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Below is an overview of the single article that appeared in this issue of VOLUME:

Derivation of the Single Breath VA, TLCO and Haemoglobin Correction Equations. (Hennig Imberger, Peter D. Rochford and David P. Johns.)

*[This detailed paper was written partly in response to the study published in VOLUME in December 1985 (*Questionnaire Based Study of Inter-Laboratory Variability of the Single Breath TLCO Test – *reviewed last month) that reported a wide discrepancies between laboratories in TLCO and VA computed from raw data, and also in the equations used to correct TLCO for abnormal haemoglobin concentrations. Unfortunately, the impact of this derivation paper on laboratory practices was not followed up. However, it would be interesting to compare the values obtained using the current fully computerised systems with those obtained using the working equations given in this paper– with due attention to the specific measurement conditions now used in current testing systems … not that easy, I think.]*

This study provided complete derivations, together with necessary simplifying assumptions and correction factors, of working equations for computing single breath TLCO and VA. Also included was the derivation of the equation(s) used to adjust TLCO (and TLCO/VA) to a standard haemoglobin concentration of 14.6 g/dL.

The derivation of the TLCO adjustment to a standard haemoglobin concentration was based on the Roughton and Forster model (i.e. $1/TLCO = 1/DM + 1/\theta.VC$; Journal of Applied Physiology, 1957) and the article included an useful table which quantified the theoretical effect on the adjustment equation of changing the value of DM/Vc ratio (usually assumed to equal 0.7) and pulmonary capillary oxygen tension (PcO_2), both of which are not usually known. The results suggest that moderate inaccuracies in the assumed value of PcO_2 (usually 100 mmHg) does significantly affect the haemoglobin correction factor. However, any inaccuracies in the assumed value for DM/Vc has a greater effect. Because the actual DM/Vc ratio depends on the relationship between PcO_2 and theta (θ), the specific reaction rate of CO and haemoglobin (i.e. when haemoglobin concentration is normal and COHb is negligible, then $1/\theta = \alpha + \beta \times PcO_2$), the intercept ($\alpha$) and slope ($\beta$) coefficients are also important and assumptions need to be made about the values of these. The quantity "λ" (i.e. the ratio of the permeability of the red blood cell membrane to red blood cell interior) also affects the Hb concentration factor as it is intimately associated with the value of α. Most derivations assume a value of 2.5 for λ.

Please contact me if you are interested in a copy of this or any other issue of VOLUME.

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