Agreement and differences between venous and arterial gas analysis

Sir,

Koul *et al*.[1] have compared arterial blood gas (ABG) and venous blood gas (VBG) analysis to determine whether the latter can be used as an alternative to the former because of easier access, less pain and fewer complications associated with it. The objectives are clinically very relevant. However, the study could have been designed and analyzed differently to obtain greater information.

The agreement between ABG and VBG analysis was very strong for pH and PCO_2 and but much less for PO_2. From this, Koul *et al*.[1] conclude that it is not clinically acceptable enough to support uniform usage of venous PO_2 instead of the arterial measurements in clinical situations. These results are entirely predictable on a physiological basis. Venous blood gas values depend on the arterial PO_2, arterial-tissue exchanges, cardiac output and local blood flow. Normally, venous–arterial PCO_2, pH and HCO_3 differ only in a narrow range because of effective buffering and regulatory mechanisms, whereas PO_2 differs greatly because the normal levels in tissues are 40 mmHg while arterial level is close to 100 mmHg. From the data presented, it is apparent that there were a substantial proportion of subjects with a normal ABG in this study and hence the results are as expected.

Analysing patients with normal and abnormal ABGs separately would have provided more useful information. The VBG in the latter are likely to be unpredictable as the underlying cause, compensations and complications such as a hemodynamic compromise would alter the normal arterial–venous relationship. The normally linear relationship for pH, PCO_2 and HCO_3 is known to be lost in critically ill patients.[2] Regression of venous values over arterial would have brought out the strength of the relationship and answered the question of utility or otherwise of VBG in such patients.

Nevertheless, VBG has its uses. Normal venous pH, PCO_2 and HCO_3 rule out severe acid–base disturbances.[2] As reviewed by the authors, in several conditions of metabolic acidosis as well as in acute exacerbations of chronic obstructive pulmonary disease (COPD), ABG and VBG provide similar or predictable results for pH, PCO_2 and HCO_3. A venous PCO_2 value above 45 mmHg detects all cases of significant arterial hypercapnia.[3]

VBG analysis therefore has limitations in the assessment of oxygen delivery in respiratory failure while in primarily metabolic disturbances, it can be as useful as an ABG sans all the disadvantages of the latter. The suggestion of the authors is that VBG may be used for pH and PCO_2 and combined with spO_2 is worthwhile and needs to be studied for its utility in replacing ABG in serial measurements to monitor patients especially when long-term intensive management is required or sampling is required several times daily. An spO_2 above 95% makes respiratory failure extremely unlikely and hence an ABG can be avoided.

There appears to be an oversight or a typing error. The SD of arterial pH is given as 0.56 that appears to be too high considering the range of values and the 95% CI.

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