended pre-hospital treatments for severe smoke inhalation include a supply of 100% oxygen by mask and hydroxocobalamin administered intravenously in adults at a dose of 5 grams in 200 mL solution, at 15 mL/minute (1). Hydroxocobalamin (OHCbl, a vitamin B12 analog), however, is known to interfere with CO-Oximetry measurements (2).

Recent study by Livshits et al (3) refers to two carbon monoxide poisoning patients and claimed that the CO-Oximeter reported falsely low carboxyhemoglobin after hydroxocobalamin therapy. The paper by Livshits et al went on to suggest that the false reading by the CO-Oximeter may lead to incorrect diagnosis and delay of appropriate treatment. However, assessment in our lab prior to this publication (2) showed a smaller interference at normal COHb levels. In this study, impact of hydroxocobalamin at high COHb levels is evaluated.

Methods: Blood samples collected from healthy donors were used to prepare COHb levels (25 -50 %). COHb samples spiked with hydroxocobalamin (1 g/L) were measured in triplicate for each spiking concentration on 3 GEM Premier 4000 analyzers. The effect of OHCbl interference on carboxyhemoglobin is evaluated using the measured difference between the unspiked and the spiked samples with hydroxocobalamin. To emulate the treatment conditions reported in Livshits reference, blood samples were tonometered with 80% O₂, 5% CO₂ and balance N₂ gas mixture.

Average %COHb across the 3 GEM 4000 analyzers was compared to assess the influence of OHCbl on hemoglobin measurements. The measured differences in hemoglobin between the unspiked and the OHCbl spiked samples were used as a guideline to assess the impact. The degree of interference is considered to be clinically acceptable if the difference between the control and spiked sample is within $\pm 2\%$ (absolute; not relative) for hemoglobin fractions and within ± 0.7 g/dl for total hemoglobin.

Results: Carboxyhemoglobin data shown in table below confirmed that accuracy is slightly affected by the presence of OHCbl (1-2 units). However, with or without OHCbl, the reduction in COHb is mainly triggered by the oxygen treatment. In addition, spiked samples were appropriately flagged by the iQM software.

Conclusions: Blood samples spiked with 1 g/L OHCbl showed a small interference (1-2%) on carboxyhemoglobin consistent with our prior data in reference 2. Based on these results, the dramatic reduction in the COHb level as reported by Livshits is not due to interference from hydroxocobalamin and oxygen treatment would likely have caused reduction in COHb levels.

References:

- 1) O'Brien DJ¹, Walsh DW, Terriff CM, Hall AH., Prehosp. Disaster Med. 2011 Oct; 26(5):374-82.
- 2) P.V.A. Pamidi, et al, Clin. Chim. Acta, 401, 2009, 63-67.
- 2) Z. Livshits, et al, New ENGLAND J. MED 367: 1270 - 1271, SEPTEMBER 27, 2012

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COHb Sample	COHb (%)	COHb + OHcbl 1 g/L (%)	Delta
25% COHb	26.7	25.8	0.9
25% COHb (O₂ Tonometry 0.5 hr)	19.9	20.2	-0.3
25% COHb (O₂ Tonometry 1 hr)	14.3	15.0	-0.7
25% COHb (O₂ Tonometry 2 hrs)	7.3	7.7	-0.4
25% COHb (O₂ Tonometry 3 hrs)		3.7	
50%COHb	52.3	50.7	1.7
50%COHb (O₂ Tonometry 0.5 hr)	41.1	38.1	3.0
50%COHb (O₂ Tonometry 1 hr)	28.9	27.5	1.3
50%COHb (O₂ Tonometry 2 hrs)	15.3	12.3	2.9
50%COHb (O₂ Tonometry 3 hrs)		5.7	