An indirect calorimetry system for ventilator dependent very low birthweight infants

Sir,—While the need for measurement of energy expenditure and nutrient utilisation in sick ventilator dependent infants is undisputed, we have several reservations about the indirect calorimetry system described by Forsyth and Crighton.1 On p316 V\textsubscript{e} is the inspired or expired minute ventilation? The equations given appear to take these to be equal, even though this amounts to assuming that the respiratory quotient (RQ) is 1. If instead the inspired and expired volumes of inert gas, are assumed equal the oxygen consumption (V\textsubscript{O\textsubscript{2}}) can be found as

\[
V_{O2} = V_{\text{inspired}} \times \left( F_{O2} - F_{O2e} - F_{CO2} - F_{CO2e} \right)
\]

a similar expression exists for carbon dioxide production. When F\textsubscript{O2}=0-4 the equations in the paper underestimate V\textsubscript{O2} by 12% if RQ=0-7 and overestimate it by 8% if RQ=1-2; calculated values of RQ will be biased towards 1, with true RQs of 0-7 and 1-2 being computed as 0-80 and 1-11 respectively.

In the gas infusion studies reported in table 1 it is unclear how to assess the values calculated for V\textsubscript{O2} when nitrogen is infused into the system. This part of the study calculates V\textsubscript{O2} as if the results were from a patient; the first equation on p318 then allows the calculated V\textsubscript{O2} to be checked in terms of nitrogen flow rate and F\textsubscript{N2}. If V\textsubscript{O2} is calculated correctly then this check equation is

\[
V_{\text{N2}} = 1 - F_{N2}
\]

if the equations on p316 are used then this becomes:

\[
V_{\text{N2}} = V_{\text{inspired, N2}} - F_{N2} V_{O2} = V_{\text{inspired}} + V_{\text{N2}}
\]

For the nitrogen flow rates given in table 1 (10-10, 14-10 ml/min) and F\textsubscript{N2} is 0-40, the expected values of V\textsubscript{O2} would be, from the first equation, 6-73, 9-40 ml/min and from the approximate version of the second equation, 4-04, 5-64 ml/min. From the results for the higher nitrogen concentration it appears that the second equation has been used (as would be consistent with the earlier part of the paper) but the agreement is poor at the lower flow rate.

Finally, we were disappointed that gas infusion studies were performed using only one ventilator setting. Increasing the inspired oxygen concentration (while keeping V\textsubscript{O2} constant) causes a reduction in the inspired—expired oxygen difference (F\textsubscript{O2} - F\textsubscript{O2e}). Thus as F\textsubscript{N2} decreases, the error sensitivity in the measurement of V\textsubscript{O2} is magnified. 1 It is not uncommon for sick ventilated infants to need F\textsubscript{N2} to be 22%, and the errors in the measurement of energy expenditure at high oxygen concentrations will be markedly increased and this must be acknowledged.

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