"About the ECCS Summary Equations"

Having used the CEC lung function prediction equations (Quanjer, 1983) for a number of years to compare with our own measured values, we have become aware of a striking inconsistency in their predicted values for single breath transfer factor (TLCO) and the transfer coefficient (KCO).

Calculation, for example, of TLCO for a 1.75 m tall, 40 year old man using the CEC summary equation (TLCO=11.1H - 0.66A - 6.03) gives a value of 10.77 mmol min^{-1} kPa^{-1}. Similarly the CEC predicted value for KCO (KCO predicted =2.43 - 0.011A) is 1.99 $mmol{\cdot}min^{-1}{\cdot}kPa^{-1}{\cdot}l^{-1}$ (Method 1). An apparent anomaly arises when results, expressed as percentages of these predicted values, are assessed alongside the percent predicted values of TLC, if the latter has been measured separately. According to the CEC recommendations KCO is calculated by dividing TLCO by the lung volume, which is determined by adding the inspired volume of test gas to the RV obtained from, say, the multiple breath dilution method (Quanjer, 1983) and is equivalent to TLC. If predicted KCO is instead calculated from the quotient (predicted TLCO/predicted TLC =7.99H - 7.08) a value of 1.56 $mmol{\cdot}min^{-1}{\cdot}kPa^{-1}{\cdot}l^{-1}$ is found (method 2), which is 24% less than KCO predicted by the published regression equation given above. Another source (Cotes, 1979) widely used in the UK, gives the prediction equation of KCO=2.20 - 0.013A, which generates predicted values nearer to (slightly greater than) the latter procedure than to the CEC predicted values, 1.68 $mmol{\cdot}min^{-1}{\cdot}kPa^{-1}{\cdot}l^{-1}$ in this example. These three methods are compared for males aged 20–70 years (see figure).

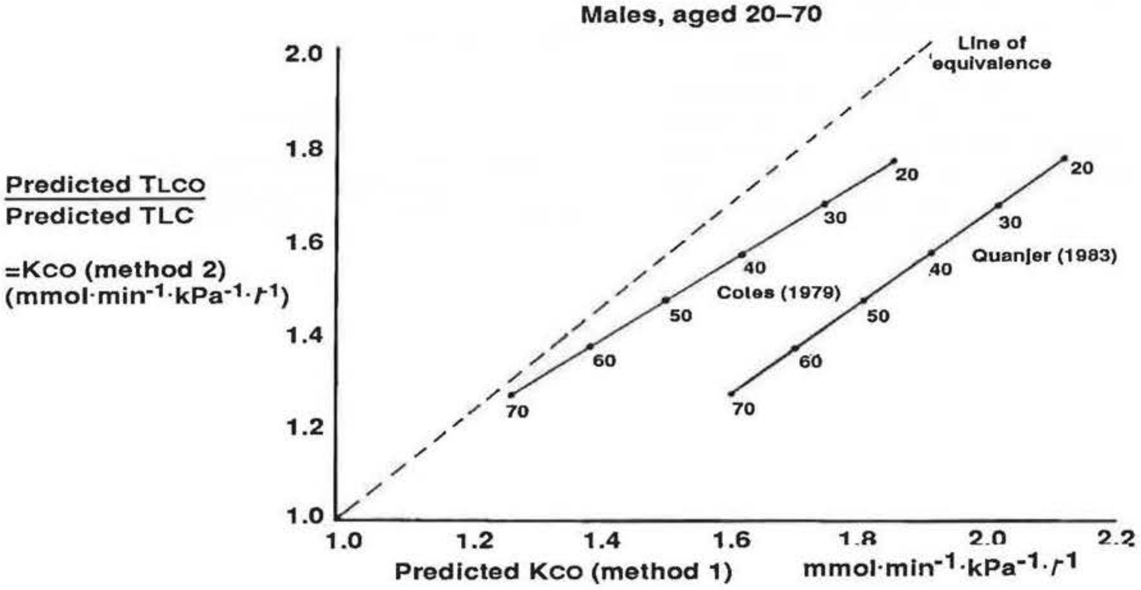

Fig. 1. – Relationship between predicted KCO and predicted KCO derived from predicted TLCO/predicted TLC

One should of course be cautious when comparing predicted values derived from different sources and procedures and the authors who discuss the internal consistency of sets of reference equations make this point (Quanjer, 1983). Nevertheless, such a large discrepancy is probably unacceptable to most users of reference equations. Consequently respiratory physiologists and physicians who use them should be aware of the potential problems raised when a set of lung function results is interpreted for clinical purposes.

We would therefore recommend that users of the CEC reference equations should either use our method 2 to derive a predicted KCO for male patients or use the equation of Cotes (1979) also quoted in Quanjer (1983).

R.G. Love
A. Seaton

References

1. Quanjer Ph.H. ed. – Standardised lung function testing. European Community for Coal and Steel, Luxembourg, 1983. *Bull Eur Physio Res*, 1983, 19, Suppl 5, 1–95.

2. Cotes JE. – Lung function: Assessment and application in medicine, 4th edition. Blackwell, Oxford, 1979.

Reply to Dr Love and Dr Seaton

Doctors Love and Seaton bring to light a deficiency in Kco predicted in two different ways. Unlike the inconsistencies in spirometric indices and lung volumes (ref. 1, page 50) this one went unnoticed when the Working Party "Standardisation of Lung Function Tests" prepared its recommendations. The summary equations for transfer factor and for total lung capacity derive from a relatively large number of published data, those for Kco from a relatively small set of publications. This may have contributed to the inconsistency in predictions. Given the two options suggested by Drs. Love and Seaton I think there would be something to recommend using the ECCS equations for transfer factor and for total lung capacity to derive Kco (method 2 in their letter), the advantage being that uniformity in using the set of equations recommended in Europe can be maintained.

The working Party will shortly resume work, part of its task will be to review the recommendations and update them. Certainly the prediction of Kco will be on the list of problems to be resolved.

Philip H. Quanjer

Reference

1. Quanjer PhH ed. – Standardised lung function testing. Report of a Working Party of the European Community for Coal and Steel. *Bull Eur Physiopath Respir*, 1983, 19, Suppl. 5, 1–95.