Thorax 1981;**36**:800

Correspondence

Exponential analysis of lobar pressure-volume characteristics

Sir,—In their article on exponential analysis Berend *et al* (*Thorax* 1981;**36**:452) incorrectly quote our work (Colebatch *et al J Appl Physiol* 1979;**46**:387) for a method of analysis which, in their hands, gives unsatisfactory results. We did not describe, and have never used, the method attributed to us—that is, limiting the exponential analysis of pressure-volume (P-V) data of individuals to a range which maximises r^2. Using results from 20 healthy subjects we found that an increase in the lower volume limit (LVL) from 40% to 75% of total lung capacity (TLC) increased the value obtained for the exponent, K. Therefore, to ensure the repeatability of exponential analysis, the LVL should be standardised. In the pooled results in the above study, a high value for r^2 was only one of several considerations that led us to adopt a LVL between 50% and 60% of TLC.

In normal lungs P-V data at low lung volumes tends to lie to the left of an exponential curve fitted to a higher volume range, whereas in emphysematous lungs the opposite trend is seen (compare figs 2A and 3A in Greaves *et al* (*Am Rev Respir Dis* 1980;**121**:127). This means that restricting the exponential fit to the upper 20% or less of lung volume (as was done by Berend *et al*) increases the value for K obtained from healthy lungs and decreases it for emphysematous lungs. This approach explains the failure of Berend *et al* to demonstrate differences that would be evident were the exponential function fitted over an appropriate volume range. The object of the analysis is to represent the elastic behaviour of the lungs and not to achieve an illusory statistical perfection expressed as a value for r^2 approaching 1·0000 [sic].

Fitting the exponential function over a range which gives the highest r^2 for a set of data from a single deflation of the lungs only, makes the volume range for such a fit, as well as derived values, unduly influenced by the chance error in a few datum points. In this way variance is increased and the reason for the statement of Berend *et al* "that K is so variable that it will not always distinguish between the presence and absence of emphysema" becomes self-evident.

The results obtained by Berend *et al* are a consequence of their particular approach and do not invalidate the use of exponential analysis of P-V data over a wider volume range to distinguish real differences between normal and emphysematous lungs (Colebatch *et al*. In: *Mechanisms of airways obstruction in human respiratory disease*. Balkema: Rotterdam, 1979:25). The recent findings of Pereira *et al* (*Thorax* 1981;**36**:29) also support the usefulness of K in quantifying pulmonary distensibility.

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Sir,—Dr HJH Colebatch appears unhappy about several aspects of our study (*Thorax* 1981;**36**:452). In the main he is critical of our method of fitting the exponential to a volume range which maximises r^2. In their study, (*J Appl Physiol* 1979;**46**:387) Colebatch and coworkers have limited their exponential pressure-volume curve fit to volumes above 50 to 60% total lung capacity for a number of reasons, only one of which was the fact that over this volume range the r^2 was greatest. The others apparently were: (1) that K was dependently critically on the volume range used, and thus the volume range had to be standardised; (2) when the curve fit was extended down to FRC, systematic deviations of the fitted curve from the data points resulted.

Our reasoning was exactly analogous to theirs, but happened to result in a lower range of volumes for fitting the exponential. We have found in excised human lungs (irrespective of whether we used data points from one or several deflations) that even at 50 to 60% V_{30} (volume at a transpulmonary pressure of 30 cm H_2O), systematic deviations of the fitted exponential from the data points are present and these obviously affect the values of K. Since we were looking for small changes in K between lobes in this study, we wanted to be certain that the exponential was as nearly a perfect fit to the data points as possible and that no systematic deviations remained which may have explained lobar differences. This necessitated looking at a relatively small volume range and we pointed this out specifically in the paper.

It was not the aim of this study to demonstrate the usefulness of K in distinguishing emphysematous from non-emphysematous lungs. We happen to think that K is not as useful as believed by Colebatch and coworkers in distinguishing emphysema and certainly does not provide an absolute distinction between lungs with and without emphysema, but this belief is based on a much larger series of excised lungs (and not related to whether data points from single or multiple deflations are used).

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