

Carboxyhemoglobin and Pulse Oximetry

To the Editor:—The use of pulse oximetry is a standard practice in the operating room and intensive care because of its accuracy, non-invasiveness and ease of use, but it has some limitations. Barker and Tremper¹ have recently reported erroneous pulse oximeter readings (oxygen saturation [SpO₂]) in dogs exposed to carbon monoxide. They established that since the light absorbance spectra of carboxyhemoglobin (COHb) and oxyhemoglobin are similar in the red wavelength range, the pulse oximeter is unable to differentiate between them. Thus, in the presence of COHb, the instrument may seriously overestimate arterial blood oxygen saturation (SaO₂). Based on these experimental data, the authors concluded that the pulse oximeter should be used with caution in patients with a possible recent history of carbon monoxide inhalation.

We have had the opportunity to verify this assumption in two patients in whom a diagnosis of carbon monoxide intoxication was made. The two patients, a 51-yr-old female and a 55-yr-old male, were admitted comatose and stuporous, respectively. The only abnormal laboratory results found were the arterial blood gases (IL 1302 Gas Analyzer) (table 1). A history compatible with carbon monoxide poisoning was related by relatives. The SpO₂ readings (Pulse Oximeter 7840, Kontron Instruments) on admission were 96 and 99%, whereas COHb levels were 32 and 22.7% and SaO₂ were 66.1 and 77%, respectively (IL-282 Cooximeter). Hyperbaric oxygen treatment at a pressure of 2 atm was initiated in both patients. After 2 h of treatment, COHb levels were 1.1 and <1%, respectively. Measured SaO₂ and SpO₂ were now similar and >95% (table 1). The patients were awake, and there was no further deterioration.

These two cases illustrate the clinical implications proposed by Barker and Tremper: the pulse oximeter is not useful in assessing the oxygenation of patients intoxicated with carbon monoxide.

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REFERENCE

1. Barker SJ, Tremper KK: The effect of carbon monoxide inhalation on pulse oximetry and transcutaneous P_{O₂}. ANESTHESIOLOGY 66:677–679, 1987

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TABLE 1. Blood Gas Measurements

Time	Patient	SaO ₂	COHb	SpO ₂	P _{O₂}	P _{CO₂}	pH	Hb
Admission	1 (F)	66.1	32.0	96	88	28.9	7.30	17.6
	2 (M)	77.0	22.7	99	71	26.1	7.30	15.5
2 h after treatment	1	97.4	1.1	96	223	32.2	7.40	—
	2	99.0	<1	98	153	27.0	7.43	—

Train-of-four Ratio Is Not Always Independent of Stimulating Current

To the Editor:—In a recent study, Brull *et al.*¹ have compared train-of-four (TOF) ratios by mechanomyography using 20, 30, and 50 mA currents delivered to the ulnar nerves of volunteers and patients receiving nondepolarizing muscle relaxants. The authors concluded that "... T₄/T₁ testing can be accomplished reliably in patients without using a supramaximal stimulus."¹ They claim to show that TOF ratio is unchanged regardless of the stimulating contact used. However, they have manipulated their data in an improper way to arrive at this conclusion.

Brull *et al.* state in their methods section, "If a T₄ response was not obtainable at a given current (as was the case for nine of 28 intra-operative assessments at 20 mA), then the subject was excluded from the main study population because the T₄/T₁ ratio could not be calculated."¹ I take issue with this statement because a TOF ratio *can* be calculated if T₁ > 0 but T₄ = 0. In that case, T₄/T₁ = 0. Thus, Brull *et al.* have conveniently discarded all T₄/T₁ ratios of 0. They then proceed to use the TOF ratios on these same individuals at 30 and 50 mA. If, as they should have, Brull *et al.* had included individuals with