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CORRESPONDENCE

Pulmonary diffusion impairment following heart transplantation: a prospective study

To the Editor:

Dr EGAN and colleagues [1] have compared changes in transfer factor of the lung for carbon monoxide ($T_{L,CO}$) before and after heart transplantation (HT) and coronary artery bypass grafting (CABG). Both operations involved thoracotomy, so that CABG provided a control for the operative procedure. Thirty days after the operation, the authors observed significant falls in $T_{L,CO}$ of 1.0 mmol·min^{-1}·kPa^{-1} (SI unit) after HT and 1.7 SI units after CABG. At this point, they might have deduced that changes in $T_{L,CO}$ after HT were due to the operative procedure. Instead, they expressed their results as carbon monoxide transfer coefficient (K_{CO}) ($T_{L,CO}$)/alveolar volume (V_A); this index showed a decline over the postoperative period for HT, but not for CABG, hence they concluded that "following HT there was an early fall in gas transfer which was independent of surgery and lung bypass, implicating early immunosuppression".

The authors' conclusion presupposes that division by V_A standardizes $T_{L,CO}$ for variations associated with alveolar volume. The latter index, expressed as total lung capacity (TLC), decreased by 0.5 L following both operations. In fact, K_{CO} is negatively correlated with V_A [2], so that use of $T_{L,CO}/V_A$ overcorrects $T_{L,CO}$ for the effect of lung volume. The true relationship of $T_{L,CO}$ to VA is not precisely known, but between a litre above functional residual capacity (FRC) and TLC it can be represented as approximately linear. The slope of the relationship is such that, for a decrease in V_A of 0.5 L, the $T_{L,CO}$ would have been expected to decrease by approximately 0.5 SI units [3, 4]. Hence, on the assumption that V_A was equal to TLC, the postoperative reduction in $T_{L,CO}$ at constant lung volume for HT was 0.5 SI units, and for CABG 1.2 SI units. These figures do not support the authors' thesis. However, the corrections should be applied to the actual volumes during breathholding. It would be of interest to know what these were, and if applying a linear correction to them led to a similar conclusion.

References

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REPLY

From the author:

Cotes and Reed have highlighted the fact that the use of single-breath alveolar volume (V_A) *versus* total lung capacity (TLC) in the estimation of the carbon monoxide transfer coefficient (K_{CO}) is an area of controversy. As they suggest, one cannot absolutely assume that V_A is equal to TLC. In our study investigating the influence of heart transplantation on lung physiology, the reported measurements of TLC were completed by plethysmography and not by helium dilution [1]. The potential advantage that estimates of V_A have is that it can be considered in physiological terms as the carbon monoxide uptake in the ventilated portion of the lung at "effective" TLC [2]. Controversy does exist as to these interpretations, but it is generally recommended to use single-breath V_A for clinical and epidemiological purposes [2].

Notwithstanding, as suggested by LOVE and SEATON [3], the predicted K_{CO} should be calculated from TLC rather than V_A. It is noteworthy that our standardized residual (SR) values for K_{CO}, dependent on the calculation of predicted K_{CO} using TLC, demonstrated a fall in K_{CO} following heart transplantation that was not observed in the patients following coronary artery bypass grafting.

However, the application of K_{CO} standardized residual values (= (observed - predicted)/residual standard deviation (RSD)) also has potential limitations, as RSD values for K_{CO} have not been provided by the European Working Party [4]. Therefore, RSD values for K_{CO} can only be estimated correctly from a sample of the individual population K_{CO} values. We calculated SR values for K_{CO} in this fashion. Accordingly, the fall in standardized residual value of K_{CO} and the observation

by others of a fall in gas transfer following heart transplantation suggests that our conclusions are reasonable [5, 6].

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